Disclaimer: Section 508 of the Rehabilitation Act of 1973 (29 U.S.C. § 794d), as amended in 1998, requires that the information in federal documents be accessible to individuals with disabilities. CHIPS for America, U.S. Department of Commerce, has made every effort to ensure that the information in the Micron Semiconductor Manufacturing Project Final Environmental Impact Statement is accessible; however, some Appendix elements may not be fully accessible. Individuals with disabilities are encouraged to contact David Frenkel, Environmental Division Director by phone at (240) 204-1960 or by email at david.frenkel@chips.gov for access to the information contained in this document.

APPENDIX L
HUMAN HEALTH AND SAFETY

Appendix L-1
Use, Management, and Disposal of Per- and Polyfluoroalkyl Substances at the Micron New York Semiconductor Fabrication Facilities

L-1 Use, Management, and Disposal of Per- and Polyfluoroalkyl Substances at the Micron New York Semiconductor Fabrication Facilities

This Appendix supplements the discussion in FEIS Chapter 3.8 and incorporates where appropriate Appendix C of the "Final Programmatic Environmental Assessment for Modernization and Expansion of Existing Semiconductor Fabrication Facilities under the CHIPS Incentives Program" (NIST, 2024).

L-1.1 Background

Per- and polyfluoroalkyl substances (PFAS) are a group of manufactured fluorinated organic chemicals. The term "PFAS" is generally used as a broad, general, and nonspecific term that does not necessarily indicate whether a particular compound is harmful but may merely communicate as a technical matter that the compound has a fully fluorinated methyl or methylene carbon moiety. Under the broadest definitions of PFAS, the term can group together gases, liquids, and solids with vastly different properties and hazards (SIA, 2023c).

Only a small number of PFAS, primarily perfluorooctanoic acid (PFOA) and perfluoroctane sulfonate (PFOS), have been well-studied for their environmental deposition mechanisms, human and animal exposure effects, or toxicological effects. The science around PFAS is relatively new and evolving. This includes not only developing knowledge of the types and nature of PFAS but also on-going advancements in methods of detection, changing regulatory requirements and emerging ways to avoid, minimize, manage and mitigate the storage, use and disposal of PFAS.

Depending on how PFAS are defined, there are thousands of different PFAS manufactured and used throughout the global economy. PFAS are widely used due to their unique characteristics, such as water, heat, oil, and chemical-resistant qualities among other features. These substances have been used in a wide range of products, including in the manufacture of nonstick cookware, water-repellent clothing, stain resistant fabrics and carpets, some cosmetics and personal care products, some firefighting foams, and products that resist grease, water, and oil. They are also used in critical industries such as aerospace, automotives, defense, electronics, and healthcare/medical devices.

There is growing international attention on PFAS due to the potential health effects and persistence in the environment. Most scientific and regulatory attention has been directed at two specific PFAS compounds – PFOA and PFOS – though both regulatory and scientific focus are expanding beyond these two substances. While additional regulation of PFAS is anticipated, these substances may be used consistent with legal requirements.

Semiconductor manufacturers use PFAS as an essential material in multiple steps in the fabrication process (SIA 2023c). The general process for semiconductor manufacturing includes the following steps: oxidation, lithography, etching, deposition, ion implantation, metallization and interconnects, passivation, chemical mechanical planarization, dicing, testing and quality control. PFAS are most utilized during the lithography, etching, and certain deposition processes, in addition to being used throughout some general processes and equipment (e.g., wet chemical

process, heat-transfer fluids (HTFs), assembly, test, packaging and substrate (ATPS), pump fluids and lubricants, and articles) (SIA 2023c).[23]

This Appendix further describes the various PFAS definitions, analytical techniques for measuring the presence of PFAS, the existing regulatory landscape for managing PFAS, as well as intended use and disposal of PFAS for the Micron Project. It then expands on Micron's overall chemical management practices for responsible use of these critical substances at the Micron Campus, based on available information and design progress to date. Next, this Appendix describes avoidance and minimization strategies for PFAS that are being considered and will be implemented, to the extent feasible and practicable, including (i) identification and implementation of non-PFAS alternatives, and (ii) requirements for wastewater treatment, air emissions controls, and recycling and disposal frameworks.

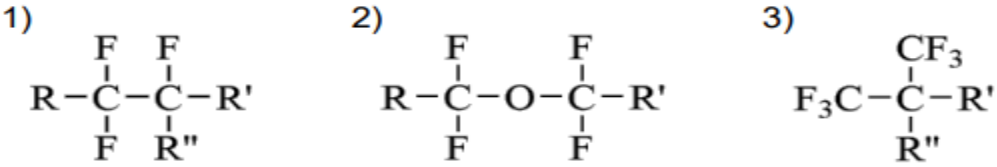
Overall, the FEIS including this Appendix summarize the available information to identify PFAS use and management, address the associated potential risks to the environment and human health, and identify the procedural controls and BMPs that will be implemented to manage such risks consistent with all applicable state and local permits. As a result, the Proposed Project's storage, use, wastewater discharge and disposal of PFAS containing substances would not be anticipated to result in significant adverse effects.

L-1.2 What are PFAS?

PFAS are a group of manufactured fluorinated organic chemicals that are characterized by their carbon and fluorine bonds. The definition of PFAS is evolving and varies by organization. For instance, the Organisation for Economic Co-operation and Development (OECD) defines PFAS as fluorinated substances that contain at least one fully fluorinated methyl or methylene carbon atom (without any H/Cl/Br/I atom attached to it), i.e. with a few noted exceptions, any chemical with at least a perfluorinated methyl group (–CF3) or a perfluorinated methylene group (–CF2–)) (OECD, 2021). The OECD publishes a list of thousands of PFAS falling within its definition that is searchable by chemical abstracts service (CAS) number. The OECD list containing thousands of PFAS chemicals is available at: https://comptox.epa.gov/dashboard/chemical-lists/PFASOECD. Similarly, the United States Environmental Protection Agency (USEPA) has defined PFAS under section 8(a)(7) of the Toxic Substances Control Act (TSCA) and the TSCA implementing regulations at 40 C.F.R. Part 705, as any chemical substance or mixture that contains at least one of the following three sub-structures (Figure L-1): (1) R-(CF2)-CF(R′)R″, where both the CF2 and CF moieties are saturated carbons (carbons which are single-bonded to their maximum stable number of atoms or groups); (2) R-CF2OCF2-R′, where R and R′ can either be F, O, or saturated carbons; and (3) CF3C(CF3)R′R″, where R′ and R″ can either be F or saturated carbons. USEPA published a list of known PFAS that is searchable by CAS number, available at https://comptox.epa.gov/dashboard/chemical-lists/PFAS8a7.

[23] Note, however, that these processes and uses are meant to describe practices in the semiconductor industry generally, and may not be applicable to Micron's operations.

Figure L-1 TSCA PFAS-Defining Sub-Structures



New York State uses a different approach, defining PFAS as "a class of fluorinated organic chemicals containing at least one fully fluorinated carbon atom." N.Y. Envtl. Conserv. Law Sec. 37-0101(7) (defining hazardous substances); see, e.g., N.Y. Gen. Bus. Law Sec. § 391-u(f) (providing restrictions on the sale and use of PFAS-containing firefighting foams). New York does not currently publish a list of substances that meet this definition. See https://dec.ny.gov/environmental-protection/water/emerging-contaminants.

PFAS may be characterized as either long-chain (containing six or more linked carbon atoms) or short-chain (containing fewer than six carbon atoms) (ITRC, 2020).[24] To date, most PFAS regulatory efforts have focused on addressing long-chain PFAS; short-chain PFAS may be more environmentally mobile and degrade faster, making them less persistent (ITRC 2023a). An overview of potential risks associated with PFAS is available in Appendix C of the "Final Programmatic Environmental Assessment for Modernization and Expansion of Existing Semiconductor Fabrication Facilities under the CHIPS Incentives Program" (NIST 2024).

For purposes of the FEIS, the lead agencies did not exclude consideration of any PFAS based on these definitions, taking a broad view to review potential impacts of the Proposed Project. The agencies also did not limit consideration to currently regulated PFAS or to long-chain or short-chain PFAS.

L-1.3 Analytical Developments and Challenges

While some PFAS substances are detectable at very low concentrations (in the single digit parts per trillion (ppt) levels), depending on the environmental media, technology for detection of other PFAS is still evolving and requires the continued development and validation of effective detection methodologies. (NIST 2024). Various federal and state agencies, including USEPA, are engaged in these development efforts (NIST 2024). Industry groups, such as the Semiconductor Industry Association, have supported or explored the review and development of PFAS-detection metrologies (Droz 2025). Semiconductor Industry Association (SIA) members have developed a roadmap and goals for development of PFAS abatement and advanced analytical and sensing methods. SIA members participating in the Semiconductor PFAS Consortium are also exploring options for research through university-led projects or by individual companies.

Available PFAS detection methods vary depending on the medium (i.e., potable drinking water, wastewater, source air emissions, or solid waste) (USEPA 2024e). These methodologies are in various stages of validation. USEPA has developed several methods to detect PFAS in potable

[24] Perfluoroalkane sulfonic acids are typically considered to be short-chain if they have fewer than 6 carbons, while perfluoro carboxylic acids are considered short-chain if they have less than 8 carbons (ITRC 2020).

drinking water sources in support of the Safe Drinking Water Act (SDWA). Methods 533, 537.1 version 2.0, and 537 can detect up to 29 PFAS compounds in drinking water (USEPA 2019, 2025a). USEPA has developed methods for analyzing aqueous non-potable water samples primarily through the Clean Water Act (CWA) and methods for solid waste (SW-846) under the Resource Conservation and Recovery Act (RCRA). USEPA Method 8327 applies to the detection of 24 PFAS in non-potable water (wastewater, surface water, or groundwater), whereas Methods 1633 and 1633A detect 40 PFAS in wastewater, surface water, groundwater, soil, biosolids, sediment, landfill leachate, and fish tissue (USEPA 2024c). Method 1633A has been validated and is pending approval for inclusion in the Code of Federal Register, with USEPA indicating that it may be used in various applications, including National (or authorized State) Pollutant Discharge Elimination System (NPDES or SPDES) permits (USEPA 2024e).

USEPA has posted two Other Test Methods (OTM) for PFAS and fluorinated compounds in source air emissions. OTMs are test methods that have not yet been subject to the federal rulemaking process. EPA's posting of an OTM technique is not "an endorsement by EPA regarding the validity of the test method nor a regulatory approval of the test method," but a mechanism to promote scientific discussion on an analytical technique. (USEPA 2025b, USEPA 2025c). OTM-45 focuses on approximately 50 semi-volatile and particulate-bound PFAS, whereas OTM-50 measures 30 specific volatile fluorinated compounds (potential indicators of PFAS) from stationary sources (USEPA 2025b, USEPA 2025c). Laboratories capable of performing OTM-45 and OTM-50 are currently limited in number. USEPA is currently accepting feedback on OTM-45 and OTM-50 from the scientific community to support future validation of these methods (USEPA 2024e).

Method 1633 and OTM-45 were developed alongside Method 1621. Method 1621 was designed to detect adsorbable organic fluorine in aqueous matrices, thus allowing the method to broadly screen for thousands of known PFAS (and other) compounds at the part per billion level in aqueous (water) samples (USEPA 2024d). Method 1621 currently is not required for CWA compliance monitoring at the national level, but USEPA is considering whether to promulgate it as a mandatory test method through rulemaking (USEPA 2024e).

There are also a range of more experimental metrologies under development for analysis of PFAS in semiconductor wastewater, including total oxidizable precursor (TOP) assay, total organic fluorine (TOF), adsorbable organic fluorine (AOF), and ^{19}F nuclear magnetic resonance (NMR), which are briefly discussed below. None of these methods has been standardized or validated by USEPA for measurements in wastewater or other media.

The TOP assay is a method for estimating precursor PFAS concentrations by oxidizing them into measurable perfluoroalkyl acids (PFAAs), preserving fluorinated chain length for electrofluorination-based precursors. However, it cannot detect non-oxidizable PFAS, such as ether acids, and may underestimate PFAS in semiconductor wastewater due to incomplete oxidation or exclusion of short-chain products (Droz 2025).

TOF methods, often used synonymously with total fluorine analysis, are used to estimate total organic fluorine by subtracting measured fluoride ion concentrations from the total organic and inorganic fluorine measured. TOF methods have high detection limits and may overestimate organic fluorine if fluoride is not efficiently removed. Thus, TOF's accuracy is challenged by high fluoride backgrounds in semiconductor effluent, which can interfere with accurate quantification.

The method also has questionable application for distinguishing low levels of PFAS when high non-PFAS containing fluorine is present (Droz 2025). Additionally, these methods detect non-PFAS substances.

AOF methods, including USEPA Method 1621, are intended to capture a broad spectrum of PFAS including unknowns and total organic fluorine estimation. Yet, they suffer from variable recovery for short-chain and neutral PFAS and are challenged by high fluoride backgrounds in semiconductor effluent, which can interfere with accurate quantification (Droz 2025).

^{19}F NMR spectroscopy analyzes for the ^{19}F isotope of fluorine and may offer the ability to distinguish organic from inorganic fluorine, with minimal sample preparation, and applicability to fluoropolymers. It is non-destructive and tolerates diverse sample conditions, but its low sensitivity, susceptibility to interference from paramagnetic ions, and lack of standardized methods for wastewater analysis limit its routine use (Droz 2025).

The lack of validated methods for accurately identifying and quantifying the full range of PFAS in various media creates challenges for PFAS regulation and management. Government and industry groups, including semiconductor trade groups in which Micron actively participates, are working to advance these capabilities. USEPA has identified development of additional PFAS test methods as a priority (USEPA 2025d).[25]

L-1.4 PFAS Regulatory Regime

PFAS regulation is rapidly evolving at the federal and state level. USEPA has finalized multiple regulations and guidance on PFAS use, reporting, monitoring, treatment, and cleanup, while New York State has enacted its own standards, often ahead of and more stringent than federal requirements. Additional PFAS regulation is anticipated to emerge as the Proposed Project is constructed and operated. Lawful and responsible use of PFAS continues to be permitted, particularly in critical industry sectors. Recognizing that these may change over the life of the Proposed Project, the current regulatory schemes relevant to the planned Micron Campus in Clay, NY and, with which Micron will be required to comply, are discussed below.

In April 2024, USEPA promulgated final maximum contaminant levels (MCLs) under the Safe Drinking Water Act for six PFAS substances in drinking water: PFOS, PFOA, hexafluoropropylene oxide dimer acid (HFPO-DA, a.k.a. GenX), perfluorohexanesulfonic acid (PFHxS), perfluorononanoic acid (PFNA), and perfluorobutanesulfonic acid (PFBS). USEPA set final MCLs for PFOA and PFOS at 4 ppt each, and limits for PFHxS, PFNA, and HFPO-DA at 10 ppt each (40 CFR § 141.61(c)(2)). The Hazard Index MCL defines when the combined levels of two or more of PFHxS, PFNA, HFPO-DA, and PFBS require action. A mixture with combined levels of two or more of these four PFAS that is greater than 1 (unitless) indicates an exceedance of health protective levels. For the Hazard Index MCL, USEPA set health-based water concentration (HBWC) levels for PFHxS (10 ppt), PFNA (10 ppt), HFPO-DA (10ppt), and PFBS (2,000 ppt). The individual ratios of PFAS concentrations to HBWCs are then summed across the mixture to yield the hazard index (40 CFR § 141.61(c)(2)(i)). While USEPA has announced plans

[25] USEPA Administrator Zeldin announced plans to "Ramp up the development of testing methods to improve detection and strategies to address PFAS" (USEPA 2025d).

to alter the compliance deadline from 2029 to 2031 for PFOA and PFOS and to rescind requirements for the other four PFAS, USEPA has not published a proposed (or final) rulemaking (USEPA 2025e). However, in September 2025, USEPA asked the United States Court of Appeals for the D.C. Circuit to vacate the individual MCLs for PFNA, PFHxS and HFPO-DA, the Hazard Index MCL, and the associated maximum contaminant levels goals in *American Water Works Ass'n v. EPA*, Case No. 24-1188 (D.C. Cir.). USEPA did not ask the court to vacate the MCLs for PFOA and PFOS. Limits and controls established for specific PFAS prioritized for regulation would reasonably be expected to provide controls for other PFAS as well. (USEPA 2024a).

New York State has set drinking water standards for PFOA and PFOS at 10 ppt each. The New York State Department of Environmental Conservation (NYSDEC) also has established guidance values for PFOA and PFOS in surface water sources at 6.7 and 2.7 ppt, respectively (NYSDEC 2023). NYSDEC has issued draft guidance (TOGS 1.3.14) to implement these guidance values in SPDES permits issued to POTWs, including for the existing Oak Orchard WWTP SPDES permit (NYSDEC 2024).

In May 2024, USEPA finalized a rule designating PFOA and PFOS as hazardous substances under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Section 102(a) (89 Fed. Reg. 39,124 (May 8, 2024)). In addition to bringing these two PFAS into CERCLA's liability framework, the rulemaking also establishes reportable quantity thresholds for releases of these substances to the environment. In September 2025, USEPA confirmed its intent to retain these designations under CERCLA. (USEPA 2025f). New York was one of the first states in the nation to make a similar hazardous substance designation of PFOA and PFOS.

In February 2024, USEPA proposed, but has not finalized, a new rule to list nine PFAS as hazardous constituents, which if finalized would authorize USEPA to address releases of these PFAS at permitted hazardous waste facilities under the RCRA corrective action requirements (89 Fed. Reg. 8606 (Feb. 8, 2024)). At this time, USEPA has not proposed listing any PFAS as hazardous wastes under RCRA. USEPA's current interim guidance on PFAS destruction and disposal describes the agency's latest assessment of the available methods for treatment and management of the PFAS-containing waste (USEPA 2024b). This and other guidance assess suitable methods for disposal and management of PFAS-containing materials. Such disposal activities also must comply with applicable law for the safe and proper disposal of any generated solid and hazardous waste.

USEPA also released a final rule under the Emergency Planning and Community Right-to-Know Act (EPCRA) that added certain PFAS to the list of Lower Thresholds for Chemicals of Special Concern. This rule increases reporting of PFAS to the Toxic Release Inventory (TRI) program beginning with the 2024 reporting year (due July 2025) by eliminating the de minimis exemption that allowed facilities to avoid reporting information on PFAS when those chemicals were used in small concentrations. Under this rule, certain PFAS will be subject to the same reporting requirements as other chemicals of special concern and USEPA will receive more comprehensive data on PFAS. Chemicals of special concern are excluded from the de minimis exemption, may not be reported on Form A (Alternate Threshold Certification Statement), and may have limits on the use of range reporting. In May 2024, USEPA published a new rule adding seven PFAS to the TRI list of reportable chemicals. In compliance with EPCRA TRI reporting,

Micron would report the manufacture, process, or other use of any individual TRI-listed PFAS that exceed reporting thresholds.

USEPA finalized a PFAS Reporting Rule in October 2023, under TSCA Section 8(a)(7). The rule requires manufacturers and importers of PFAS or PFAS-containing articles in any year from 2011 to 2022 to report detailed data on chemical identity, uses, volumes, byproducts, exposures, disposal methods, and health/environmental effects. Because the Proposed Project has not been constructed and has not manufactured or imported any substance during the lookback period, this rule will not be applicable to the Proposed Project.

In 2017, certain chemical manufacturers entered into an agreement with USEPA pursuant to TSCA Section 5 to conduct testing and data collection on photoacid generators (PAGs) and onium compounds used in semiconductor manufacturing. Device manufacturers, including Micron, partnered in this effort in order to provide use and treatment conditions for these photolithography materials. Such upfront testing was initiated to test the persistence and bioaccumulation potential of these PAGs and is intended to ensure that the semiconductor industry's uses of certain PFAS will not result in harmful environmental releases or human health risks, while allowing critical uses by important industry sectors like semiconductors (USEPA 2023).[26]

Presently, there are no federal regulations that specifically address air emissions of PFAS, as a group or individually. However, fluorinated greenhouse gases (F-GHGs), some of which may be defined as PFAS, may become "regulated NSR pollutants" that are "subject to regulation" at sites subject to Prevention of Significant Deterioration (PSD) permitting (40 CFR § 52.21(b)(49)(i), (iv)) and Best Available Control Technology requirements, if such emissions exceed regulatory thresholds. USEPA has proposed, but not finalized, a rule to rescind its 2009 greenhouse gas endangerment finding (which serves as the foundation for certain greenhouse gas emissions regulation), but the proposal does not expressly rescind regulation of greenhouse gas emissions under the PSD program (90 Fed. Reg. 36,288 (Aug. 1, 2025)). F-GHGs also may be required to be reported under USEPA's Mandatory Greenhouse Gas Reporting Rule (40 C.F.R. Part 98). USEPA has proposed, but not finalized, a rule to reconsider the Mandatory Greenhouse Gas Reporting Rule (90 Fed. Reg. 44,591 (Sept. 16, 2025)).

NYSDEC has not promulgated regulations specific to air emissions of PFAS, but regulates air emissions of all contaminants, including PFAS, as part of its air toxics program. Like other emissions of air contaminants from process emission sources, emissions of compounds that could potentially be classified as PFAS are subject to 6 NYCRR Part 212. New York's state air toxics program establishes air quality guideline concentrations (both annual guideline concentrations (AGC) and short-term guideline concentrations (SGC)) for several non-criteria pollutants and requires these non-criteria pollutant emissions to be controlled adequately based on their potential health effects (6 NYCRR Part 212). When NYSDEC has not established air quality standards for a compound that may be emitted from an industrial facility, it follows a process published in the Division of Air Resources guidance "DAR-1: Guidelines for the Evaluation and Control of Ambient Air Contaminants Under 6 NYCRR Part 212" to derive an AGC and/or SGC for that

[26] USEPA's announcement discussed the preexisting testing agreements with photolithography material manufacturers and US-based semiconductor device manufacturers (USEPA 2023).

compound that informs the levels of emissions control needed to protect public health. Such reviews are based on the best available science and a rigorous review of publicly available literature.

Because some F-GHGs also have a high global warming potential (GWP), many of these gases have been subject to regulation implementing international treaties, such as the United Nations Framework Convention on Climate Change, the Kyoto Protocol, and the Kigali Amendment to the Montreal Protocol (SIA 2023b). This includes USEPA's regulations implementing the American Innovation and Manufacturing (AIM) Act through its Hydrofluorocarbons (HFC) Phasedown Rules, which currently provide for application-specific allowances for the etching of semiconductor material or wafers and the cleaning of chemical vapor deposition chambers within the semiconductor manufacturing sector (40 CFR 84.13(a)(4)). Similarly, New York State has finalized restrictions on the sale, distribution, and purchase of certain high GWP HFCs (6 NYCRR 494).

L-1.5 Overview of Semiconductor Fabrication Facility (Fab) PFAS Use

L-1.5.1 General Overview of PFAS Use in Semiconductor Fabrication

Semiconductors play a critical and foundational role in the U.S. economy, technology leadership, and national security. Semiconductors enable innovation in sectors throughout the economy – ranging from telecommunications and healthcare to transportation and energy – and play a pivotal role in the emerging technologies of the future, including artificial intelligence, 5G/6G networks, and quantum computing. Semiconductor fabrication process technologies are dynamic, reflecting rapid, ongoing cycles of innovation in the design and manufacture of semiconductors.

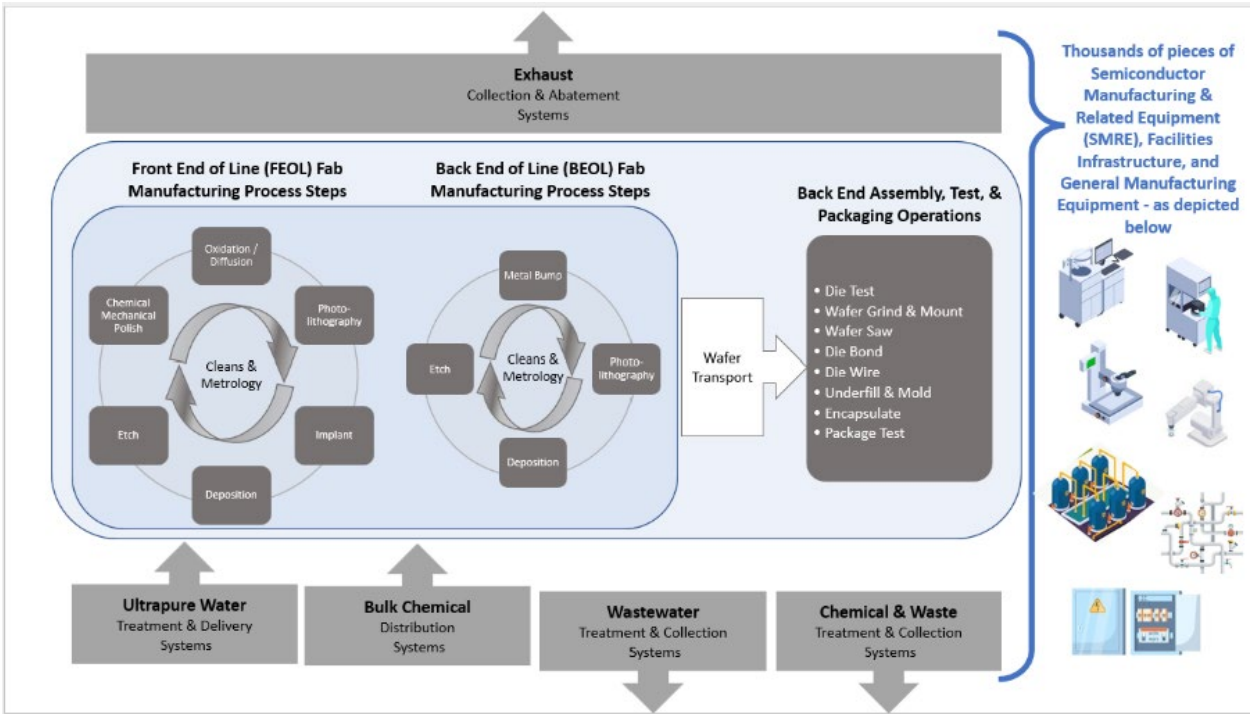
PFAS have enabled the manufacture of modern semiconductors through a range of uses: (1) fab infrastructure, tools, and parts; (2) fabrication process chemistries and indirect fabrication support needs; and (3) substances used to create packaging materials for products that incorporate semiconductors. Some, but not all, of these categories of chemicals and materials may contain PFAS. The Semiconductor PFAS Consortium, of which Micron is a member, has made efforts to identify these uses, to explain how PFAS is important to their functionality (including with respect to the protection of workers), and to identify potential releases and exposure pathways for typical use cases of these PFAS-containing materials in the manufacture of semiconductors. This Section V provides background on each of these categories of use, but the first two categories (infrastructure/parts and chemical usage) are the primary areas of focus for the Proposed Project, which will include front-end semiconductor fabrication.[27] As further background, Figure L-2 below refers to the process steps and supporting facilities that may use PFAS-containing materials (SIA 2023b).

PFAS are used in semiconductor fabrication due to their many useful structural and chemical properties, such as heat resistance, high purity, chemical resistance, chemical stability, low molecular polarization, low outgassing, high vapor pressures, low enthalpies of vaporization,

[27] As discussed herein, the third category would be less relevant for the Proposed Project but is included for additional information.

relatively low viscosity, and desirable solubility (SIA 2023c). There are no known non-PFAS alternatives for many of these functions. Developing and implementing substitutes for these materials could take years, if not decades (SIA 2023a, SIA 2023c). This FEIS has been prepared for the Proposed Project based on available information.

Figure L-2 Overview of semiconductor manufacturing process steps, operations, and systems



Source: SIA 2023d.

Fab infrastructure, tools, and parts. Fab infrastructure, tools, and parts refers to the thousands of individual pieces of semiconductor manufacturing and related equipment that support individual process steps and functions within a modern semiconductor fab (SIA 2023d). This category of materials includes certain equipment used to manufacture, measure, assemble, or test semiconductor products. It includes certain equipment that processes silicon wafers; equipment component parts; and auxiliary, support, or peripheral equipment (chemical controllers, chemical delivery systems, vacuum pumps). It also includes items such as structures, piping, ductwork, effluent treatment systems, valve manifold boxes, filtration, and heaters (SIA 2023d). Various components of fab infrastructure, tools, and parts may contain PFAS, while other components do not. Figure L-2 also refers to the process steps and supporting facilities that may use PFAS-containing articles (SIA 2023d). Due to the functions of PFAS, a wide range of these materials may contain PFAS. As such, the Proposed Project may use equipment, parts, and other infrastructure that was manufactured with PFAS, and the PFAS-content of such used equipment would be a consideration in the management of these materials when they reach end-of-life, as discussed further below.

Fabrication process and indirect support chemistries. Fabrication process chemistries include chemicals that come into contact with the wafer to fabricate semiconductors, while indirect

support chemistries include chemicals that are used to support the fab infrastructure and fab maintenance processes. Some of the chemicals used in semiconductor fabrication contain PFAS. Sources of PFAS in process chemistries include some photolithography and dry etch chemistries. Indirect support chemistries used to support fab infrastructure can include some heat transfer fluids, refrigerants, and lubricants/greases. PFAS also may be present in chemical delivery systems and shipping packaging delivered to the facility, with the potential to leach into the chemicals used in fabrication process chemistries and indirect support chemistries. As these chemical uses have the potential to be included in various semiconductor fabrication waste streams, these uses for the Proposed Project are discussed in more detail in subsection C below.

Packaging materials. Packaging materials include the combination of materials and structural elements that connect an integrated circuit to a printed circuit board, interposer, or device, while protecting the package from outside environmental influences. The package allows the integrated circuit to connect to other components on the printed circuit board (SIA 2023e). In other words, these are the materials used to create a product containing semiconductors. Some of these materials are made with PFAS. PFAS may be found in assembly and test packaging substrates, printed circuit boards, die attach adhesive, mold compounds, and other materials (SIA 2023e). The Proposed Project is not anticipated to include any significant assembly and test (i.e., back-end) operations that incorporate integrated circuits (or semiconductors) into such packaging materials and thus is not anticipated to involve use or disposal of such packaging materials. Therefore, this Appendix does not include further discussion of packaging materials.

The semiconductor industry is a highly competitive business sector, where continuous innovation in memory and storage technologies is essential for maintaining market leadership. The chemistry, materials, and processes are fundamental to how a company like Micron drives innovation to make its product, and such information is among the most valuable information that a semiconductor manufacturer possesses. This innovation has produced numerous patents with approximately 60,000 patents granted to Micron alone (and counting). Such proprietary and trade secret information includes trade names, supplier details, chemical abstract series numbers, and chemical constituents. These details are protected under strict confidentiality measures to prevent risks like reverse engineering and competitive harm.

While these uses are critical to semiconductor fabrication, published information suggests that the semiconductor industry's PFAS uses comprise a very small percentage (potentially around 1%) of the overall PFAS market (SIA 2024). For example, a recent article calculates the amount of PFAS used in different industry sectors in Europe and concludes that the electronics sector as a whole uses a very small amount of overall PFAS, and the semiconductor industry is just a portion of this small amount (Lim 2023).

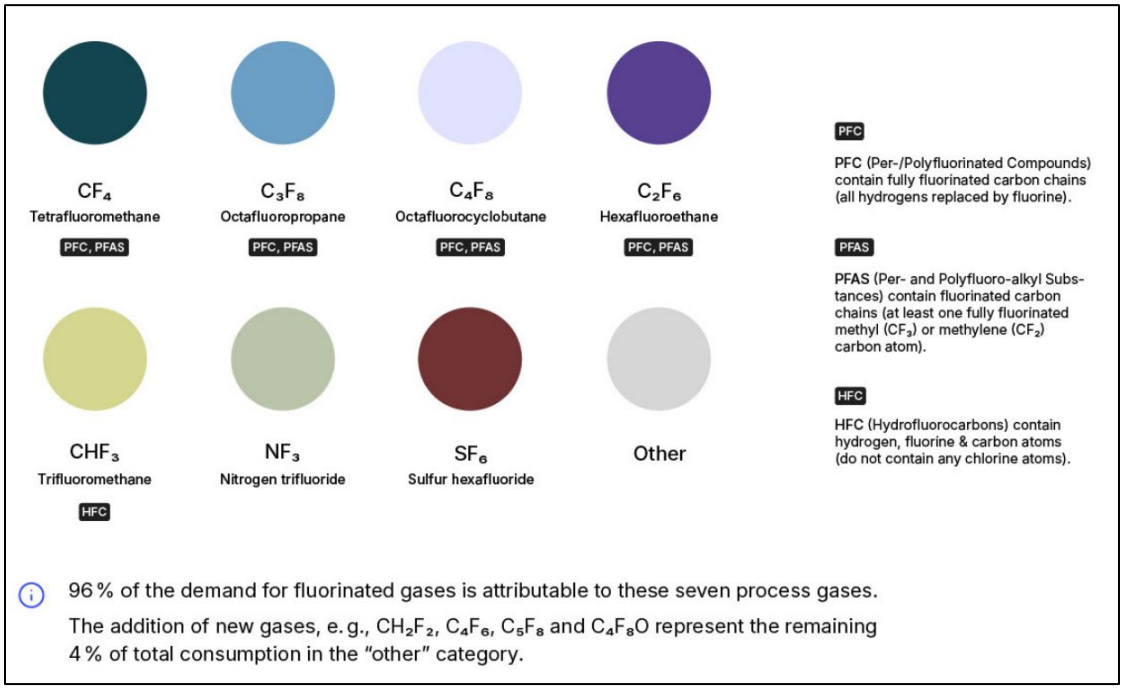
L-1.5.2 Relative Volumes of PFAS Compounds Used in Fabrication Process and Indirect Support Chemistries in Semiconductor Fabrication

As semiconductor manufacturing is a highly automated, enclosed process that takes place in a cleanroom environment, published information suggests that a small percentage of the PFAS used in the process are estimated to have the potential to enter the environment during semiconductor production (ECHA 2023, Hess 2024). There also appears to be a very small amount of PFAS that may remain in the final chip (ECHA 2023). Nonetheless, most of what remains of PFAS usage is anticipated to be found in industrial wastewater (Hess 2024).

In the context of front-end manufacturing, PFAS are an essential ingredient of chemicals used in semiconductor fabrication processes and indirect support chemistries. PFAS are a critical component of lithography chemicals. In solvent cleaners and heat transfer fluids, non-polymeric ionic PFAS such as perfluorobutanesulfonate (PFBS) are commonly used (Hess 2024). PFAS are also commonly found fluoropolymers used in fab infrastructure and tooling, such as polytetrafluoroethylene (PTFE), paraformaldehyde (PFA), polyvinylidene difluoride (PVDF), ethylene tetrafluoroethylene (ETFE) and fluorinated ethylene propylene (FEP) (Hess 2024).The composition of PFAS chemicals, however, is unique to their specific application and varies by company, facility, and product type. See generally Table C-4 to NIST's Programmatic Environmental Assessment (NIST, 2024) (reproduced as Exhibit B to this Appendix) (describing key PFAS use applications in semiconductor fabrication generally and their criticality to the process).[28]

Several specialty gases used in etching and chamber cleaning are fluorinated gases (also known as F-gases). The seven process gases presented in Figure L-3 below generally account for 96% of emissions from fluorinated gases that may be used in a fab: tetrafluoromethane (CF4), octofluropropane (C3F8), octafluorobutane (C4F8), hexafluoroethane (C2F6), trifluoromethane (CHF3), nitrogen trifluoride (NF3) and sulfur hexafluoride (SF6). Some fluorinated gases also fall under the PFAS category, including CF4, C2F6, C4F8 and C3F8.[29]

Figure L-3 Seven Fluorinated Gases Used in Chip Production



Source: Hess (2024)

[28] The Proposed Project ultimately might not employ precisely the same PFAS use applications described therein, but any such differences are not expected to alter the FEIS's analysis of PFAS-related effects of the Proposed Project.

[29] Note that these percentages are meant to describe PFAS usage in semiconductor fabrication generally and not necessarily the precise usage percentages or types to be used at the Micron Campus.

L-1.5.3 Fabrication Process and Indirect Support Chemistries to be Used in Micron's New York Semiconductor Fabs

Micron will be required to have a policy to secure full chemical disclosure from all chemical suppliers, including through the use of non-disclosure agreements with these suppliers, to ensure that it has sufficient information to evaluate regulatory compliance and worker safety. Such information is tightly controlled and not publicly shared, reinforcing the critical importance of safeguarding intellectual property and technological edge. This information will, however, be shared confidentially with USEPA and NYSDEC to the extent required by law.

Semiconductor fabrication involves the use of these carefully selected and proprietary chemistries, some of which may contain PFAS. While maintaining confidentiality of Micron's proprietary and trade secret information, this section provides additional detail on plans for use of fabrication process and indirect support chemistries that may contain PFAS at the Proposed Project. Further detailed information about these critical PFAS uses in semiconductor fabrication is available at www.semiconductors.org/pfas.[30] While the specific number and order of processing steps that will be used at the Proposed Project is proprietary, front-end semiconductor fabrication facilities generally use the PFAS compounds discussed herein, and follow the same series of semiconductor device manufacturing steps as detailed in the SIA fabrication literature. The Proposed Project will be a front-end manufacturing site or fab that generally will use process steps consistent with those described generally in Table 2.2-1 to NIST's Programmatic Environmental Assessment (NIST, 2024) (reproduced as Exhibit A to this Appendix) and the SIA-produced video entitled, "The Chemistry of Semiconductor Episode 2: Manufacturing the Miraculous," which is available at https://youtu.be/H1kMEffPV6s?list=PLbGVNpq7GkrRkw78mlKNWL-SNRq0g3lmv.[31]

Key PFAS-containing fabrication process chemistries include photolithography materials and dry etch gases, while indirect support chemistries include heat transfer fluids, refrigerants, and lubricants/greases. The concentration of PFAS varies by chemical and can be as low as less than 0.1 percent PFAS by weight.

Photolithography Materials. Photolithography is a patterning process that defines where to add or remove materials in each step of the fabrication of integrated circuits. Specialized fluorinated organic chemicals serve several important roles in performing photolithographic patterning processes (Ober 2022). Generally, photolithography chemicals are tuned for specific applications and products and are among the most proprietary chemicals used in semiconductor fabrication. There are three main types of photolithography materials – PAGs, surfactants, and other additives.

PAGs are a vital component of many semiconductor photolithography formulations. Semiconductor patterning performance depends on the PAG's ability to interact directly or indirectly with photons and disassociate to form the catalytic photoacid (SIA 2023f). The

[30] Additional information is available on SIA's website at https://www.semiconductors.org/the-chemistry-of-semiconductors/

[31] The Proposed Project ultimately might not employ precisely the same equipment or steps described in these resources, but any such differences are not expected to change the FEIS's analysis of PFAS-related effects of the Proposed Project.

effectiveness of the PAG molecule to generate targeted, well-defined, repeatable patterns depends on these attributes: (a) ability to generate a strong nonnucleophilic acid; (b) high control of photoacid diffusion; (c) good solubility in existing lithography solvent and good miscibility with matrix polymers; (d) high stability; and (e) exacting wavelength-dependent transparency and absorption in resist formulations. PFAS-containing PAGs meet each of these attributes, but the semiconductor industry continues to explore alternatives to PFAS. Full transition to non-fluorinated PAGs would require extensive research and development, and it will be many years (even decades) before implementation can be accomplished (SIA 2023f).

PAGs generally consist of fluorinated sulphonic acids and sulphonates that are generally small-chain PFAS (C1-C4). Perfluorobutanesulfonic acid (PFBS) is a commonly used PAG, but semi-fluorinated sulphonates are becoming more common and generally range from C1-C2 and can be fully or partially fluorinated. Surfactants may also be used in photolithography materials and are used to improve wettability and reduce pattern collapse during development (SIA 2023g). Some extreme ultraviolet (EUV) lithography rinses contain a fully fluorinated sulphonamide. Other additives in photoresist chemicals include quenchers and polymers that may contain PFAS-based functional groups like -CF2 or -CF3. Generally, photolithography chemicals include fully and partially fluorinated small-chain sulphonates.

Plasma (Dry) Etch Gases. Plasma (dry) etching uses a partially ionized gas in a vacuum reactor to selectively remove material from a wafer's surface. Plasma (dry) etching is essential for transferring lithographic patterns into semiconductor metal and dielectric layers in modern chips. Etch gases are useful for a specific application, as the structure of each F-GHG used determines the affinity of the fluorine ion to the chemicals and elements on the wafer to be etched. Since this process is performed on a nanometer scale, the properties of the etch gas are critical to ensuring that the desired geometry is achieved in a precise fashion. Therefore, the etch gas must be carefully selected to ensure the proper function in the etching process. Plasma (dry) etching and chamber cleaning gases include HFCs (such as difluoromethane (CH2F2)), perfluorocarbons (PFCs) (such as tetrafluoromethane (CF4)), and unsaturated fluoroalkenes (i.e., molecules with double bonded carbons) (SIA 2023b).[32] These are smaller molecules, some of which are not defined as PFAS by USEPA and OECD, typically in the C1-C4 range, and some of these substances are also referred to as fluorinated greenhouse gases.

Heat Transfer Fluids and Refrigerants. HTFs are an indirect support chemistry that enables optimal performance of multiple types of fabrication tools. Many HTFs are PFAS-based and are used depending on the application. Many semiconductor processes require precise operational temperature control, making the equipment and processes highly dependent on fluorinated heat transfer fluids (F-HTFs). These fluids support both heating and cooling needs during fabrication (i.e., dry etch and thin-film deposition) and product testing, ensuring chips perform reliably in final electronic devices. Factors that influence the selection of an HTF material include: operational temperature range, physical properties, viscosity, and others, like particle formation / contamination.

[32] Dry etch and chamber cleaning processes also use other non-PFAS fluorinated gases, like nitrogen trifluoride (NF3) and sulfur hexafluoride (SF6) (Hess 2024).

F-HTFs can include perfluoropolyethers (PFPEs), perfluorocarbons (PFCs), hydrofluorocarbons (HFCs), hydrofluoroethers (HFEs), hydrofluoroolefins (HFOs), fluorinated ketones, and other fluorinated liquids (SIA 2023h), some of which are not currently classified as PFAS by USEPA and OECD. PFC structures vary widely and include straight-chained, branched, and fully fluorinated substances. Some types are long-chained fluorinated polymers or substances of unknown or variable composition (UVCB) with various functional groups (i.e., no sulphonic acid or carboxylic acid functional groups) (SIA 2023h). Structure depends on the application, which dictates the physical properties required.

Like heat transfer fluids, refrigerants used in the refrigerant cycle of equipment chillers provide precise operational temperature control to support dry etch, thin-film deposition and device test applications. Fluorinated refrigerants have the ability to meet multiple performance requirements at once. They possess high boiling points, low vapor points, and low kinematic viscosity at working temperatures (SIA 2023h). Fluorinated refrigerants may include PFCs, HFCs, HFOs, fluorinated ketones and other fluorinated liquids. Where appropriate, the Micron Campus will also use non-fluorinated refrigerants, like CO2.

Lubricants and Greases. High-performance PFAS-containing lubricants are essential within the semiconductor manufacturing process because of their ability to meet multiple performance requirements simultaneously. These requirements include the need to prevent particle creation and outgassing while providing effective lubrication within the extreme physical environments present in manufacturing processes, and remaining inert to other chemistries used in certain manufacturing process steps (SIA 2023i). The most commonly used lubricants in various semiconductor applications are polytetrafluoroethylene (PTFE) and perfluoropolyether (PFPE), typically in cleanroom tools such as vacuum pumps (SIA 2023i). PTFE is a fluoropolymer that is also approved by the U.S. Food and Drug Administration (USFDA) for use in medical devices implanted in persons and for food contact uses (USFDA 2025).

Because PFAS-containing fabrication process chemistries (e.g., photolithography, plasma (dry) etch) may come into contact with the wafer during the fabrication process, PFAS may be present in process-related wastewater and/or air emissions. Heat transfer fluids tend to evaporate and may be found in fugitive air emissions. Residual levels of process chemistries, indirect support chemistries, and lubricants and greases may be found in materials sent for reuse, recycling, or disposal.

L-1.6 Measures to Avoid and Minimize PFAS Use and Discharge

L-1.6.1 Non-PFAS Alternatives for Potential Use in Semiconductor Fabrication

The semiconductor industry and its chemical suppliers engaged in a concerted, multi-year effort to transition away from using PFOS and PFOA as fabrication process chemistries by substituting with short-chain compounds (SIA 2023j). Notwithstanding, many semiconductor applications depend on PFAS due to certain chemical properties, such as low surface tension, high stability, and compatibility. Despite extensive research, no viable PFAS-free alternatives exist for many key uses in semiconductor fabrication. Replacing these materials is a complex, multi-year process, and may involve significant technical, containment, transport, safety, and supply chain challenges. Until proven alternatives emerge, the industry has committed to using PFAS

chemistries safely and responsibly. Exhibit B also describes key PFAS use applications in semiconductor fabrication and their criticality to the process.

Implementation of non-PFAS alternatives requires research, testing, and time. (SIA 2023c). This timeline consists of four phases: research, development, integration, and ramp to high-volume manufacturing (HVM).

- **Research and innovation** of chemistries for use in semiconductor fabrication can begin as much as 15 years before manufacturing ramp, and much of it is never explored in subsequent phases.
- **Development** involves the exploration of a pared down list of research chemistries (focusing on proof of concept and the development of prototype materials, processes, and equipment) to evaluate application requirements.
- **Integration** focuses on qualification and verification of new chemistries in fab processes to evaluate function, reliability, and scale.
- **Ramp to HVM** is the implementation of the new process or chemistry, including optimization of the process to streamline HVM processes. (SIA 2023c).

The timeline to implement non-PFAS alternatives varies based on factors like chemical availability and associated process changes, with shorter times needed for drop-in replacements and longer times needed where new chemistry or technology must be invented:

- **Three to four years**: If a suitable non-PFAS alternative already exists and does not require infrastructure changes, it typically takes 3–4 years to test and implement it in HVM.
- **Three to 10-plus years**: When a viable alternative needs tooling or process changes, it can take 3 to over 10 years to modify systems, qualify the solution, and integrate it into HVM.
- **Five to 25-plus years – invention required**: If no existing alternative meets performance needs, new chemicals or fabrication methods must be invented, which can take 5 to over 25 years and may not ultimately succeed.
- **No alternative achievable**: In some cases, no non-PFAS alternative can deliver the necessary chemical functionality, making replacement unfeasible. (SIA 2023c).

Micron is active in numerous initiatives designed to support the further reduction of PFAS usage. These include engagement in external research of PFAS-free alternatives through the National Science Foundation/Semiconductor Research Corporation Research Center for Environmentally Benign Materials, and Micron's leadership in semiconductor industry PFAS consortiums (including the SIA's Semiconductor PFAS Consortium and the SEMI PFAS Initiative) working to reduce PFAS consumption or eliminate use where possible, identify alternatives, and minimize and control emissions or discharges. While novel projects to reduce or substitute essential materials such as these often take many years and are usually based on guidelines from regulatory agencies, Micron is engaged in these industry efforts to accelerate these evaluations in advance of potential regulation (Micron 2025) and will continue its involvement in initiatives like these, as appropriate.

Additionally, recognizing that challenges remain as of today, Micron will continue to work with HTF vendors to identify non-PFAS replacements, where feasible based on market availability, operational safety, and other considerations. For instance, some candidate materials meet temperature range requirements but are flammable, posing safety and other risks. Switching materials would require extensive retooling and raise concerns about possible wafer contamination

resulting in yield loss and increased field failures. Indeed, advantages of PFAS-containing HTFs include that they are inert and non-flammable. Similarly, Micron has represented to the lead agencies that it is exploring non-PFAS dry etch gases, but progress has been limited due to fluorine's critical role in these processes. Efforts have focused on identifying lower GWP molecules, including unsaturated fluorocarbons. Finally, manufacturers and users also are working to identify non-PFAS photolithography materials. While most PFAS-containing surfactants have been phased out, critical materials like post-EUV rinses still rely on PFAS. Efforts are also underway to identify non-PFAS containing PAGs. Photolithography materials are some of the most complex, tailored, and specific materials in the semiconductor industry and an extensive amount of research and development is needed to support next generations of memory technology. Photolithography vendors have been researching alternate materials since industry efforts began to remove PFOS and PFOA but have not yet found non-PFAS PAGs for cutting edge technology like EUV. There has been some success with earlier generation materials such as those supporting 193 nanometer (nm) or earlier lithography technologies, but the materials needed for smaller line and space are not yet available (Ober 2022).

L-1.6.2PFAS Wastewater Treatment for the Proposed Project

Wastewater from semiconductor fabrication facilities contains PFAS that must be treated and managed in accordance with the law and applicable permits prior to discharge. Industrial wastewater generated by the Proposed Project will be treated on the Micron Campus either for reuse or to levels necessary to meet PFAS discharge limitations and conditions contained in an Industrial Wastewater Discharge Permit (IWDP) to be issued to Micron by Onondaga County Department of Water Environment Protection (OCDWEP). The IWDP will set limits that must be met at the point of discharge from the Micron Campus, prior to being sent as secondary residual wastewater via the wastewater conveyance to the Industrial Wastewater Treatment Plant (IWWTP) at the Oak Orchard Site.

To accept new discharges from the Micron Campus, OCDWEP has applied for an updated SPDES permit for discharge of treated wastewater to the Oneida River. As discussed in FEIS Section 3.8.3.2, it is anticipated that NYSDEC will require effluent monitoring for PFAS and other compounds in OCDWEP's SPDES permit, including sampling for approximately 40 compounds using EPA Method 1633/1633A and leveraging state guidance values, as applicable (NYSDEC 2025).[33]

Micron's proposed wastewater discharges to the Oak Orchard IWWTP will require an IWDP issued by OCDWEP, establishing PFAS discharge limits and other terms consistent with the USEPA-approved pretreatment program and the requirements of the Oak Orchard WWTP SPDES permit for PFAS. Establishment of the discharge requirements of these compounds will be subject to any changes in regulatory or SPDES permit requirements. Periodic monitoring and reporting of these compounds by Micron will be required (NYSDEC 2025; USEPA 2022). Monitoring for PFAS compounds will also be conducted by OCDWEP prior to discharge to the Oneida River (NYSDEC 2025), in accordance with its SPDES permit conditions.

[33] NYSDEC guidance is also consistent with USEPA's December 5, 2022 memo encouraging POTWs to impose PFAS monitoring provisions in indirect discharge permits issued to industrial users (USEPA 2022, NYSDEC 2025).

In order to meet these effluent limitations in its IWDP, the Proposed Project will include PFAS wastewater treatment at the Micron Campus. As discussed in FEIS Section 3.8.3.2, Micron is evaluating various wastewater treatment technologies and their effectiveness to address the wastewater matrix anticipated for a high-volume semiconductor fabrication facility. Wastewater at the Micron Campus may include a mix of the following types of PFAS in ppt-level concentrations: perfluoroalkyl carboxylic acids, perfluorosulfonic acids, fluorotelomer sulfonic acids, perfluoroalkane sulfonamides, perfluoroalkane sulfonamidoacetic acids, perfluoroalkane sulfonamide ethanols, per- and polyfluoroether carboxylic acids, ether sulfonic acids, and fluorotelomer carboxylic acid (SIA 2025).

Due to the evolving nature, complexity, and rapid innovation of treatment options, Micron has not yet determined which specific technologies will be included in the Proposed Project for implementation at the Micron Campus. As summarized in Exhibit C of this Appendix, a suite of candidate technologies is available for potential inclusion in the Proposed Project. Promising developments include technologies that may break the carbon-fluorine bonds, thereby reducing cost and risk associated with secondary waste streams. Such technologies may be used in tandem with other proprietary technologies that Micron similarly is scrutinizing for appropriateness. Detailed, site-specific design will determine the technology or technologies selected based on factors such as their suitability and configuration for semiconductor fabrication wastewater systems, scalability, the candidate technologies' capabilities, the commercial viability of the treatment vendors, the feasibility of any necessary pretreatment, and their operational characteristics, but the existence of effective treatment and destruction technologies is not currently in doubt.

Micron continues to evaluate technologies and methods for managing PFAS in wastewater. Micron's early evaluations suggest that the most effective wastewater treatment approach for the Proposed Project is anticipated to involve at least two strategies: (1) direct piping of certain segregated streams (including materials that may be beneficially reused or disposed) to collection systems; and (2) localized segregation and concentration technologies at relevant process streams at the Micron Campus prior to discharge to the IWWTP.

As the first strategy, Micron would pipe certain streams, such as used process solvent potentially containing PFAS, to closed bulk storage systems. As discussed above, the PFAS content and reuse potential of these materials may vary. These streams would be segregated from wastewater discharge and instead will be managed in accordance with the framework described in Section VI.D. of this Appendix. Such materials would be collected, reused (onsite or offsite), recycled, treated, or disposed in accordance with applicable legal requirements by licensed and permitted treatment and disposal facilities.

As the second strategy, for waste streams that will ultimately be discharged to wastewater, Micron would identify locations within the processes with the most concentrated PFAS as the best candidates for localized PFAS segregation and concentration technologies at or near those locations. Such localized application of segregation and concentration technologies appear most effective when installed where PFAS levels are more concentrated and have fewer potentially interfering non-PFAS constituents (as compared to the facility's final discharge point).

If additional treatment is needed after these localized upstream measures in order to comply with IWDP effluent limitations, Micron may explore installation of PFAS wastewater treatment

further downstream at a location on the Micron Campus prior to the permitted IWDP final effluent discharge monitoring location(s). This option may require an additional concentration step and risk reduced effectiveness due to the presence of other non-PFAS constituents or other factors. Use of the segregation and concentration technologies would then require management of the concentrated PFAS stream either through pairing with a PFAS destruction technology or management in accordance with the framework discussed in Section VI.D. of this Appendix. Concentrated PFAS from the segregation step would be collected in a bulk system or other container for offsite disposal or routed for further treatment (such as a PFAS destruction technology) before it is collected for offsite disposal at a licensed and permitted treatment or disposal facility. If a treatment medium, such as a resin or granular activated carbon is used, the treatment medium would be sent by Micron to an offsite facility for regeneration, as needed, or for disposal at an offsite licensed facility at end-of-life. Such offsite management or disposal will be in accordance with applicable legal requirements and the framework discussed in this Appendix.

Regardless of the final technologies or mechanisms selected, Micron will be required to meet discharge limits that OCDWEP will impose in Micron's IWDP, which will necessitate implementation of PFAS wastewater pretreatment on the Micron Campus.

Micron also intends to work with OCDWEP to develop a plan to reuse treated Oak Orchard IWWTP effluent volumes as makeup water for the Micron Campus' cooling towers and other mechanical systems. Only treated effluent from the IWWTP that is not recycled and returned to the Micron Campus would be discharged into the Oneida River. This discharge would comply with the Oak Orchard WWTP's approved permit and applicable regulations, as discussed in FEIS Section 3.10.3.2.

Micron also has focused efforts on investigating and testing possible wastewater treatment options as the development of technology in this area continues to evolve. Micron continues to participate in industry-wide initiatives, local partnerships, and exploration of alternatives with key suppliers. Micron is working with various semiconductor industry groups to pursue PFAS pollution prevention and treatment options (Micron 2025). This FEIS does not displace the anticipated more detailed forthcoming permitting processes and associated decisions that are not yet made.

Micron will continue evaluating available and evolving tools to manage PFAS in wastewater to support its industrial wastewater discharge permit application and required discharge limits. Selection of wastewater treatment technology(ies) for the Micron Campus will consider the factors discussed here and other considerations that may become available as part of its reviews. Micron will be required to comply with the terms of an IWDP.

L-1.6.3PFAS in Air Emissions Control and Abatement Technologies for the Proposed Project

Although there are no specific federal or state standards for PFAS individually or as a group, all air pollutants (including PFAS) anticipated from Micron's future operations have been evaluated and process gas emissions will be controlled or otherwise managed. FEIS Sections 3.6 and 3.7 provide a thorough and comprehensive analysis of project-associated emissions. Appendix I of the FEIS provides an assessment of the air modeling conducted, including modeling performed for mobile and stationary sources for criteria and non-criteria pollutants associated with the

Proposed Project. In sum, the Micron Campus will be a stationary source of air pollutants subject to stringent permitting and emissions controls.

For air pollution control and safety reasons, semiconductor fabs are equipped with highly segregated exhaust systems for fabrication processes. Acid exhaust ducts carry a mixture of corrosive gases and particulate from multiple process tools to central or house wet scrubbers, while solvent exhaust ducts carry volatile organic compounds (VOCs) from various processes to central or house thermal oxidizers. For certain processes, abatement is installed on the process tool itself, often referred to as point-of-use (POU) abatement or as a process equipment exhaust conditioner (PEEC). These process exhausts include both unreacted input materials and reaction byproducts. For example, C-F input gases may form C-F byproducts in the plasma process. Inorganic fluorine compounds or F2 may generate C-F byproducts when etching or cleaning carbon-containing films (SIA 2023b). Captured fabrication process exhausts will be routed to emissions controls, with built-in redundancy.

Most anticipated PFAS-containing air emissions (over 90%) from semiconductor manufacturing come from plasma (dry) etching and chamber cleaning processes (Hess 2024). Micron anticipates that these processes will use substances that may be considered PFAS, such as HFCs (like difluoromethane (CH2F2)), PFCs (like tetrafluoromethane (CF4)), and unsaturated fluoroalkenes (i.e., molecules with double bonded carbons) (SIA 2023b). These processes also may use non-PFAS substances like nitrogen trifluoride (NF3) and sulfur hexafluoride (SF6) (Hess 2024). These same gases are anticipated as air emissions from Micron's operations. All etch and chamber cleaning processes will be equipped with control devices, such as POUs, with a destruction removal efficiency that corresponds to each fluorinated gas, as set forth in Table 6.17 of the 2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories (IPCC 2023). These emissions will be treated using controls like regenerative catalytic systems (RCS) or POU thermal oxidizers with up to 99% destruction efficiency for most compounds. (IPCC 2023).

Anticipated air pollutants from the Micron Campus are being evaluated for compliance with federal and state ambient air quality standards pursuant to the state's stationary source permitting process. Additionally, the Micron Campus is anticipated to be a major source under the Prevention of Significant Deterioration (PSD) Program, triggering Best Available Control Technology (BACT) requirements for emissions of carbon monoxide, nitrogen oxides, and regulated New Source Review (NSR) pollutants, including fluorinated greenhouse gases that may be defined as PFAS. Again, these gases may be treated using RCS or POU thermal oxidizers, which can reach 99% destruction removal efficiency for most compounds.

Under NYSDEC's air toxics program (6 NYCRR Part 212), all non-criteria air pollutants (including PFAS) are regulated using annual and short-term guideline concentrations (AGC/SGC) based on their potential health effects. Where no AGC/SGC exists for a compound, NYSDEC derives such values per the Division of Air Resources guidance, "DAR-1: Guidelines for the Evaluation and Control of Ambient Air Contaminants Under 6 NYCRR Part 212," based on the best available science on the potential toxicological effects of each compound (NYSDEC 2021). This includes guidelines for anticipated PFAS emissions, which may be subject to air dispersion modeling and/or emissions controls to protect public health and safety.

Fugitive emissions of fluorinated heat transfer fluids from process chillers would be minimized through efficient use and maintenance practices. Micron is proposing GHG BACT for the proposed HTFs via good design, usage monitoring to ensure efficient usage, and heightened maintenance practices. Ultimately, NYSDEC will condition Micron's air permit appropriately. Micron is evaluating the opportunity to use the low-GWP and/or non-PFAS HTFs that are technically viable to meet the heat transfer needs of each desired application. Similarly, potential fugitive emissions from refrigerants would be reduced by transitioning to alternative lower GWP substances, where feasible.

GHG emissions from the Proposed Project are subject to New York's Climate Leadership and Community Protection Act (CLCPA) Analysis, including potential PFAS emissions from F-GHGs. NYSDEC is conducting a contemporaneous review of the Proposed Project under the CLCPA pursuant to "DAR-21: The Climate Leadership and Community Protection Act and Air Permit Applications" guidance (NYSDEC 2022), which entails assessment of direct, upstream, and downstream GHG emissions from the Proposed Project, including the Micron Campus. A copy of Micron's CLCPA Analysis has been appended to the FEIS as Exhibit J.

Additionally, as many F-GHGs are also PFAS chemistries in the broadest definition, the semiconductor industry has made significant efforts to address potential PFAS air emissions from semiconductor fabrication processes as part of its efforts to reduce climate change. These efforts include development of F-GHG emissions abatement technologies, alternative chemistries and processes (where feasible), process optimization to reduce gas consumption, and recovery and recycling technologies (SIA 2023b). Additionally, the development of abatement technologies continues to evolve and the destruction removal efficiencies of these devices and measures can be further fine-tuned after operation commences. The benefit of these efforts will be reflected in the stationary source permit for the Micron Campus.

L-1.6.4PFAS Materials Management and Solid Waste Treatment and Disposal Framework for the Proposed Project

Waste material, including waste containing PFAS, is regulated at the state and local level as solid waste.[34] Under 6 NYCRR Part 360.2(a), NYSDEC regulations define when a material qualifies as a solid waste. These well-established solid waste requirements are intended to protect human health and the environment by providing acceptable and licensed facilities for management of solid wastes. Licensed solid waste management facilities have improved over time, and historic, inactive facilities are not necessarily representative of state-of-the-art facilities today.

In considering management of PFAS-containing waste, USEPA emphasizes that it is "important to distinguish between a potential environmental release and a direct human exposure. A PFAS release does not inherently imply direct and immediate human exposure and a release does not necessarily present an unacceptable risk to specific populations" (USEPA 2024b). USEPA has developed a framework for "decision-makers who need to identify the most effective

[34]Two specific PFAS compounds, PFOA and PFOS, have been designated as hazardous substances under CERCLA and by New York state to facilitate cleanup of PFAS-contaminated sites. Designation of hazardous substances is distinct from listing a substance as hazardous waste or regulating a material that exhibits hazardous characteristics as a hazardous waste. Presently, PFAS is not a listed hazardous waste, is not included in the list of compounds for the toxicity characteristic, and is not understood to fall under another category for hazardous waste designation.

means for destroying or disposing of PFAS-containing materials and wastes" (USEPA 2024b). This framework for choosing a technology to destroy or dispose PFAS-containing wastes considers the type of PFAS (including unknown PFAS), concentration, volume, availability of analytical methods, whether a particular treatment technology is available at the scale needed, engineering controls to prevent or minimize release of PFAS into the environment, performance of the technology being considered, whether there are non-PFAS materials in the waste that may affect the technology's performance, and other detailed considerations (USEPA 2024b). Micron will consider these and other factors in evaluating and determining appropriate disposal and destruction options for PFAS-containing wastes from the Proposed Project. This will also support use of emerging treatment technologies where appropriate, effective, and available.

Micron will also consider and evaluate disposal and destruction options for consistency with New York's framework for solid waste management. For instance, key considerations in determining management of a waste are the concentration and type of PFAS. For a waste that is predominantly PFAS, Micron would apply stringent management approaches, such as destruction of the material (by incineration or another destruction technology).[35] At the other end of the spectrum, some predominantly non-PFAS materials might have nominal concentrations of PFAS. Depending on the materials, some have the potential to be beneficially used in a manner that minimizes the potential for environmental release and also comports with public policy that favors reuse and reduction of waste as discussed below. This would be assessed on an individual basis considering the profile of the material and state and local requirements.

As discussed in the FEIS, Micron will be required to have a policy to implement its reuse, recycle and recovery (RRR) Program and will identify opportunities to minimize waste generation, based on vendor availability, commercial and technical feasibility, and professional judgment. Recognizing that there is no one-size-fits-all technology or treatment program for PFAS-containing waste material, Micron through its RRR Program will implement feasible, practicable, and necessary measures to reuse, recycle, and recover materials or waste generated at the facility.

Waste that is destined for treatment or disposal would be properly managed onsite to minimize potential for any release and would be collected via licensed private haulers for transport to permitted private facilities authorized to receive the waste. (FEIS Sec. 3.8.3.2). Non-hazardous drummed used solvents would be collected via private haulers for transport to authorized off-site incineration facilities for energy recovery or for other RRR activities. The non-RRR portions of this waste would be collected via licensed private haulers for transport to private, active industrial waste facilities and landfills identified in FEIS Table 3.8-8. The non-hazardous solid waste generated on-site would either be disposed of at the WTE Facility for energy recovery or, depending on the waste type, collected via private hauler for transport to active landfills. (FEIS Sec. 3.8.3.2). The FEIS also addresses disposal and RRR management methods Micron would employ to address hazardous materials generated during operations. (FEIS Sec. 3.8.3.2). Wastes containing PFAS would be subject to the foregoing framework and protocols.

[35] *See* USEPA 2024b, at pp. 45, 53, and 60 (citing studies and concluding that "Incineration may be a viable PFAS destruction technology if done under certain conditions" and describing favorable conditions). EPA further describes that "temperatures above approximately 1,100°C / 2,012°F may result in high destruction efficiencies and few detectable fluorinated products of incomplete combustion." (USEPA 2024b).

For certain wastes, Micron would implement its RRR Program in a manner that follows applicable NYSDEC requirements such as the Beneficial Use Determination (BUD) program. When a material is put to a beneficial use that is consistent with a NYSDEC-approved BUD, the material is not considered a solid waste under the agency's solid waste regulations at 6 NYCRR Part 360. 6 NYCRR § 360.12(c) sets forth categories of pre-determined beneficial uses where the materials in question cease to be wastes as long as they are used in a manner specified in the applicable provision (e.g., industrial wastes historically used as an ingredient in a manufacturing process). Where a proposed reuse is not covered under a pre-determined BUD, the waste generator can seek a case-specific BUD. Case-specific BUDs typically are for waste material used as a substitute for a component material in the manufacture of a product, or as a substitute for a commercial product. Consistent with its RRR Program, Micron will consider petitioning NYSDEC under 6 NYCRR § 360.12(d) for case-specific BUDs for certain wastes. A BUD petition must include detailed information, including but not limited to "analytical data concerning the chemical and physical characteristics of the waste and of each type of proposed product, and the chemical and physical characteristics of any analogous raw material or commercial product for which the waste is proposed to be an effective substitute" and a "demonstration that the management of the waste when used in accordance with the beneficial use will not adversely affect public health and the environment.…" 6 NYCRR § 360.12(d)(2)(iv) & (vii). Thus, to the extent Micron seeks a case-specific BUD for any waste material containing PFAS, its eligibility for beneficial reuse can be assessed under NYSDEC's BUD program, as appropriate.

Micron represents that it is also focused on identifying appropriate disposal or RRR operations for PFAS-containing wastes such as solvent waste and end-of-life fab infrastructure (e.g., tools, tubing, exhaust ducts). This includes designing fabrication processes to segregate certain waste streams that may contain PFAS for management at off-site permitted treatment and disposal facilities. To the extent that these end-of-life materials are PFAS-containing, Micron would be required to have a program to manage such materials consistent with the applicable regulatory requirements and the framework discussed in this Section VI(D).

As discussed above, it is anticipated that Micron will segregate process solvent waste containing PFAS from facility wastewater streams to closed bulk systems for off-site management by licensed and permitted treatment and disposal facilities, or for appropriate RRR operations, unless and until better methods are available. Micron would dispose or otherwise manage materials known to contain regulated PFAS in accordance with regulation and as appropriate given its content and characteristics.

USEPA's current interim guidance on PFAS destruction and disposal describes the agency's latest assessment of the available methods for treatment and management of the PFAS-containing waste (USEPA 2024b). Micron will use this and other guidance to assess suitable methods for disposal and management of PFAS-containing materials. Such disposal activities also must comply with applicable law for the safe and proper disposal of any generated solid and hazardous waste. Regulatory agencies with permitting authority will have confidential access to specific PFAS compounds used at the Micron Campus and thus would have the ability to assess whether the treatment technology used for the Proposed Project is sufficient to achieve compliance with applicable laws and regulations. The FEIS does not displace the anticipated more detailed forthcoming permitting processes and associated decisions that are not yet made.

L-1.6.5PFAS Chemical Management Practices for the Proposed Project

As discussed in FEIS Sections 3.9.2 and 3.9.3.2, Micron employs extensive care and precautions to protect workers, consumers, and the environment. Micron employs the Semiconductor Equipment and Materials International (SEMI) S2 standard, which establishes standards for design and installation of manufacturing processes to avoid or reduce workplace hazards, including for gas effluent handling, exhaust ventilation, fire risk avoidance and minimization, and electrical design and hazards. These efforts include use of enclosed automated chemical delivery systems (which physically separate workers from the production process) to minimize potential worker safety risks and exposures. Micron would also use advanced leak detection and employ toxic gas monitoring for hazardous chemical usage. Generally, PFAS-containing compounds are a component of other chemistries used in the facility, whereby generally applicable exposure controls would also protect workers from potential PFAS exposures. For instance, PAGs (which can be PFAS-containing chemicals) that are used in EUV lithography are typically 3-15% of an overall lithography formulation (Choi 2007). Chemical management practices that minimize potential exposures to other substances during processes like photolithography would also reduce potential exposures to the PFAS used in such processes (USEPA 2023).[36]

More generally, Micron controls and mitigates chemical and process hazards in the workplace by employing the principles of the NIOSH Hierarchy of Controls (i.e., elimination, substitution, engineering, administrative, and personal protective equipment (PPE)), as well as USEPA's waste management hierarchy for source reduction, reuse, recycling, treatment and disposal. Micron incorporates these approaches in its evaluation and approval of chemical usage. Micron requires its chemical suppliers to provide full disclosure to Micron of all substances used in the semiconductor fabrication process and conducts a comprehensive review before those chemicals are approved for use in Micron facilities. Through this process, Micron identifies sources of PFAS in its fabrication process chemistries and can make efforts to identify possible non-PFAS containing alternative chemistries where available and feasible. However, review of alternative chemistries may involve evaluation of chemistries that introduce other health, safety, process safety, and environmental risks.

Micron worked with the semiconductor industry collectively to eliminate PFOS and PFOA from fabrication process chemistries. Micron also is working with the semiconductor industry to investigate PFAS applications throughout the manufacturing process, research the feasibility of substitutes, explore opportunities to reduce PFAS use and implement process changes, and pursue treatment options. The industry formed the Semiconductor PFAS Consortium and the SEMI PFAS Initiative to improve its understanding of the availability of alternatives, optimize uses of PFAS in the manufacturing process, and direct adoption of abatement and treatment technologies. This includes ongoing efforts to develop industrial hygiene measurement techniques to monitor for potential PFAS exposures.

[36] USEPA's announcement acknowledged that use of "PFAS will not result in worker, general population or consumer exposure and are not expected to result in releases to the environment, which such PFAS are used in a closed system with occupational protections as is generally the practice in the manufacture of some semiconductors and other electronic components" (USEPA 2023).

Also discussed in FEIS Section 3.3.4.2, the Proposed Project will be subject to stormwater prevention permits, stormwater best management practices, chemical storage and management practices, and spill prevention measures that would avoid or minimize the potential for spills, stormwater runoff, or significant releases of hazardous substances that could cause significant adverse effects on environmental resources. Specifically, the SPDES stormwater permit and Micron's chemical management programs will address the protocols for managing hazardous materials and the potential for accidental leaks. This includes management of PFAS-containing chemicals, which vary in PFAS concentration by chemical.

L-1.7 Cumulative Effects of PFAS Uses from the Proposed Project

Cumulative effects analysis properly focuses on the incremental effects of the Proposed Project and Connected Actions, rather than a similarly detailed accounting of separate projects or historical sources or releases. Chapter 4 of the FEIS on cumulative effects also references rather than repeats analysis of growth inducing effects discussed in Chapter 3. Based on this analysis for use, treatment, and disposal of PFAS, the Proposed Project is not anticipated to have significant adverse cumulative effects.

The FEIS is inherently based on currently available information and what is reasonably foreseeable. Specific potential PFAS uses and releases from various future commercial and residential uses, or the availability or utilization of any non-PFAS alternatives associated with those uses, are not presently known or reasonably determinable at this time. Other future projects, including potential developers on the White Pine Science and Technology Park and projects identified in Table 4.2-1, will be required to comply with all applicable regulatory requirements concerning PFAS and, where required, their own applicable wastewater discharge limits imposed by OCDWEP and other requirements, including for PFAS. Additional details regarding potential use or disposal of ubiquitous PFAS by other projects are not essential to inform a reasoned choice among the alternatives for or to evaluate significant cumulative environmental effects of the Proposed Project.

As discussed above, the semiconductor industry's PFAS uses are critical, but comprise a very small percentage of the overall PFAS market relative to other industries' uses of PFAS (potentially around 1%) (SIA 2024; Lim 2023). The concentration of PFAS anticipated to be used in Micron's operations varies by chemical and can be as low as under 0.1 percent PFAS by weight. Micron and the semiconductor industry are engaged in efforts to identify non-PFAS alternatives for these critical uses, but limited drop-in substitutes are available and the development of alternatives could take many years, where possible.

It is anticipated that the Micron Campus will be subject to a range of regulatory requirements that will directly or indirectly limit potential PFAS discharges and emissions from its operations. As discussed above, this includes anticipated discharge limits for certain PFAS requiring the installation of PFAS wastewater treatment and periodic monitoring of PFAS concentrations in wastewater. It also includes rigorous air permitting and air emissions control requirements. Micron will also apply a framework for management of PFAS-containing wastes that is consistent with legal requirements, EPA guidance, and other factors. Compliance with these relevant laws, regulations, and guidance would reduce the potential for cumulative impacts within the analysis area.

Other potential sources of PFAS in the analysis area would be subject to similar laws and regulations and would have access to similar guidance documents. Other future projects can be reasonably anticipated to comply with associated discharge limits and other requirements. This includes anticipated development of the White Pine Science and Technology Park, for which any significant industrial users discharging to OCDWEP are anticipated to be subject to indirect discharge permits from OCDWEP with PFAS discharge limits and monitoring requirements. To the extent these sources constitute stationary sources of air pollutants, they would be subject to rigorous permitting and air pollution controls under applicable laws and regulations. These sources must also comply with relevant laws and regulations governing disposal of PFAS-containing materials and could employ USEPA guidance on best practices for such materials management (USEPA 2024b). Specific potential PFAS uses and releases from various commercial and residential uses are not presently known or reasonably determinable at this time.

References

Amen, R. et al. (2023). A Critical Review on PFAS Removal from Water: Removal Mechanism and Future Challenges. J. Sustainability 2023, 15(23), 16173; https://doi.org/10.3390/su152316173. https://www.mdpi.com/2071-1050/15/23/16173.

Choi, K.W., et al. (2007). Effect of photoacid generator concentration and developer strength on the patterning of model EUV photoresist. Proc. of SPIE Vol. 6519 651943-1. https://tsapps.nist.gov/publication/get_pdf.cfm?pub_id=852725.

Droz, B. et al. (2025). Practical Guidance on Selecting Analytical Methods for PFAS in Semiconductor Manufacturing Wastewater. ACS Meas. Sci. Au 2025, 5, 4, 399–423 https://doi.org/10.1021/acsmeasuresciau.5c00021.

Duinslaeger, N., Radjenovic, J. (2022). Electrochemical Degradation of PFAS using Low-cost Graphene Sponge Electrodes. arXiv:2202.06741, https://doi.org/10.1016/j.watres.2022.118148. https://arxiv.org/abs/2202.06741

European Chemicals Agency (ECHA) (2023). Annex to the ANNEX XV Restriction Report: Proposal for a Restriction: Per- and polyfluoroalkyl substances (PFAS), Version Number 2. https://echa.europa.eu/documents/10162/57812f19-8c98-ee67-b70f-6e8a51fe77e5

Griffin, A., et al. (2024). Rejection of PFAS and priority co-contaminants in semiconductor fabrication wastewater by nanofiltration membranes. Water Research 262, Sep 15:262:122111, doi:10.1016/j.watres.2024.122111, Epub 2024 Jul 17. https://doi.org/10.1016/j.watres.2024.122111 https://www.sciencedirect.com/science/article/abs/pii/S004313542401011X

Hess, J. (2024). Chip Production's Ecological Footprint: Mapping Climate and Environmental Impact. Interface. https://www.interface-eu.org/publications/chip-productions-ecological-footprint?link_id=43&can_id=ebc866ae0784791189e4bf2d773ba4a7&source=email-this-week-in-chips-a-weekly-update-from-chips-communities-united-827-2&email_referrer=email_2877527&email_subject=this-week-in-chips-a-weekly-update-from-chips-communities-united-98&&

Intergovernmental Panel on Climate Change (IPCC). (2023). 2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories, V. 3 Industrial Processes and Product Use, Ch. 6 Electronics Industry Emissions (Rev. Nov. 2023). https://www.ipcc-nggip.iges.or.jp/public/2019rf/pdf/3_Volume3/19R_V3_Ch06_Electronics.pdf

Interstate Technology & Regulatory Council (ITRC). (2020). Naming Conventions for Per- and Polyfluoroalkyl Substances (PFAS). https://pfas-dev.itrcweb.org/wp-content/uploads/2020/10/naming_conventions_508_2020Aug_Final.pdf.

Interstate Technology & Regulatory Council (ITRC). (2023a) PFAS – Per- and Polyfluoroalkyl Substances: 5 Environmental Fate and Transport Processes. https://pfas-1.itrcweb.org/5-environmental-fate-and-transport-processes/.

Interstate Technology & Regulatory Council (ITRC). (2023b). PFAS – Per- and Polyfluoroalkyl Substances: 12 Treatment Technologies for PFAS. https://pfas-1.itrcweb.org/12-treatment-technologies/

Lim, X.Z. (2023). Could the world go PFAS-free? Proposal to ban 'forever chemicals' fuels debate. Nature 620, 24-27. https://www.nature.com/articles/d41586-023-02444-5

Medina, R. et al. (2022). Pilot-scale comparison of granular activated carbons, ion exchange, and alternative adsorbents for PFAS removal. AWWA Water Science 4, e1308. https://doi.org/10.1002/aws2.1308. https://awwa.onlinelibrary.wiley.com/doi/abs/10.1002/aws2.1308

Micron Technology, Inc. (Micron) (2025). 2025 Sustainability Report https://assets.micron.com/adobe/assets/urn:aaid:aem:f2d2221a-6b76-4a98-9a06-f52fa958c91e/renditions/original/as/Micron-2025-Sustainability-Report.pdf National Institute of Standards and Technology (NIST). (2024). Final Programmatic Environmental Assessment for Modernization and Expansion of Existing Semiconductor Fabrication Facilities under the CHIPS Incentives Program. https://www.nist.gov/system/files/documents/2024/06/28/Final%20PEA%20for%20Modernization%20and%20Expansion%20of%20Semiconductor%20Fabs%206-28-2024%20-%20OGC-508C.pdf.

New York State Department of Environmental Conservation (NYSDEC). (2021). DAR-1: Guidelines for the Evaluation and Control of Ambient Air Contaminants Under 6NYCRR Part 212. https://extapps.dec.ny.gov/docs/air_pdf/dar1.pdf.

New York State Department of Environmental Conservation (NYSDEC). (2022). DAR-21: The Climate Leadership and Community Protection Act and Air Permit Applications. https://extapps.dec.ny.gov/docs/air_pdf/dar21.pdf.

New York State Department of Environmental Conservation (NYSDEC). (2023). Addendum to Technical and Operational Guidance Series (TOGS) 1.1.1: Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations, https://extapps.dec.ny.gov/docs/water_pdf/togs111addendum2023.pdf.

New York State Department of Environmental Conservation (NYSDEC). (2024). Draft Technical and Operational Guidance Series (TOGS) 1.3.14: Publicly Owned Treatment Works (POTWS) Permitting Strategy for Implementing Guidance Values for PFOA, PFOS, and 1,4-Dioxane. https://dec.ny.gov/environmental-protection/water/emerging-contaminants

New York State Department of Environmental Conservation (NYSDEC). (2025). Emerging Contaminants in NY's Waters. (Accessed Sept. 23, 2025). https://dec.ny.gov/environmental-protection/water/emerging-contaminants.

Ober, D. et al. (2022). Review of Essential Use of Fluorochemicals in Lithographic Patterning and Semiconductor Processing. J. Micron/Nanopattern. Mater. Metrol. 010901-1. https://doi.org/10.1117/1.JMM.21.1.010901

Orange County Water District (OCWD). (2021). PFAS Phase I Pilot-Scale Treatment Study Final Report. https://www.ocwd.com/wp-content/uploads/2021-03-24_ocwd-pfas-pilot-i_finalreport.pdf.

Organisation of Economic Cooperation and Development (OECD). (2021). Reconciling Terminology of the Universe of Per- and Polyfluoroalkyl Substances: Recommendations and Practical Guidance, Series on Risk Management No. 61. https://www.oecd.org/content/dam/oecd/en/publications/reports/2021/07/reconciling-terminology-of-the-universe-of-per-and-polyfluoroalkyl-substances_a7fbcba8/e458e796-en.pdf.

Semiconductor Industry Association (SIA). (2023a). Comments of the Semiconductor Industry Association (SIA) on Draft PFAS Legislation of the Senate Environment and Public Works (EPW) Committee, July 14 2023. https://www.semiconductors.org/wp-content/uploads/2023/07/SIA-Comments-on-EPW-Draft-PFAS-Legislation-7_14_23.pdf

Semiconductor Industry Association, Semiconductor PFAS Consortium (SIA). (2023b). PFAS-Containing Fluorochemicals Used in Semiconductor Manufacturing Plasma-Enabled Etch and Deposition. https://www.semiconductors.org/wp-content/uploads/2023/06/FINAL-Plasma-Etch-and-Deposition-White-Paper.pdf.

Semiconductor Industry Association, Semiconductor PFAS Consortium (SIA). (2023c). Background on Semiconductor Manufacturing and PFAS. https://www.semiconductors.org/wp-content/uploads/2023/05/FINAL-PFAS-Consortium-Background-Paper.pdf.

Semiconductor Industry Association, Semiconductor PFAS Consortium (SIA). (2023d). PFAS-Containing Articles Used in Semiconductor Manufacturing. https://www.semiconductors.org/wp-content/uploads/2023/07/FINAL-PFAS-Containing-Articles-Used-in-Semiconductor-Manufacturing.pdf.

Semiconductor Industry Association, Semiconductor PFAS Consortium (SIA). (2023e). PFAS-Containing Materials Used in Semiconductor Manufacturing Assembly Test Packaging and Substrate Processes. https://www.semiconductors.org/wp-content/uploads/2023/06/Assembly-Test-Packaging-Substrate-White-Paper1.pdf.

Semiconductor Industry Association, Semiconductor PFAS Consortium (SIA). (2023f). PFAS-Containing Photo-Acid Generators Used in Semiconductor Manufacturing. https://www.semiconductors.org/wp-content/uploads/2023/06/FINAL-PAG-Case-Study.pdf.

Semiconductor Industry Association, Semiconductor PFAS Consortium (SIA). (2023g). PFAS-Containing Surfactants Used in Semiconductor Manufacturing. https://www.semiconductors.org/wp-content/uploads/2023/06/FINAL-Surfactants-Case-Study.pdf.

Semiconductor Industry Association, Semiconductor PFAS Consortium (SIA). (2023h). PFAS-Containing Heat Transfer Fluids Used in Semiconductor Manufacturing. https://www.semiconductors.org/wp-content/uploads/2023/07/Final-Heat-Transfer-Fluids-Paper.pdf

Semiconductor Industry Association, Semiconductor PFAS Consortium (SIA). (2023i). PFAS-Containing Lubricants Used in Semiconductor Manufacturing. https://www.semiconductors.org/wp-content/uploads/2023/09/PFAS-Containing-Lubricants-Used-in-Semiconductor-Manufacturing-September-18-2023.pdf

Semiconductor Industry Association, Semiconductor PFAS Consortium (SIA). (2023j). PFOS and PFOA Conversion to Short-Chain PFAS-Containing Materials Used in Semiconductor Manufacturing. https://www.semiconductors.org/wp-content/uploads/2023/06/FINAL-PFOS-PFOA-Case-Study-Paper.pdf.

Semiconductor Industry Association, Semiconductor PFAS Consortium (SIA). (2023k). PFAS Release Mapping from Semiconductor Manufacturing Photolithography Processes. https://www.semiconductors.org/wp-content/uploads/2023/09/PFAS-Release-Mapping-from-Semiconductor-Photolithography-Processes-Rev.0.pdf

Semiconductor Industry Association (SIA). (2024). The U.S. Semiconductor Industry's Environment, Health, and Safety Practices Fact Sheet. https://www.semiconductors.org/wp-content/uploads/2024/12/SIA_Environment-Health-Safety-Practices_Fact-Sheet-12-9-24.pdf.

Semiconductor Industry Association, Semiconductor PFAS Consortium. (SIA). (2025). 2023 Semiconductor PFAS Consortium Survey Results: PFAS in Semiconductor Fabrication Facility Wastewater. https://www.semiconductors.org/wp-content/uploads/2025/01/Semiconductor-PFAS-Consortium-Results-PFAS-in-Semiconductor-Fab-Wastewater.pdf

U.S. Environmental Protection Agency (USEPA). (2019). EPA Analytical Methods for PFAS in Drinking Water. https://www.epa.gov/sites/default/files/2019-12/documents/table_of_pfas_methods_533_and_537.1.pdf.

U.S. Environmental Protection Agency (USEPA). (2022). Memo Addressing PFAS Discharges in NPDES Permits and Through the Pretreatment Program and Monitoring Programs. https://www.epa.gov/system/files/documents/2022-12/NPDES_PFAS_State%20Memo_December_2022.pdf.

U.S. Environmental Protection Agency (USEPA). (2023). EPA Announces New Framework to Prevent Unsafe New PFAS from Entering the Market. https://www.epa.gov/newsreleases/epa-announces-new-framework-prevent-unsafe-new-pfas-entering-market.

U.S. Environmental Protection Agency (USEPA). (2024a). PFAS National Primary Drinking Water Regulation, 89 Fed. Reg. 32,532, 32,560 (Apr. 26, 2024).

U.S. Environmental Protection Agency (USEPA). (2024b). Interim Guidance on the Destruction and Disposal of Perfluoroalkyl and Polyfluoroalkyl Substances and Materials Containing Perfluoroalkyl and Polyfluoroalkyl Substances, V.2. https://www.epa.gov/system/files/documents/2024-04/2024-interim-guidance-on-pfas-destruction-and-disposal.pdf.

U.S. Environmental Protection Agency (USEPA). (2024c). Method 1633, Revision A: Analysis of Per- and Polyfluoroalkyl Substances (PFAS) in Aqueous, Solid, Biosolids, and Tissue Samples by LC-MS/MS https://www.epa.gov/system/files/documents/2024-12/method-1633a-december-5-2024-508-compliant.pdf

U.S. Environmental Protection Agency (USEPA). (2024d). Method 1621: Determination of Adsorbable Organic Fluorine (AOF) in Aqueous Matrices by Combustion Ion Chromatography (CIC). https://www.epa.gov/system/files/documents/2024-01/method-1621-for-web-posting.pdf

U.S. Environmental Protection Agency (USEPA). (2024e). CWA Analytical Methods for Per- and Polyfluorinated Alkyl Substances (PFAS). https://www.epa.gov/cwa-methods/cwa-analytical-methods-and-polyfluorinated-alkyl-substances-pfas.

U.S. Environmental Protection Agency (USEPA). (2024e). PFAS Analytical Methods Development and Sampling Research. https://www.epa.gov/water-research/pfas-analytical-methods-development-and-sampling-research.

U.S. Environmental Protection Agency (USEPA). (2025a). EPA PFAS Drinking Water Laboratory Methods. https://www.epa.gov/pfas/epa-pfas-drinking-water-laboratory-methods.

U.S. Environmental Protection Agency (USEPA). (2025b). Other Test Method 45 (OTM-45) Measurement of Selected Per- and Polyfluorinated Alkyl Substances from Stationary Sources. https://www.epa.gov/system/files/documents/2025-01/other-test-method-45-rev1-final-1-14-25.pdf

U.S. Environmental Protection Agency (USEPA). (2025c). Other Test Method 50 (OTM-50) Sampling and Analysis of Volatile Fluorinated Compounds from Stationary Sources Using Passivated Stainless-Steel Canisters. https://www.epa.gov/system/files/documents/2025-01/otm-50-release-1-r1.pdf.

U.S. Environmental Protection Agency (USEPA). (2025d). Administrator Zeldin Announces Major EPA Actions to Combat PFAS Contamination. https://www.epa.gov/newsreleases/administrator-zeldin-announces-major-epa-actions-combat-pfas-contamination

U.S. Environmental Protection Agency (USEPA). (2025e). EPA Announces It Will Keep Maximum Contaminant Levels for PFOA, PFOS. https://www.epa.gov/newsreleases/epa-announces-it-will-keep-maximum-contaminant-levels-pfoa-pfos.

U.S. Environmental Protection Agency (USEPA). (2025f). Trump EPA Announces Next Steps on Regulatory PFOA and PFOS Cleanup Efforts, Provides Update on Liability and Passive Receiver Issues. https://www.epa.gov/newsreleases/trump-epa-announces-next-steps-regulatory-pfoa-and-pfos-cleanup-efforts-provides

U.S. Federal Drug Administration (USFDA). (2025). PFAS in Medical Devices. https://www.fda.gov/medical-devices/products-and-medical-procedures/pfas-medical-devices.

EXHIBIT A

General Overview of Semiconductor Manufacturing Process and Equipment, Excerpt from Table 2.2-1 from NIST's "Final Programmatic Environmental Assessment for Modernization and Expansion of Existing Semiconductor Fabrication Facilities under the CHIPS Incentives Program" (NIST 2024)[37]

[37] Note this exhibit is intended to provide an overview of semiconductor manufacturing processes and equipment generally. Some of these processes and equipment may not be relevant to Micron's anticipated operations at the New York semiconductor fabrication facilities.

Process Step	Semiconductor Manufacturing Equipment (SME)	Pollution Control and Water and Energy Conservation Trends
Oxidation	• Dry or wet thermal oxidation equipment. • Plasma-enhanced CVD equipment. • Electrochemical anodic oxidation equipment. • Diffusion/oxidation furnaces.	Manufacturers are increasingly using single wafer cleaning processes, which increase energy and water consumption per wafer; however, fabs also are increasing process and non-process (cooling and abatement) water reuse to offset this increased water demand.
Lithography	• Wafer and photomask handlers, including front-opening unified pods (FOUPs) and other types of automated wafer handling systems. • Resist processes (tracks) coat photoresists on wafers (typically by spin-coating, which spins the wafer to spread deposited photoresist), develop them (dissolve portions hit by light), and bake them (harden undissolved photoresist to prepare for etching). • Scanners and steppers are used to produce light that passes through the photomask (e.g., EUV scanners, argon fluoride (ArF) scanners, ArF immersion scanners, krypton fluoride steppers, and i-line steppers). • Mask aligners. • Electron-beam lithography (chip- and/or mask-making). • Laser lithography (mask-making). • Ion-beam lithography (mask-making). • Imprint lithography.	Transition to increased use of EUV lithography over DUV lithography may initially greatly increase the energy consumption per mask step; however, EUV reduces process complexity, which, depending on the productivity of the EUV lithography tools, can reduce the consumption of water, chemicals, and energy needed in the process.
Etching	• Dry (gas) etching, which may include equipment for conductor etching, dielectric etching, ion milling, and/or dry stripping. • Dry cleaning equipment.	Currently, per- and polyfluoroalkyl substances (PFAS) are used in lithography and etching. PFAS compounds contain the stable carbon-fluorine bond, making decomposition into smaller, nontoxic molecules difficult.

Process Step	Semiconductor Manufacturing Equipment (SME)	Pollution Control and Water and Energy Conservation Trends
	• Wet etching and wet cleaning equipment.	PFAS compounds are resistant to hydrolytic, photolytic, and oxidative reactions, which limit wastewater treatment technologies to high temperature (high cost) processes or adsorption onto a medium. Adsorption has limitations on the ability to remove small molecules and requires disposal of the medium. To determine the removal efficiency of such technologies, analytical methods for the detection of PFAS compounds in wastewater are needed; however, currently available methods for detection are limited to only a few chemistries. This has posed challenges to permitting and control authorities who have begun to include PFAS monitoring requirements in permits. See **Appendix C** for more detailed information on PFAS use in fabs. Dry etching and thin-film deposition (TFD) chamber cleaning use and emit powerful and long-lived, high global warming potential (GWP) fluorinated greenhouse gases (F-GHGs), including perfluorocarbons (PFCs), sulfur hexafluoride (SF_6), nitrogen trifluoride (NF_3), and hydrofluorocarbons (HFCs). TFD, diffusion, and dry removal of photoresist use and emit nitrous oxide (N_2O). Fabs are reducing these emissions through abatement, alternative chemistries, and process optimization.
Deposition and Passivation	• CVD equipment, including plasma CVD, low • CVD, high temperature CVD, and atomic layer • deposition equipment. • PVD equipment. • Electrochemical coating. • Spin-coating. • Rapid thermal processing.	Deposition and dry etching use high GWP F-GHGs, including PFCs, HFCs, and N_2O. Fabs are reducing these emissions through abatement, alternative chemistries, and process optimization. Dry etching and TFD chamber cleaning use and emit F-GHGs, including PFCs, SF_6, NF_3, and HFCs. TFD, diffusion, and dry removal of photoresist use and emit N_2O.

Process Step	Semiconductor Manufacturing Equipment (SME)	Pollution Control and Water and Energy Conservation Trends
	• Tube-based diffusion and deposition. • Deposition (non-integrated circuits). • TFD chamber cleaning, which can occur through three different processes: in-situ plasma, in-situ thermal, and remote plasma, with remote plasma becoming the dominant technology.	Fabs are reducing these emissions through abatement, alternative chemistries, and process optimization.
Ion Implantation	• Low to medium current ion implanters. • High current ion implanters. • High voltage ion implanters. • Ultra-high dose doping ion implanters.	There are no notable pollution control or water and energy conservation trends for ion implantation.
Metallization and Interconnects	• Sputtering. • CVD. • Interconnects for silicon-based chips were historically made of aluminum, but now are typically made of copper and cobalt. • Spin-coating is most typically used to deposit insulator layers between metal interconnects.	The number of chip-to-chip interconnects is expected to continue to increase, increasing the demand for materials and the need for PFC abatement. Changes in metallization over time may include new formulations for copper electrochemical deposition, including extending copper plating bath life or recycling for reuse.
Chemical Mechanical Planarization	• Chemical mechanical planarization tools use chemical slurries and polishing pads to press and flatten the wafer.	Fabs are trending toward more three-dimensional structures over the traditional planar structure, requiring more masking, deposition, etching, and polishing steps per wafer to achieve the required transistor density on the device. This requires more tools, cleanroom space, and ultra-pure water (UPW) to support a given number of wafers, which drives greater water, energy, and chemical demand. Specific drivers of increasing fab emissions include: (1) The increasing complexity of devices, reflected in an increasing number of layers per device; and (2) The decreasing linewidths of the devices, which are achieved through multiple patterning and etching steps for

Process Step	Semiconductor Manufacturing Equipment (SME)	Pollution Control and Water and Energy Conservation Trends
		each layer. Each turn or step for each layer requires the use of F-GHGs to etch patterns. Each deposition step increases the need for F-GHGs to clean TFD chambers.
Dicing	• Wafer bonders and aligners are used to join silicon wafers prior to dicing. • Dicing tools.	There are no notable pollution control or water and energy conservation trends for dicing.
Testing and Quality Control	• Memory test. • System-on-a-chip (SoC) test. • Burn-in test. • Linear and discrete test. • Handlers and probers. • Inspection and measuring equipment, including scanning electron microscopes, atomic force microscopes, optical inspection systems, and wafer probes. • Certain metrology and inspection systems.	There are no notable pollution control or water and energy conservation trends for testing and quality control. Fluorinated heat transfer fluids (F-HTFs) are used for temperature control in manufacturing processes, cleaning, soldering, and thermal shock testing. These high-molecular-weight, fully fluorinated compounds are typically liquid at room temperatures and pressures but evaporate during use (which often occurs at high temperatures) to enter the atmosphere. Fluorinated compounds are potent, long-lived GHGs. They include perfluoroamines, perfluoromorpholines, perfluoropolyethers (PFPEs), and long-chain perfluorocarbons. F-HTF abatement methods include monitoring and repairing leaks, and recovery and proper disposal of F-HTFs upon chiller servicing or retirement.

Source: NIST 2024.

EXHIBIT B

Key PFAS Use Applications in Semiconductor Fabrication Generally, Excerpt from NIST "Final Programmatic Environmental Assessment for Modernization and Expansion of Existing Semiconductor Fabrication Facilities under the CHIPS Incentives Program" (NIST 2024)[38]

[38] Note this exhibit is intended to provide an overview of PFAS use applications in the semiconductor industry generally. Some of these uses may be applicable to anticipated uses for Micron's New York semiconductor fabrication operations.

Semiconductor Fabrication Process(es)	Use Application for PFAS	Function	Types of PFAS-Containing Materials in Use	PFAS Criticality
Photolithography	PAGs	Precursor for the photo-acid catalyst needed for CARs, PBO/PI, BARCs, and color filter resists.	Perfluoroalkyl-sulfonates C4 or lower and C4 or lower substituted superacid anions, such as C1. For some advanced resists, these are bound to polymers.	PFAS component of PAGs generates strong acids that do not show side reactions that interfere with the chemical amplification process.
Photolithography	Photoresists – polymers	Control pattern profile in EUV lithography.	C1 PFAS polymer	Increases absorbance, improves dissolution properties, and increases resolution.
Photolithography	Pattern collapse mitigation/ EUV anti- collapse rinses	Prevent pattern collapse.	PFAS-containing materials are used in many formulations that mitigate pattern collapse issues, including fluorinated surfactants, surface modification treatment materials, displacement fluids, and organic solvents.	Low surface tension and high contact angle to reduce capillary forces.
Photolithography	Top Anti-Reflective Coatings (TARCs)	Control of thin film interference effects in resists.	Fluorinated water and developer-soluble polymers	High fluorine content is needed to achieve the low refractive index needed to effectively suppress film interference effects.

Semiconductor Fabrication Process(es)	Use Application for PFAS	Function	Types of PFAS-Containing Materials in Use	PFAS Criticality
Photolithography	Surface protectors/ immersion barriers (immersion topcoats)	Protection of the resist from immersion liquid and of the exposure process equipment from contamination. Prevent water film pulling and resist component leaching in immersion topcoats.	Spin-on barriers: water-insoluble and developer-soluble polymers with fluorinated side chains. Embedded barriers (in situ topcoats): oligomeric or low molecular weight polymeric highly fluorinated compounds. Fluoroalcohol methacrylate polymers with high water contact angles (>90º).	Soluble in casting solvents and developer, insoluble in water, and do not intermix with photoresists. Hydrophobicity and control of contact angle, inertness under 193 nanometer (nm) radiation, and transparency.
Photolithography	Surfactants	Improved coating uniformity in photoresists, PBO/PI, BARCs, and color filter resists.	Longer-chain PFAS (C6-C8) and telomer alcohols form polymer backbones. Now mostly replaced by C4 pendant chains.	Low surface tension and control of contact angle.
Photolithography	PBO/PI	Provide protection from electrical, thermal, mechanical, and moisture-related impacts.	Water-insoluble C1 PFAS polymers	C1 PFAS groups, attached to the polymer backbone, provide solubility in environmentally friendly casting solvents and enable aqueous development.
Plasma etch, chamber clean, and deposition	Back end of line (BEOL) interconnect patterning (damascene	Definition of trench and via patterns in dielectric films before filling with metal.	Octafluorocyclobutane (C_4F_8)/(RC318) Hexafluoro-1,3-butadiene (C_4F_6) Tetrafluoromethane (CF_4)/(R14) Trifluoromethane (CHF_3)/(R23)	Selectivity to mask materials, selectivity to different dielectrics (ability to stop on certain layers), and profile control of trench/via sidewalls.
Plasma etch, chamber clean, and deposition	High-aspect ratio channel (3D NAND)	Definition of ultra-high-aspect-ratio channel in multiple dielectric layers.	C_4F_8 C_4F_6 CF_4 CHF_3	Selectivity to mask materials, selectivity to different dielectrics, profile control of channel, and high-etch-rate anisotropic process.

Semiconductor Fabrication Process(es)	Use Application for PFAS	Function	Types of PFAS-Containing Materials in Use	PFAS Criticality
Plasma etch, chamber clean, and deposition	Waveguide fabrication in silicon photonics processes	Patterning of waveguides into silicon and silicon-based dielectric materials.	CF_4 CHF_3	Selectivity to mask materials and ability to reduce line-edge and line-width roughness of patterned features to reduce transmission losses caused by scattering.
Plasma etch, chamber clean, and deposition	Front end of line (FEOL) hard mask patterning	Transfers lithographic patterns into a hard mask for subsequent definition of transistors.	CF_4 CHF_3	Selectivity to mask materials, ability to reduce line-edge and line-width roughness of patterned features to reduce transmission losses caused by scattering, and ability to detect process endpoints from the optical emission signature of carbon-containing byproducts such as C-O and C-N.
Plasma etch, chamber clean, and deposition	FEOL spacer patterning	Define spacer structures (dielectric encapsulation that protects the sidewalls of transistor features).	CHF_3	High selectivity to transistor gate materials and underlying substrate.
Plasma etch, chamber clean, and deposition	Through-silicon via etch	Create deep via structures through entire wafers for packaging applications.	C_4F_8 C_4F_6	Thermal resistance, inertness toward aggressive chemicals, nonflammability, low vapor pressure and off-gassing at high operating temperatures and low pressures, and good stick-slip behavior.

Semiconductor Fabrication Process(es)	Use Application for PFAS	Function	Types of PFAS-Containing Materials in Use	PFAS Criticality
Plasma etch, chamber clean, and deposition	Cleaning processes for CVD and PVD chambers	Remove deposit buildup on chamber walls to ensure reproducibility and prevent yield loss caused by contamination.	CF_4 Hexafluoroethane (C_2F_6)/(R116) Octafluoropropane (C_3F_8)/(R-218)	N/A
Plasma etch, chamber clean, and deposition	Deposition precursors for ALD	Improved volatility and stability of ligands for the uniformity of metal deposition and reproducibility of processes.	Transition metal compounds containing the 1,1,1- trifluoro-2,4-pentane-dionate and 1,1,1,5,5,5-hexafluoro- 2,4-pentane-dionate ligands	No known viable alternatives.
Plasma etch, chamber clean, and deposition	Surface treatment processes for area-selective ALD processes	Remove metal-oxide contaminants from surfaces before deposition.	N/A	Unknown
Miscellaneous wet chemical processes (wet chemical etching; planarization; electroplating; and wafer cleaning, rinsing and drying)	Wet etching	Facilitate entry of the wet etchant into - and reaction products out of - a capillary space by reducing the surface tension of the fluid and the contact angle with the solid. Adsorb to a surface to prevent the deposition of metals that are introduced into the solution during an etching process or to suppress etching of one material while another material is preferentially removed. Mitigate the formation of air bubbles.	Aqueous etch/clean formulations Organic-based etch formulations	PFAS additives are critical for some, but not all wet-etch applications. The requirement for a PFAS additive depends on the physical dimensions and aspect ratio of the device feature being etched, and the particular set of materials exposed to the etchant during etching.

Semiconductor Fabrication Process(es)	Use Application for PFAS	Function	Types of PFAS-Containing Materials in Use	PFAS Criticality
Miscellaneous wet chemical processes	Chemical mechanical planarization (CMP)	Surfactants and surface-active materials disperse the particles, provide slurry stability, control the wettability of films and polishing pads, and reduce corrosion.	Oxide CMP slurries Metal CMP slurries Post-CMP cleaning solutions	Fluorinated surfactants are critical to achieving CMP performance requirements in certain situations. In particular, they enable selective film inhibition and the wetting of low-surface-energy substrates.
Miscellaneous wet chemical processes	Cleaning/ stripping	Some wafer clean/strip formulations and cleaning operations conducted on parts outside of clean rooms require organic solvents to provide the necessary solvency and fluid-handling characteristics.	In some applications, these mixtures comprise fluorinated organic solvents and/or fluorinated organic alternatives.	PFAS-containing solvent mixtures are critical for some, but not all solvent-clean applications. The requirement for a PFAS depends on the material properties of the substance that needs removing.
Miscellaneous wet chemical processes	Plating and electroless plating	Surfactants and surface-active materials reduce surface tension to improve wetting and access to the plating bath solution; and mitigate hydrogen gas inclusion and bubble and/or mist formation.	Fluorinated surfactants	Fluorinated surfactants can achieve low aqueous surface tensions. Fluoroalkyl acid surfactants are uniquely strong acids that remain ionized and hydrophilic even if the pH of the plating solution approaches zero.
Lubrication	Oils and greases in vacuum pumps	Effective lubrication of bearings, gears, and seals.	Perfluoropolyether (PFPE) oil Greases containing PFPE base oils with PTFE thickener	Thermal resistance, inertness toward aggressive chemicals, nonflammability, low vapor pressure and outgassing at high operating temperatures and low pressures, stability under high shear forces, low aggression to metals and elastomers. No known viable alternative for PTFE-thickened greases

Semiconductor Fabrication Process(es)	Use Application for PFAS	Function	Types of PFAS-Containing Materials in Use	PFAS Criticality
Lubrication	Greases and solids used in vacuum processing environments	Lubrication within low- pressure and high-temperature environments that require high purity for low wafer contamination.	Greases containing PFPE base oils with PTFE thickener Greases containing multiply- alkylated cyclopentane (MAC) base oils with PTFE thickener PTFE in solid lubricants	Thermal resistance, inertness toward aggressive chemicals, nonflammability, low vapor pressure and outgassing at high operating temperatures and low pressures, complete oxidation resistance, and good stick-slip behavior. No known viable alternative for PTFE-thickened greases and PTFE solids.
Lubrication	Greases and solids used to lubricate robotic systems, O- rings, and seals	Effective lubrication and sealing within low-pressure and high-temperature environments that require high purity for low wafer contamination.	Greases containing PFPE base oils with PTFE thickener PTFE in solid lubricants	Thermal resistance, inertness toward aggressive chemicals, nonflammability, low vapor pressure and outgassing at high operating temperatures and low pressures, complete oxidation resistance, and good stick-slip behavior. No known viable alternative for PTFE-thickened greases and PTFE solids.
Lubrication	Greases used in photolithograph y applications	Effective lubrication of moving parts within environments exposed to UV light.	Greases containing PFPE base oils with PTFE thickener	Low outgassing and UV stability. No known viable alternative for PTFE- thickened greases.

Semiconductor Fabrication Process(es)	Use Application for PFAS	Function	Types of PFAS-Containing Materials in Use	PFAS Criticality
Lubrication	Greases used to lubricate gears and bearings	Effective lubrication.	Greases containing PFPE base oils with PTFE thickener	Thermal resistance, inertness toward aggressive chemicals, nonflammability, low vapor pressure and outgassing at high operating temperatures and low pressures, stability under high shear forces, and low aggression to metals and elastomers. No known viable alternative for PTFE- thickened greases
Lubrication	Greases and solids used to lubricate linear guides, slides, ball screws, and valves	Effective lubrication of mechanical parts that move at high speeds within environments that require high purity for low wafer contamination.	Greases containing PFPE base oils with PTFE thickener PTFE in solid lubricants	Thermal resistance, inertness toward aggressive chemicals, nonflammability, low vapor pressure and outgassing at high operating temperatures and low pressures, and good stick-slip behavior. No known viable alternative for PTFE-thickened greases and PTFE solids.
Heating and cooling	HTFs	F-HTFs are used to transfer heat between process equipment and chillers to provide precise temperature control for specific manufacturing operations.	F-HTF classes include: PFPEs Perfluorocarbons (PFCs) Hydrofluorocarbons (HFCs) Hydrofluoroethers (HFEs) Hydrofluoroolefins (HFOs) Fluorinated ketones Other fluorinated liquids	F-HTFs are electrically nonconductive, compatible with all construction materials including sensitive electrical components, nonflammable, and useful within the operational range required for the manufacturing and testing of semiconductor products. No known viable alternative can meet all these requirements at once.

Semiconductor Fabrication Process(es)	Use Application for PFAS	Function	Types of PFAS-Containing Materials in Use	PFAS Criticality
Heating and cooling	Refrigerants	Fluorinated refrigerants are used within closed systems that undergo repeated phase changes to help transfer heat from process equipment to a facility's central cooling system.	Fluorinated refrigerant classes include: PFCs HFCs HFOs Fluorinated ketones Other fluorinated liquid	The most critical performance requirement of the refrigerant is the ability to maintain the lowest operational set point while avoiding a catastrophic phase shift to a solid form, as the refrigerant must remain in a gaseous or liquid form to remain pumpable and useful for temperature control.
ATPS	Substrate/printe d circuit board	PFAS-containing substrate materials exhibit low dielectric constants and loss, have low moisture absorptivity, can be used over a wide temperature range, and are nonflammable.	PTFE-containing dielectric polymers	Among all polymeric dielectrics, PFAS-containing polymers have the lowest dielectric constants (1.9 to 2.1) and are widely used as substrate materials. Alternatives are viable though with greater dielectric constants.
ATPS	Encapsulants	Encapsulants provide environmental and mechanical isolation of semiconductors and wire bonds in addition to heat conductivity to ensure optimum semiconductor performance.	Fluorinated polymers	PFAS provide low thermal expansion while being electrically insulator and hydrophobic. Alternatives are viable.
ATPS	Release layer	Fluorinated polymers act as "anti-adhesion" or release layers for temporary bonding debonding.	Fluorinated polymers	Fluorinated polymers act as strong release layers but are not critical; alternatives are viable.

Semiconductor Fabrication Process(es)	Use Application for PFAS	Function	Types of PFAS-Containing Materials in Use	PFAS Criticality
ATPS	Adhesive tapes	As a generic adhesive, PFAS-containing materials can help prevent sticking of thermal or UV-curable materials to an applicator during processing.	N/A	Strong alternatives are viable.
ATPS	Flux/surfactants	PFAS-containing chemicals can help control flux spread during high-temperature exposure, so that the flux can remain in the solder joint area during soldering and improve the solder joint quality and yield.	N/A	PFAS-containing surfactants are typically more heat-resistant, with wetting properties that control spread.
ATPS	Die overcoat/ adhesive	Packaging applications need hermetic and chemical resistance adhesive coatings.	N/A	Adhesive materials required for use in semiconductor packaging must have the ability to simultaneously meet ultra-low dielectric constant property targets as well as reliability requirements such as adhesion to ultra-low roughness and unroughened copper under high-humidity, high-temperature conditions.
ATPS	Underfills	Underfills are typically polymer materials that bind the package to the printed circuit board and reduce stress on the solder joints.	Fluorinated polymers and fluorinated rubbers, such as: Vinylidene fluoride-propylene hexafluoride copolymer; and Tetrafluoroethylene-propylene copolymer.	Underfill will contain approximately 50% silica materials, with the remainder polymeric materials with high viscosity and low volatility.

Semiconductor Fabrication Process(es)	Use Application for PFAS	Function	Types of PFAS-Containing Materials in Use	PFAS Criticality
ATPS	Mold compounds, release layers, and films	Mold compounds are used as a protective outer layer covering most or all of the semiconductor package substances.	PTFE or ethylene tetrafluoroethylene (ETFE)	PTFE is essential for release sheets and there are currently no known alternatives.
ATPS	Thermal interface materials	In order to prevent dual-layer thermal interfaces from ripping, tearing or otherwise losing or disrupting their dielectric or thermal properties during assembly, the material-comprising layer must be tear-resistant and have a high tensile strength.	Fluorinated resins: Fluorocarbon resins; Fluororesins; and Fluorinated polyalkyl ether.	Fluorinated resins help achieve high thermal conductivity and can also help hold the components during processing due to high viscosity and elasticity.
ATPS	Die passivation	PFAS-containing materials are used as part of the controlled collapse of chip connection (C4) bumping process that connects the chip to the interposer.	PFAS-containing polyimide, polybenzoxazole and other epoxy-based passivation.	There are no known alternatives.
Miscellaneous	Articles	PFAS-containing articles includes essential equipment that processes substrates (silicon wafers, reticles); its component parts; and its auxiliary, support or peripheral equipment (chemical controllers, chemical delivery systems, vacuum pumps)	FP and non-FP components containing PTFE, PVDF, FFKM, and PFBS	The potential substitution of fluoropolymers with alternative materials is problematic, because in general, identifying an alternative that meets the characteristics required for each fluoropolymer article has not been successful and will require invention.

Source: NIST 2024

EXHIBIT C

Overview of PFAS Wastewater Treatment Technologies

Section 3.8.3.2 of the FEIS discusses PFAS wastewater treatment technologies that currently exist and that are in the process of development. This assessment includes review segregation and concentration technologies, as well as destruction capabilities. It also includes review of removal or destruction efficacy of various chain lengths, effectiveness of technologies alone or in combination, and management options for PFAS-containing materials generated during treatment.

Commonly discussed technologies that are available for treatment of wastewater containing PFAS include reverse osmosis and nanofiltration (membranes used to filter out PFAS, effectively removing them from the water), granular activated carbon (adsorption), ion exchange resins (which selectively capture and remove PFAS from wastewater), foam fractionation (segregates PFAS using air injection), and advanced oxidation processes (used to break PFAS down).[39] The effectiveness of these technologies depends on a range of factors, and USEPA has indicated that several of these technologies are capable of co-removing both those PFAS substances subject to drinking water limits and other PFAS (USEPA 2024a).

As the technology continues to evolve, substantial research supports application of these technologies for PFAS treatment and destruction capabilities.[40] For instance, published literature discusses focused study of four separation technologies – nanofiltration followed by reverse osmosis, PFAS-selective ion exchange, granular activated carbon, foam fractionation – and PFAS-specific destruction technologies, such as electrochemical oxidation. For instance, nanofiltration has been identified as a removal technology capable of achieving over 90% removal of a PFAS:

> Treatment of the fab wastewater, containing high concentrations of perfluorocarboxylic acids (PFCAs), including trifluoroacetic acid (TFA: 96,413 ng/L), perfluoropropanoic acid (PFPrA: 11,796 ng/L), and perfluorobutanoic acid (PFBA: 504 ng/L), resulted in ≥92 % rejection of all PFAS while achieving 90% water recovery in a semi-batch configuration. These findings demonstrate nanofiltration as a promising technology option for incorporation in treatment trains targeting PFAS removal from wastewater matrices.

(Griffon 2024).

Similarly, granular activated carbon (GAC) has been studied and determined to be effective. The Orange County Water District's 2021 report found that GAC and certain other

[39] 40 CFR 141.61(d), Table 3 (identifying anion exchange, GAC, reverse osmosis and nanofiltration as best available technology, treatment technique, or other means available for achieving compliance with the MCLs for all regulated PFAS).

[40] See, e.g., USEPA 2024a (discussing leachate treatments); ITRC 2023b (discussing several treatment technologies, including foam fractionation); Griffin 2024 (nanofiltration and reverse osmosis), OCWD 2021 (PFAS-selective ion exchange); Medina 2022 (granular activated carbon); Duinslaeger 2022 (electrochemical destruction); Amen 2023.

adsorption media "showed the strongest performance" with respect to later initial PFOA breakthrough and the lowest sustained PFOA effluent concentration during 13 months of pilot testing (OCWD 2021). The 2021 report has been cited as the nation's largest PFAS adsorptive media pilot test at that time, with the evaluation of 14 treatment media. The assessment used USEPA Method 537.1 and water that contained seven PFAS compounds, including some short-chain compounds (PFBS and PFHxA) and other longer chain compounds (such PFOA and PFOS). A 2022 publication provides further support particularly for long-chain removal by adsorption (Medina 2022). The 2022 study showed that adsorbents (including ion exchange resins) and GAC can effectively remove certain PFAS in certain applications or as part of a treatment train. They also are effective for polishing. The study further suggests that appropriate considerations in selection of treatment options includes effectiveness in removal of short- and ultrashort-chains, the frequency of changeouts, and waste handling requirements.

Foam fractionation also has been used effectively for industrial wastewater and other applications involving PFAS. This technology uses the surfactant properties of PFAS to separate these substances from wastewater. It injects air to create bubbles in a PFAS-containing liquid, because PFAS molecules tend to accumulate at the air-water interfaces due to their hydrophobic and hydrophilic ends. This causes the PFAS to adsorb to the surface of the rising bubbles. As the bubbles reach the top, they form a foam layer that can be skimmed off and managed separately. Benefits of this method include its relatively low energy requirements, scalability, and effectiveness in concentrating PFAS from dilute solution. It has been demonstrated for wastewater treatment with long-chain PFAS, and additional research is underway to evaluate effectiveness for short-chain PFAS (ITRC 2023b). This technology also requires optimization of bubble size and flow rates to maximize removal efficiency.

Additional developments appear promising for PFAS destruction (as distinguished from separation methods). For instance, certain destruction technologies like electrochemical oxidization, nonthermal plasma, hydrothermal alkaline treatment, and supercritical water oxidation, have been shown to be effective for treatment of high concentration, low volume liquids but may be less suitable for high volume, low concentration liquids (ITRC 2023b).

Appendix L-2
Relevant OSHA Standards

L-2 Relevant OSHA Standards

OSHA promulgates general industry safety and health standards under the Occupational Safety and Health Act, which are codified at 29 C.F.R. Part 1910, and construction safety and health standards under the Contract Work Hours and Safety Standards Act, which are codified at 29 C.F.R. Part 1926. Table L-1 provides descriptions of the OSHA general industry and construction standards most relevant to semiconductor manufacturing projects.

Table L-1 OSHA General Industry and Construction Standards

Standard	Description
General Industry Standards	
29 C.F.R. Part 1910, Subpart D	Walking-working surfaces: requirements for stairways, ladders, fall protection, and training.
29 C.F.R. Part 1910, Subpart G, § 1910.94	Ventilation: protection against abrasives, surface coatings, and respirable dusts.
29 C.F.R. Part 1910, Subpart G, § 1910.95	Occupational noise exposure: guidelines for workplace noise protection.
29 C.F.R. Part 1910, Subpart H, § 1910.119	Hazardous materials: process safety management (PSM) of highly hazardous chemicals.
29 C.F.R. Part 1910, Subpart H, §§ 1910.123-126	Hazardous materials: requirements for dipping and coating operations.
29 C.F.R. Part 1910, Subpart I, §§ 1910.132, 134	PPE: general requirements and specific respiratory protection.
29 C.F.R. Part 1910, Subpart J, § 1910.147	General environmental controls: hazardous energy controls (lockout / tagout procedures).
29 C.F.R. Part 1910, Subpart Z	Toxic and hazardous substances: employee exposure requirements.
29 C.F.R. Part 1910, Subpart Z, § 1910.1000	PELs: maximum allowable substance concentrations.
29 C.F.R. Part 1910, Subpart Z, § 1910.1200	Hazard communication: classification and information requirements consistent with the United Nations Globally Harmonized System of Classification and Labelling of Chemicals, including requirements relating to container labeling, safety data sheets, and employee training.
Construction Standards	
29 C.F.R. Part 1926, Subpart C	General safety and health provisions: requirements for safety training and education, first aid, fire protection, housekeeping, sanitation, and PPE.
29 C.F.R. Part 1926, Subpart D	Occupational health and environmental controls: requirements for medical services and first aid; occupational noise exposure; non-ionizing radiation;

Standard	Description
	gases, vapors, fumes, dusts, and mists; ventilation; and hazard communication.
29 C.F.R. Part 1926, Subpart E	PPE: general requirements and specific respiratory protection.
29 C.F.R. Part 1926, Subpart H	Requirements for handling, storage, use, and disposal of waste materials.
29 C.F.R. Part 1926, Subpart I	Hand and power tools: requirements for hand tools, power-operated hand tools, abrasive wheels, jack-lever, screw and hydraulic tools, air receivers, and mechanical power transmission apparatus.
29 C.F.R. Part 1926, Subpart J	Welding and cutting: requirements for gas and arc welding, cutting, fire prevention, and ventilation.
29 C.F.R. Part 1926, Subpart L	Scaffolds: requirements for scaffolding, aerial lifts, and associated training.
29 C.F.R. Part 1926, Subpart M	Fall protection: requirements for fall arrest and protection systems and practices and training requirements.
29 C.F.R. Part 1926, Subpart P	Excavations: requirements for protective systems, soil classifications, and specific excavation requirements.
29 C.F.R. Part 1926, Subpart Q	Concrete and masonry construction: requirements for concrete equipment and tools, cast-in-place, and pre-cast concrete.
29 C.F.R. Part 1926, Subpart R	Steel erection: requirements for hoisting and rigging, structural steel assembly, anchorage, beams and columns, joists, engineering, falling object protection, and training.
29 C.F.R. Part 1926, Subpart Z	Toxic and hazardous substances: requirements relating to worker exposure to toxic and hazardous substances, including air contaminants and carcinogens.
29 C.F.R. Part 1926, Subpart AA	Confined spaces: requirements for workplace permit-required confined spaces, entries, training, rescue, and emergency services.
29 C.F.R. Part 1926, Subpart CC	Cranes and derricks: requirements for ground conditions, assembly and disassembly of crane operations, hoisting, operations, signals, work area control, qualifications, training, inspections, and evaluations.

Appendix L-3
Micron Emergency Response Management System

L-3 Micron Emergency Response Management System

Micron's ERMS encompasses an emergency program, a crisis management program, and emergency event response procedures. The overall purpose of the ERMS is to plan and prepare for and respond to any EHS-related events that may occur at Proposed Project sites, including the Micron Campus, that would require an emergency response by Micron's dedicated internal ERT. Examples of EHS-related events that would require an emergency response would include fires, chemical leaks or spills, odors, and employee falls, injuries, and illnesses.

Micron manages the ERT under its Global EHS Department. The ERT is comprised of trained Micron employees certified in OSHA Hazardous Waste Operations and Emergency Response (HAZWOPER) standards, State and National EMT-B standards (an entry-level certification for emergency medical care), and confined space and high-angle rescue training. An on-site Occupational Medical Director (physician) oversees the ERT's medical response protocols in accordance with the National Incident Management System/Incident Command System (NIMS/ICS) (a standardized approach to incident management developed by the U.S. Department of Homeland Security). In addition, ERT members are certified to implement all of Micron's internal emergency response plans, procedures, and protocols, and receive specialized gas and chemicals training, fire response training, drill and evacuation protocol training, and instruction and guidance from Micron's EHS management professionals.

Micron's existing internal policy is to require all of its front-end manufacturing facilities to employ a minimum of two dedicated EMT personnel on each shift to ensure minimum coverage by two EMT personnel 24 hours per day, 7 days per week. Micron also provides training to operations personnel to support the ERT as needed, including training in American Heart Association (AHA) cardiopulmonary resuscitation (CPR) guidelines, semi-automatic defibrillator (AED) training, first aid training, OSHA HAZWOPER training. For example, Micron has trained more than 100 employees at its existing facility in Boise, ID in these techniques to support the ERT team during emergency event response.

The Micron Campus would include an EHS Control Room staffed 24/7 to serve as an emergency event control center and provide emergency event notifications to the ERT. EHS Control Room technicians will be certified in Emergency Medical Dispatch (EMD) National Standard Curriculum and the requirements of local dispatch agencies (e.g., local 911 dispatch). EMD certification ensures that personnel adhere to efficient communication and response protocols when requesting local county or city emergency response services. The EHS Control Room will also monitor fire alarm, toxic gas monitoring, emergency exhaust, and other systems, and will coordinate dispatch of ERT and active off-site first responders, as needed.

During an emergency event response, an ERT Captain will assume command and control of the event and will be responsible for: controlling access to the event area; ordering any necessary evacuation; securing area conditions (such as by shutting down equipment); mobilizing ERT and other resources; coordinating with off-site first responders (as needed); and overseeing event mitigation, stabilization, and recovery efforts and demobilizing resources following the response. The ERT also will conduct after-action reviews and disseminate lessons learned to site personnel promote continuous improvement. If an emergency event exceeds the ERT capacity, Micron would activate its Crisis Management Team (CRT), which is comprised of senior leadership personnel who are trained to support ERT event mitigation, stabilization, and recovery efforts.

The ERT will maintain a less than five-minute response time when responding to all emergency events and other incidents on-site. The ERT will conduct weekly trainings with operations personnel supporting the ERT to ensure adequate support is available to assist with emergency response efforts. To ensure readiness, the ERT also regularly trains with local first responders.

Event Determination

Micron will develop a risk ranking system for emergency event response management as follows:

- Level 1 Event – a relatively minor event requiring a standard level of emergency response (e.g., responding to an employee injury).
- Level 2 Event – a relatively uncommon event with serious impacts that may escalate beyond ERT capacity and warrant activation of the CRT (e.g., power loss with tools down).
- Level 3 Event – a catastrophic event with major impacts exceeding ERT capacity that requires CMT support (e.g., fire beyond control capabilities of ERT).

Micron also will maintain a registry of risk ranked events and develop response protocols to those events in accordance with the requirements of ISO 14001 (Environmental Management Systems) and ISO 45001 (Occupational Health and Safety Management Systems) standards. The ERT also maintains risk matrices for each Micron facility that specify appropriate preventative measures and corrective actions based on the estimated likelihood and severity of various hazard scenarios, taking into account each facility's layout and location and relevant risk factors, such as disease outbreaks (H1N1, COVID-19), weather and storm warnings, vehicle, rail, or aircraft incidents, earthquake, flood, and fire risk, site evacuation, workplace incidents, and chemical releases.

Local EMS Engagement

Micron's ERMS and ERT are intended to minimize the potential need to call on local EMS to the greatest extent practicable. However, Micron would contact local police, fire, or EMS in any situation that would warrant or require assistance from first responders or a 911 response. Such situations would include active fires, confined space rescues, loss of consciousness, loss of life, potential loss of limb or sight, chest pain, or other situations that the on-site Occupational Medical Director or other appropriate personnel determine warrants such a response. Micron has conducted a comprehensive review of its ERMS and ERT protocols and has coordinated with external agencies to ensure its protocols would be sufficient to respond to large-scale incidents. As part of this effort, Micron met with Clay and Syracuse fire department representatives to establish clear expectations and assess respective response capabilities.

Micron's response capabilities would include: CPR and AED use; emergency medical trauma care (e.g., bleed control, splitting, and burn management); medication administration (e.g., oxygen, epinephrine, Narcan, aspirin); confined space and high-angle rescue; initial chemical and hazardous materials (hazmat) response; and limited fire response (i.e., use of extinguishers). For chemical or hazardous materials incidents requiring local fire service response, Micron would coordinate with Clay Fire and the Syracuse Fire Department, which employs a specialty hazmat

response unit that is available to respond to incidents in Clay based on an existing mutual aid agreement with Clay Fire. Micron has engaged with both fire departments to discuss the scope of these services and the mutual aid framework to ensure continued collaboration and effective emergency response planning. Micron also has engaged with NAVAC and NOVA to discuss the scope of their EMS capabilities. NAVAC and NOVA anticipate having adequate capacity to respond to future incidents at the Micron Campus. For additional analysis of the Proposed Project's effects on police, fire, and EMS capacities, see Section 3.14 (Community Facilities, Open Space, and Recreation).

Micron On-site Clinics

Micron would establish three different clinics as components of the Proposed Project: the healthcare center at the Childcare Site, an on-site construction occupational health clinic at the Micron Campus dedicated to construction workers, and an on-site operational occupational medical clinic at the Micron Campus dedicated to operational employees. The healthcare center at the Childcare Site would provide care to Micron employees and would be staffed with appropriate family health medical providers.

The construction occupational health clinic would provide care to Proposed Project construction workers, including injury and illness management. The construction clinic would be staffed with an occupational medical physician or physician's assistant, registered nurse or licensed nurse practitioner, physical therapist (or similar), and other medical support staff. The ERT would transport injured construction worker or personnel to the construction clinic for medical care, as appropriate. In an emergency event requiring an immediate 911 call, the ERT or other Micron personnel overseeing construction would immediately call 911, which would dispatch local EMS. Otherwise, should the level of care needed exceed the construction clinic's capacities, the ERT would assist in transporting workers to the nearest and most appropriate healthcare facility, such as a hospital or urgent care center.

The operational occupational medical clinic would provide care to Micron Campus employees, including occupational health, illness, and injury care and management. The operational clinic would be headed by the Occupational Medical Director and would be staffed with occupational medical physician or physician assistants, registered nurses or licensed nurse practitioners, and physical therapist (or similar) supported by third party medical staff. The ERT would transport injured Micron Campus employees or personnel to the operational clinic for medical care, as appropriate. In an emergency event requiring an immediate 911 call, the ERT or other Micron personnel overseeing campus operations would immediately call 911, which would dispatch local EMS. Otherwise, should the level of care needed exceed the operational clinic's capacities, the ERT would assist in transporting personnel to the nearest and most appropriate healthcare facility, such as a hospital or urgent care center.

Appendix L-4
Micron Global EHS Construction Performance Standard

Global EHS - Construction Performance Standard

CONTROL INFORMATION

Control Items	Details
Document Number	2W4373RQWREN-1568922467-118
Revision	3
Revision Date	16 Oct 2024
ECN Number	101127737
Translated Documents	English, Simplified Chinese, Traditional Chinese, Hindi, Japanese, Malay

Contents

Tables

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1 Purpose

This standard prescribes Environmental, Health and Safety performance requirements for construction work activities carried out by contractors at Micron's operational facilities as well as construction sites.

2 Scope

Items	Details
Site(s) Impacted	Micron's operational facilities and construction sites
Target Audience	Global and Site EHS, Global and Site PSM, Global Facilities Construction & Engineering Team, Global Facilities Technology Team, Site Facilities Team, Site Construction and Tool Install Team, Equipment Procurement Team, Site IE Planning Team
Applicability	This Standard is applicable to: • Greenfield construction sites managed by a General Contractor under a contract, • Tool-install activities undertaken by tool-install contractors in facilities owned by Micron, • New addition and alteration to an existing facility under Micron's control. This Standard is not applicable to workplaces located in buildings not managed directly by Micron. This document supplements Micron's EHS Standards but does not supersede federal, state, provincial or local EHS regulations.

3 Roles and Responsibilities

Roles	Responsibilities
Contractor	• Adhere to the requirements stipulated in this standard. • Seek approval from Project Architect/Micron where the requirements outlined in this standard requires the Contractor to do so.
Project Architect	• Ensure the Contractor engaged to perform work fulfils the requirements outlined in this standard. • Consults Micron where required or as specified in this document to provide approval or to arrive at an amicable solution.
Site Leadership, Site EHS, or designee	• Supervision and enforcement of Micron EHS Policies and Standards for Contractor at site level. • Ensure that Contractor are appropriately briefed on Micron global and site EHS requirements before commencing work at Micron facilities. • Ensure compliance to Micron global EHS Standards, site EHS requirements and local applicable Governmental Regulations.
Global EHS	• Develop, communicate, review, and update the standard regularly. • Enforce the requirements outlined in this standard. • Audit the compliance to the standard through regular audit and site reviews.
Procurement	• Include Global EHS Standards into Procurement supplier onboarding process. • Inform Micron contractor of changes and updates to Global EHS – Construction Performance Standard. • Manage business relationship with contracting contractor through quarterly business review and other monitoring system.

Roles	Responsibilities
	• Include EHS pre-qualification elements for contractor into Micron Supplier Qualification System and evaluate them on their compliance risk profile. • Work with Micron EHS and host to issue Contractor and Vendor with Supplier Quality Notification (SQN) for significant contractor non-conformance identified by Micron host or EHS.
Micron Hosts/ Project Managers	• Ensure Contractor companies comply with all applicable Micron global EHS Standards. • Work with EHS representative to ensure that contractor is appropriately briefed and trained on Micron site EHS requirements before commencement works. • Supervision and enforcement of Micron EHS Policies and Standards for Contractor at site level.

4 Terms and Definitions

Terms	Definitions
AEW	Authorized Electrical Worker
AFR	Accident Frequency Rates
ANSI	American National Standards Institute
ASB	Accident Statistics Board
ASR	Accident Severity Rate
ASTM	American Society for Testing and Materials
BS	British Standard
CAR	Corrective Action Request
CIRIA	Construction Industry Research, and Information Association
CSA	Confined Space Attendant
CSSA	Confined Space Safety Assessor
CTE	Centre Tapped Earth
EHS MS	Environmental, Health and Safety Management System
EN	European Standards
ePTW	Electronic Permit-to-Work
FM	Factory Mutual
Greenfield Construction Site	Construction of new Fab building, central utilities building, gas farm and other auxiliary buildings outside of Micron manufacturing areas. The scopes include structure works, M&E, MEP, commissioning, tool installation, process implementation and ramp-up of new tools in the new buildings.
IPIECA	International Petroleum Industry Environmental Conservation Association
JHA	Job Hazard Analysis
JSA	Job Safety Analysis
KPI	Key Performance Index
MEWP	Mobile Elevated Working Platform
NCR	Non-Conformance Report

Terms	Definitions
NFPA	National Fire Protection Association
OGP	Oil, Gas and Petrochemical
OSHA	Occupational Safety and Health Administration
PA	Public Announcement
PE	Profession Engineer
PPE	Personal Protective Equipment
PTP	Pre-Task Plan
QP	Qualified Person
RA	Risk Assessment
SARS	Severe Acute Respiratory Syndrome
SDS	Safety Data Sheets
SIC	Safety Induction Course
SLT	Safety Leadership Team
SQN	Supplier Quality Notification
TBT	Toolbox Talk

5 References

Internal References	Link
Global EHS - Lifting and Rigging Standard	2W4373RQWREN-1568922467-82
Global EHS - Excavation Standard	2W4373RQWREN-1568922467-695
Global EHS - Confined Space Program Standard	2W4373RQWREN-1568922467-146
Global EHS - Control of Hazardous Energy (CoHE) Standard	2W4373RQWREN-1568922467-29
Global EHS - Distracted Walking and Stairwell Safety Standard	2W4373RQWREN-1568922467-26
Global EHS - EHS Risk Assessment Standard	Q6ACPCUHTZ6P-1302918059-213
Global EHS - Electrical Safety Standard	2W4373RQWREN-1568922467-388
Global EHS - Incident Reporting and Investigation Standard	2W4373RQWREN-1568922467-279
Global EHS - Lone Worker Standard	TEDSZF665RUJ-2038493890-912
Global EHS - Standard for Storing Flammables and Combustibles	2W4373RQWREN-1568922467-25
Global EHS - Toxic Gas Monitoring and Double Containment Standard	2W4373RQWREN-1568922467-11
Global EHS - Work At Heights Standard	2W4373RQWREN-1568922467-48
Construction Plant, Machinery and Tools Safety Requirements	TEDSZF665RUJ-644690799-163
Micron Construction Safety GuideBook	TEDSZF665RUJ-644690799-168

External References	Link
Nil	Nil

6 Standard

6.1 General

The Contractor shall provide, erect, maintain and finally remove, when instructed by the Project Architect/Micron, Danger Signs, Warning Signs, Caution Signs or Notice Boards, within as well as at the perimeter of the project site. The signs shall be not less than 1.5m x 1.0m in size, written boldly in relevant languages. These shall be erected on existing footpaths and at points of access likely to be used by the workers or public to warn or inform them of the prevailing works. These signs and notices shall be in addition to any signs and notices set-up up to meet statutory requirements.

The Contractor shall implement measures to eliminate dropped objects or falling objects such as identifying potential drop zones where there are works overhead with clear signages and barricades placed to divert personnel. Tool bag and tool tether anchored securely should be implemented to prevent tools falling over. These implementations shall be additional to scaffold toe-board installation.

The Contractor shall ensure that all roads, pavements, and public footpaths are kept clear of dust, silt, and debris. In countries where snow and ice covers roads, pavements, and public footpaths, it shall be cleared and kept safe.

Unless otherwise agreed, the Contractor shall be responsible for the proper fencing, hoarding, lighting, security, and supervision of the works. The Contractor shall also provide appropriate temporary roadways, footways, guards, fencing and hoardings as far as the same may be necessary for the accommodation and protection of the owners and occupiers of the adjacent property, the public and others.

Platforms, covers, ladders, stairways, staging, scaffolds, and other provisions for access erected by the Contractor shall be installed in compliance with current legal requirements and made available for use as early as possible during the construction period. Micron standards shall be adhered to where legal requirements do not specify the requirements for safe access and egress. In cases where this is impracticable, the Contractor shall provide all necessary temporary access facilities which shall be constructed, installed, and maintained in a safe and secure manner.

Designated walkways along steel walers and struts shall be levelled, flush without tripping hazards and provided with rigid guardrails and toe boards.

Fall arrest system, including but not limited to lifelines and anchor points, shall be designed by a Professional Engineer (PE), and comply with the requirements stipulated in ISO 10333-1:2000, ISO 14567:1999 and ISO 16024:2005.

The Contractor shall cap all protruding structures be it made of steel, wood, or other material, which can expose the workforce at the project site to impalement injury. This includes starter reinforcement bars with individual plastic/ rubber caps or with hose/tube.

The Contractor shall ensure that horseplay, practical jokes, scuffling, wrestling, or fighting are prohibited at the project site.

The Contractor shall ensure that the sale, storage or consumption of liquor and other prohibited substances on Site is prohibited. Gambling, prostitution or other illegal or immoral activities shall not be allowed anywhere in the project site.

Where applicable, the Contractor shall require the workforce at the worksite to correct or report unsafe conditions to their Supervisors immediately. If the unsafe condition cannot be corrected immediately,

arrangements shall be made to warn others of the lurking danger. The Contractor is expected to post caution, warning, or prohibition signs at the affected area.

Barriers and barricades, including red danger or yellow caution tape shall not be crossed for any reason unless given proper authorization by those performing the work. These barricades shall have signage stating what work is being performed and who is performing it and include contact information and date.

The Contractor shall instruct the workforce not to tamper with or defeat safety devices (such as guards, shields, interlocks, smoke or flame detectors, sprinklers, PA speakers, exhaust airflow monitors) or operate valves, breakers, disconnects, blast gates, or other similar control devices, without formal approval. This includes Life Safety Systems e.g., exhaust, alarm, fire detection, etc.

Aisles, exit routes, doorways, and access to emergency equipment (such as fire extinguishers, emergency eyewash/ showers, simplex fire control stations) shall never be blocked by materials or equipment. Materials or equipment shall not be stored in exit passageways or stairwells.

Materials brought in by the Contractor to facilitate work shall be kept neat to ensure compliance with safety and contamination control requirements. Gasoline, liquefied petroleum gas (LPG), or other internal combustion engines shall not be operated inside buildings, on roofs, or near the Fab building without Micron approval and proper controls in place. The Contractor shall ensure that the workforce or the subcontractors do not engage in horseplay, unsafe acts, threats, violent behavior, or harassment of any kind. Violators will be immediately removed from the site. In addition, the local law enforcement agencies will be notified, if necessary.

Utility knives, box knives, and similar cutting devices is prohibited. Use of safety knives with auto-retractable features is recommended wherever possible.

ISO 10333-1:2000 Personal Fall-Arrest Systems -- Part 1: Full-Body Harnesses

ISO 14567:1999 Personal protective equipment for protection against falls from a height – Single-point anchor devices

ISO 16024:2005 Personal protective equipment for protection against falls from a height – Flexible horizontal lifeline systems

6.2 Global and Regulatory Requirements

The Contractor shall comply with all applicable environmental, health and safety (EHS) legislative requirements of the country where the project is being executed including any new acts, regulations and approved codes of practice which may be gazetted during the Contract Period including any amendments or re-enactments thereto not specifically mentioned in this Standard.

The Contractor shall comply with the environmental, health and safety requirements contained in this Standard even where these impose a higher standard than that required by current country specific legislation. In the event of conflict between this Standard and the applicable laws and regulations whereby the Standard would prevent compliance with the laws and regulations, the laws and regulations shall apply. If the Standards impose a higher or stricter standard than the laws and regulations, the Standard shall apply.

The Contractor shall demonstrate that it is keeping up to date with changes in the act, regulations, approved code of practices, guidelines and other international standards referenced in this Standard through a subscription service provider or equivalent.

The Contractor shall establish a bridging document to clearly delineate areas of conflict and agreed solutions.

6.3 EHS Management System

Within 14 days of Commencement Date, the Contractor shall submit their proposed Project Specific Environmental, Health and Safety (EHS) Management System (MS) Plan in accordance with ISO14001 and ISO45001 standards. The EHS MS Plan shall incorporate all relevant legal and contractual requirements.

The EHS MS shall include, as a minimum, the Contractor's company EHS policy, safe work practices, risk management, in-house standard operating procedures, small group activities, safety cycle activities, safety promotion program, safety training, safety inspections, maintenance regime, subcontractor evaluation and selection, hazardous substances control, incident investigation, emergency procedures, occupational health program and other such systems as outlined in both ISO14001 and ISO45001 standards. The EHS MS shall identify the relevant safety equipment and describe the safe method of work to be employed for each stage of construction. The EHS MS shall incorporate the requirements of this specification.

The Contractor shall make necessary arrangements to propagate the contents of EHS MS Plan to every personnel involved in the project or those who may be affected by it. A hard copy of the EHS Plan shall be made available at the Contractor's site office and elsewhere on site to be accessible to all workers.

ANSI/ASSP Z10.0-2019, Occupational Health and Safety Management Systems

ANSI/ASSP/ISO 45001-2018, Occupational health, and safety management systems Requirements with guidance for use

ANSI/ASSE A10.38-2013, Basic Elements of an Employer's Program to Provide a Safe and Healthful Work Environment

ANSI/ASSE A10.6-2006 (R2016), Safety & Health Program Requirements for Demolition Operations

6.3.1 Rules & Regulations

The Contractor shall post relevant EHS notices and information prominently around the project site in appropriate languages for the benefit of the workforce. Such notices shall comply with industry standards and legislation.

The Contractor shall comply with Micron's 9 Critical Risks Controls and shall ensure that these rules are fully briefed to the workforce and prominently displayed around the project site. The workforce shall be informed that infringement of any of these rules may result in immediate termination from the Project.

The rules and regulations shall apply to every personnel involved in the project. The Contractor shall also comply with all updates or revisions made to legal requirements, approved codes of practice, industry standards and Micron's 9 Critical Risks Controls during the Contract Period.

6.3.2 Enforcement

The Contractor shall enforce the requirements outlined in this standard throughout the project duration. The Contractor shall establish and implement a clearly written reward and disciplinary scheme to recognize exemplary performance as well as reprimand deficient performance. Such reward and disciplinary scheme shall be presented to the Project Architect/Micron for review. This may include removal from the site of any subcontractor(s) or person(s) who fail to observe safety procedures, performs an unsafe act, or promotes an unsafe working condition.

If the Contractor fails to comply with the requirements of the applicable legislative as well as requirements stipulated in this document, the Project Architect/Micron will have the authority to instruct the Contractor to stop work in any location until the unsafe acts, conditions or practices have been rectified to the satisfaction of the Project Architect/Micron. In such cases, the Contractor shall be responsible for all costs and delays resulting from such instruction and from complying with such instruction.

6.3.3 Risk Management

6.3.3.1 Micron's 9 Critical Risks

The Contractor shall ensure the control measures outlined in Micron's 9 Critical Risk Control Protocol are taken into consideration and adhered to when performing high-risk work at the project site.

Please refer to Appendix 4 for details of Micron's 9 Critical Risk Control Protocol.

6.3.3.2 Risk Assessment

The Contractor shall carry out overall project risk assessment for all the activities and produce a risk register that outlines the risk, risk ranking, control measures and residual risks. The risk register shall be submitted to the Project Architect/Micron for approval at least two weeks before site mobilization. Risk assessment and corresponding method statement for safety critical activities rated "medium" and "high" risk shall be presented to a panel consisting of the Contractors, Project Architect and Micron.

The Contractor shall address all comments raised by the panel on the risk assessment and the associated method statement arising from the review. The Contractor shall fully comply with the risk assessment and associated method statement deliberated and agreed upon by the review panel. If there is any intention to change the method statement, the Contractor shall seek consent from the review panel.

The Contractor shall maintain a record of risk assessments, method statement and associated control measures taken.

ANSI/ASSP/ISO 31000-2018, Risk Management Guidelines

ANSI/ASSE A10.49-2015, Control of Health Hazards in Construction and Demolition Operations

ANSI/ASSP/ISO 31010-2019, Risk Management - Risk Assessment Techniques

ANSI/NFPA 551-2022, Guide for the Evaluation of Fire Risk Assessments

6.3.3.3 Job Hazard/Safety Analysis

Contractor shall develop a Job Hazard Analysis/Job Safety Analysis (JHA/JSA) for all routine, non-routine and abnormal tasks performed at the project site for the day. Adequacy and completeness of the JHA/JSAs shall be reviewed by the Contractors Project Management Team.

The finalized JHA/JSAs shall be submitted to the Project Architect/Micron for review when requested. The Contractor shall make necessary arrangement for the JHA/JSAs review to be integrated into the project schedule and updated in appropriate work groups as needed.

The Contractor shall ensure that the content of the JHA/JSAs are effectively communicated to the workforce daily. The communication shall cover the task to be performed for the day, associated hazards, and the controls to be implemented.

6.3.4 Mobilization

6.3.4.1 Dilapidation Survey

The Contractor shall carry out an impact assessment of the construction effects on the buildings, structures, and existing services near the project site and submit the Construction Impact Assessment Report to the Project Architect/Micron prior to commencing the works. The Report shall include details on the following:

- The ground conditions, geotechnical profiles, and relevant borehole logs,
- The proposed construction equipment and methods, and sequence of construction,
- Assessments to address construction equipment, methodology, vibrations, ground displacements, load transfer from foundation elements to the buildings, structures, and services,
- Vibration characteristics and attenuation for major construction equipment and methodology,
- Instrumentation and monitoring requirements,
- The damage potential and risks to the adjacent buildings, structures, and other service, and
- Preventative and remedial measures that would be utilized to protect the adjacent buildings, structure, and other services.

The Contractor shall advise the Project Architect/Micron as to the risk and level of damage expected to the adjacent buildings, structure and other services based on his detailed analysis and assessment. The Contractor shall propose mitigating measures to protect the buildings, structures, and other services from damage to the satisfaction of the Project Architect/Micron

6.3.4.2 Pre-mobilization

Upon award of Contract, the Contractor's senior management shall attend an EHS kick-off meeting facilitated by Micron. The EHS Kick-off meeting shall define and reinforce Micron's EHS requirements and expectations, such as setting of targets, submission schedules, report formats for observations, inspections, accident statistics, near-miss incidents and reporting procedures for incidents and injuries, etc.

Prior to the commencement of Works, the Contractor shall provide the Project Architect and Micron an EHS induction specific to the project. The Contractor shall in turn, conduct the project specific EHS induction for all its employees, sub-consultants, and sub-contractors. The Contractor shall keep records of the participants and the induction details and submit the records when so requested by the Project Architect/Micron.

Prior to the commencement of works, the Contractor shall be responsible for providing all necessary EHS training and associated refresher trainings, including training mandated by the local legal requirements to its employees and subcontractors. The Contractor shall keep records of all training conducted and submit the same to the Project Architect/Micron when so requested.

Contractor shall designate a “Project Readiness Review Team” to assess the status of implementation of Micron and Contractor EHS Program prior to project mobilization. The Project Readiness Review Team shall include, at a minimum, the Contractor Project Manager, EHS Manager, and Senior Superintendent(s). The Project Architect/Micron team shall be invited to be observers.

The Project Readiness Review Team shall use “Micron Contractor EHS Readiness Review Checklist” stipulated at Appendix 1 and Appendix 2 for its evaluation of project readiness. The checklist shall be used to track the evaluation and implementation of critical contractor EHS elements prior to project kickoff.

The Project Readiness Review Team shall also develop an equivalent process for evaluation of readiness for each subcontractor. Failure to meet Subcontractor Project Readiness Review requirements will prevent subcontractor from initiating work.

6.3.4.3 Project Registration

Within four (4) weeks of Commencement Date, the Contractor shall register their works with the relevant authorities and obtain a license or permit to start construction works. A copy of the license or permit shall be submitted to the Project Architect for recordkeeping.

The Contractor shall be responsible for all environmental, health and safety requirements under the Contract, the Project license/permit, and applicable legislative requirements until completion of the Contract including any extensions and the Defects Liability Period and any required rectification of defects.

The Contractor shall compose a Project Environmental, Health and Safety Slogan for this specific contract, in line with Micron’s Vision and Mission Statement.

6.3.4.4 Site Utilization

Site utilization is a critical piece of the project planning process that affects construction activities, project duration, safety, and cost. Planning the most efficient use of the space available at the project site is critical. Therefore, the Contractor shall evaluate the layout of the project site and the location of facilities to improve efficiency over the project life cycle.

Planning for all aspects of the construction process, the Contractor shall analyze the path of people, machines, and materials in and around a jobsite to ensure that everything flows smoothly.

6.3.4.5 Vibration Control

Before commencing construction work in the vicinity of buildings, structures and existing services, the Contractor shall verify the exact locations of these buildings, structures, and existing services. The Contractor shall submit a vibration control and monitoring plan to the Project Architect/Micron for approval prior to commencing such work.

The Contractor shall design both temporary and permanent works to ensure that ground movements are kept to an absolute minimum. Proven techniques and good workmanship are required to restrict ground loss that would lead to ground movement.

The Contractor shall select and operate construction equipment in a manner such that vibration induced damage to buildings, structures or existing services is negligible.

The Contractor shall be fully liable for any repair of buildings, structures or existing services damaged by the effects of the construction works. The Contractor shall also carry out any precautionary, protective or recovery measures deemed fit by the Contractor and agreed by the Project Architect/Micron during the construction stage or the defects liability period.

6.3.4.6 Post-mobilization

The Contractor shall provide and maintain a safe workplace and a safe system of work. The Contractor shall be responsible for conducting workplace inspections and safety observations. The Contractor shall make available copies of safety observation, safety inspections, accident statistics and near-miss report to the Project Architect/Micron in an agreed format.

The Contractor's Management and its EHS personnel shall attend periodic EHS dialogue with the Project Architect/Micron to review the Contractor's EHS performance.

The Contractor is required to provide the Project Architect/Micron the CV(s) before the employment of qualified competent full-time managers and site supervisors who are accountable for safe execution of work involving critical risk at the project site. These supervisors must be safety-trained by accredited training service providers. Where applicable, the Contractor shall provide additional training to ensure the work activities are performed safely.

6.3.4.7 Construction Near Buildings, Structures & Other Services

The Contractor shall establish and inform the Project Architect/Micron of the procedures and methods for all excavation and other construction work to prevent damage to adjacent buildings, structures, or existing services during the project duration.

Equipment vibrations – The peak particle velocity (PPV) impacted to adjacent buildings, structures and existing services shall not exceed the latest requirements set forth in British Standard BS 7385. This requirement applies to all construction equipment pipe-jacking, piling, and tunneling machinery. The Contractor shall provide a detailed impact assessment that clearly demonstrates the vibration attenuation for each specific equipment in similar ground conditions. This may require on-site testing and monitoring with a seismometer.

Load transfer from foundations to buildings, structures, and existing services – Load transfer (if any) from the foundation elements to building, structure and existing services (e.g., by skin friction) shall not exceed 10 kPa (10 kN/m2). This requirement may result in the foundation elements being "debonded" at and above the building, structure, and existing services.

ANSI/ASSP A10.34-2021, Protection of the Public on or Adjacent to Construction Sites

6.3.5 EHS Personnel

EHS personnel refers to designated personnel holding relevant competencies in environmental, health and safety and are registered with respective government agencies in the countries where the construction project is being undertaken.

The Contractor shall designate an EHS Manager/Lead or equivalent senior personal to lead and manage EHS function in the project. The Contractor shall ensure that the EHS Manager/Lead has at least a minimum of seven (7) years of traceable work experience. The EHS Manager/Lead shall be on-site full-time. The Contractor's EHS Manager/Lead shall coordinate activities with Construction EHS Team. The resume of the proposed EHS Manager/Lead shall be provided to the Project Architect/Micron for review and approval in advance prior to project mobilization. The proposed Contractor EHS organization chart complete with proposed personnel's name shall be provided together with the bid.

The contractor is expected to assign adequate numbers of registered/competent environmental officers and safety and health officers to manage the project in accordance with the project specific EHS MS Plan. The said personnel shall each have five (5) years of traceable work experience on a contract scope similar or equivalent in plant construction or public infrastructure projects.

The Contractor shall assign adequate numbers of registered/competent safety and health coordinators/supervisors to assist the registered/competent environmental officers and safety and health officers to manage the project. As a minimum, the Contractor shall ensure a ratio of 1 safety and health coordinators/supervisors to 30 workers. The safety and health coordinators/supervisors shall each have at least three (3) years of traceable work experience on a contract scope similar or equivalent in plant construction or public infrastructure projects.

Prior to their appointment, the Contractor shall submit the proposed EHS personnel's resume with detailed listing of their past experiences with valid references for the Project Architect's/Micron approval.

The EHS personnel shall not be removed or replaced without the Project Architect's/Micron approval. The EHS personnel shall attend to the works on-site during normal working hours and shall be available by mobile contact during other hours when works are progressing. The Contractor shall replace the appointed EHS personnel if the performance of the EHS personnel is not up to the Project Architect's/Micron expectations.

The Contractor shall provide, as a minimum, the following full time competent EHS personnel for implementing the project specific EHS MS Plan, programs, and risk management at the worksites:

- One (1) safety and health officer. If the work requires shift assignment, One (1) safety and health officer per shift,
- One (1) safety and health coordinator/supervisor. If the work requires shift assignment, One (1) safety and health coordinator/supervisor per shift,
- One (1) environmental officer. If the work requires shift assignment, One (1) environmental officer per shift; and
- One (1) EHS administrative assistant.

The above clause represents the minimum expectations; however, the Contractor is responsible for planning and resourcing for the project to ensure EHS standards are met. If deemed necessary by the Project Architect/Micron, the Contractor shall appoint additional EHS personnel to ensure adequate health and safety coverage for all Contract related works whenever work is in progress including shifts. The Contractor shall be responsible for the additional cost.

The Contractor shall appoint the EHS Manager on time to facilitate mobilization or when any work commences on site, whichever is earlier, and subsequent EHS personnel no later than three (3) months thereafter or when directed to by the Project Architect/Micron.

The Contractor shall provide appropriate and qualified EHS personnel to cover for incumbent EHS personnel's absence due to annual leave, sick leave, National Service, and trainings etc.

In addition to duties as prescribed in the respective country's Act and Regulations the EHS personnel shall carry out duties prescribed in their respective job descriptions.

The Contractor shall ensure that each subcontractor employs an on-site, qualified full-time Safety Professional or Coordinator approved of in advance by the Project Architect when the actual workforce reaches 30 employees, or the contract value exceeds 2 million US dollars (labor) or local country equivalent, or hazardous activities are predetermined to be present. The Contractor is also expected to provide an additional qualified Safety Professional or Coordinator for each increment of fifty (50) employees and/or increment of 5 million US dollars (labor) or local country equivalent thereafter.

The Contractor shall review qualifications of proposed subcontractor safety professionals based on the following criteria:

- Technical safety knowledge,
- Capacity to conduct field observations, interactions, and interventions,
- Ability to review and suggest improvements to task planning in the field,
- Experience in safety coaching and training,
- Proficiency in people management skills,
- Knowledge of hazard communication fundamentals,
- Familiarity with subcontractor corporate safety policy and EHS management system,
- Ability to track and trend results and indicators,
- Expertise in trade-specific hazard recognition, and
- Experience in case injury/illness management and investigation

The Contractor shall prepare a summary of qualifications as described above and shall submit the summary to the Project Architect/Micron for approval.

The Contractor's and/or subcontractor's EHS personnel who are not expressly approved in writing by the Project Architect/Micron will not be eligible to take part in the project.

6.3.6 EHS Training

The Contractor and those involved in the project shall attend necessary EHS training mandated in the local Act and Regulations, which is applicable to its employees and subcontractors, or as directed by the Project Architect/Micron. The Contractor shall keep records of all training conducted and submit the same to the Project Architect/Micron when so requested.

The Contractor shall ensure that its staff, workers, and subcontractors on site attend the mandatory Site Safety Induction training. The Site Safety Induction training program shall form a pre-requisite for site entry. The said training program is to be developed and delivered by the Contractor after having the training materials reviewed and endorsed by the Project Architect/Micron. This Site Safety Induction training program shall include simulations on Micron's 9 Critical Risks incorporated into the on-site Safety

Training Facility. None of the Contractor's staff, workers and subcontractors shall be allowed to work on-site without successfully completing all the Site Safety Induction trainings and associated assessments.

The Contractor shall extend the Site Safety Induction training program to all every personnel involved in the project including, Qualified Person (QP), Project Architect, and Micron staff involved in the Project. No one shall be allowed on to the project site until they have attended the Contractor's mandatory Site Safety Induction training program. The Contractor shall keep records of the participants, the induction details and submit it to the Project Architect/Micron when so requested.

The Contractor shall provide a training facility within the project site capable of facilitating the Site Safety Induction training programs. The training room(s) shall be equipped with the necessary furniture as well as audio-visual aids to facilitate the training programs.

The Contractor shall ensure that no personnel including interfacing contractors working at the project site are permitted into the site prior to completing the Site Safety Induction training program and without a corresponding access control system, which can be achieved using biometrics. The access control system provided by Contractor shall be able to clearly identify all the qualified personnel and operators.

The Contractor shall ensure that training material is translated where necessary in languages understood by the trainees. In addition, the access control system shall be capable to identify and isolate workers who do not meet project site entry pre-requisites: valid work permit, valid competencies certificates, valid mandated regulatory training, etc.

The Contractor shall employ qualified plant/machinery operators to operate the plant/machinery used on the project site in accordance with legal requirements. The operators shall have completed the mandated training and hold a competency certificate issued by regulatory agencies or approved training providers certified by the regulatory agencies. As for the plant/machinery where there is no mention of competency or skills training, the Contractor shall engage the supplier of the said plant/machinery to train the operators in the safe operations of the plant/machinery. Upon completing the training, the plant/machinery suppliers shall issue a statement in writing indicating that the workers have undergone the necessary training to operate the plant/machinery safely.

The Contractor shall develop and implement a comprehensive training and competency assessment system to assure the competency of all the personnel assigned to support the project before their deployment at the project site. The assessment system shall include face-to-face interviews and written tests that evaluate appreciation of hazards/aspects & impacts associated with respective works.

The Contractor shall ensure that new hires, or personnel transferred from other projects or personnel transferred to different disciplines are given proper EHS training relevant to their duties.

The Contractor shall produce a project specific training matrix based on a training needs analysis to capture the type trainings, duration, trainers as well as the target audiences. The Contractor shall appoint experienced and qualified trainers to facilitate the trainings.

Please refer to Appendix 5 for EHS Training Requirements

ANSI/ASSE Z490.1-2016, Criteria for Accepted Practices in Safety, Health, and Environmental Training

ANSI/ASSP Z490.2-2019, Accepted Practices for E-learning in Safety, Health and Environmental Training

6.3.7 Incident Reporting & Investigation

The Contractor shall comply with all statutory accident and incident reporting requirements. Information reported to the authorities shall be copied to the Project Architect/Micron at the time of reporting to the relevant authority or authorities.

In addition to the statutory and insurance reporting requirements, the Contractor shall notify the Project Architect/Micron of every accident, incident, dangerous occurrence or near miss that affects the environment as well as the health and safety of the workforce and public. This shall include first aid events even if it does not result in lost time. Please refer to Micron's Global EHS - Incident Reporting and Investigation Standard for expectations on reporting and investigation timeline.

Failure to provide immediate notification to the Project Architect/Micron will adversely affect the Contractor's performance review.

The Contractor shall propose remedial measures to prevent recurrence of the accidents and incidents to the satisfaction of the Project Architect/Micron.

The Contractor shall investigate each incident and submit an investigative report that defines what happened, why, direct, and indirect contributing factors, root cause analysis using an appropriate and accepted methodology, corrective actions, preventive actions, and any other relevant learning. The report shall include relevant photos, sketches and evidence related to the incident or accident in soft and hard copies as deemed necessary to the satisfaction of the Project Architect/Micron. The final report should be provided within the specified timeline. In addition, the Contractor is expected to respond to the SQN issued by Micron for the incidents with severity rating 3 and above.

The Contractor shall ensure that all incidents and accidents that result in any property/utility damage, environmental incidents, fatal injury, injury requiring first aider or Doctor's medical attention, hospitalization or other serious personal injury and all fires are recorded and fully investigated to the satisfaction of the Project Architect/Micron.

The Contractor shall follow-up, track and report the recovery status of the injured person on regular basis to the Project Architect/Micron.

6.3.8 Meeting

6.3.8.1 Safety Leadership Team

The Contractor shall coordinate, lead, and facilitate a weekly Safety Leadership Team (SLT) meeting where the participants shall be a senior site manager from each subcontractor with greater than 25 employees, plus select representatives from Contractor, Project Architect and Micron.

The SLT shall evaluate project EHS performance, evaluate effectiveness of established controls, and implement adequate control measures, where necessary, to mitigate risks arising from the work activities performed at the project site. The SLT shall evaluate input from various sources, such as Employee Feedback, Supervisor Safety Inspections, and Safety Action Items, for timely response to unhealthy project EHS performance trends, gaps, and conditions.

In addition to the weekly meeting, the Safety Leadership Team is also required to perform a weekly site walk just before the weekly meeting to evaluate EHS performance in the field at the project site.

6.3.8.2 EHS Coordination

At a minimum, the Contractor shall conduct weekly health and safety co-ordination meetings with his sub-contractors and interfacing contractors to ensure that works are carried out on Site with minimum risk to workers and to the public. The meeting shall review all works on site including the movement of plant, equipment and hazardous materials, review, safe work practices, permit to work procedures, training, PPE, and incidents. In addition to the above, the Contractor shall review the adequacy of controls for the critical risk activities to be performed at the worksite one month in advance – a one-month critical risks activities lookahead plan. The meeting shall also inform personnel of potentially dangerous work operation and key risks at the site.

During progress coordination meetings, Structural, Electrical and Mechanical (SEM) and similar type of meetings and reviews, the following items shall be included in the meeting agenda:

- Relevant lesson learned case study,
- Planning and sequencing of work activities and identify incompatible works between contractors working in the same area,
- Identification of risks and hazards of the interfacing works, including the conduct of site walk to verify these hazards,
- Highlighting potential high-risk zones during handing over, and
- Developing a site map to show delivery routes and designated storage area for the Contractor and Interfacing Contractors.

6.3.8.3 EHS Committee

The Contractor shall establish a EHS committee. The committee shall comprise management, site supervisory staff, EHS representatives from the Contractor and his sub-contractors including any interfacing contractors. The meeting chairperson shall be the Contractor's Project Director or Project Manager. The Project Architect and Micron representatives shall be invited to sit in the committee on an ex-officio basis.

The Contractor shall establish a reasonable schedule for the EHS committee meeting, site inspections as well as other related activities.

At a minimum, the Contractor shall include the following topics as the meeting agenda:

- Sharing of objectives, strategies, safety mission statement and KPI's,
- Chairman's review of HSE performance/ condition,
- Report from EHS representatives,
- EHS Committee inspection report,
- Accidents and incidents with lessons learned and implementing actions,
- Status of key EHS initiatives and programs,
- Major concerns and actions to address, and
- Authority visits, and discussion on follow up actions.

The Contractor shall ensure that all major decisions and actions made at each meeting are effectively communicated for implementation. The Contractor shall ensure that all major decisions made, follow-up actions required, and lessons learnt from incident reviews at each meeting are effectively communicated for implementation. Records of closed items arising from meeting shall be kept in records and submitted to the Project Architect/Micron when so requested.

A Toolbox Talk is an informal group discussion that focuses on a particular safety issue. These tools can be used daily to promote department safety culture as well as to facilitate health and safety discussions on job sites.

6.3.9 Safe System of Work

6.3.9.1 Electronic Permit-to-Work (ePTW)

The Contractor shall prepare, implement, and comply with electronic Permit-To-Work (ePTW) for all work as required by the local legislation or by the Project Architect/Micron. The Project Architect/Micron shall audit the Contractor's ePTW to verify compliance.

The Contractor is required to establish and implement a centralized electronic Permit-To-Work (ePTW) system to manage high-risk work activities on the project. The objectives of the system would be to streamline the preparation of ePTWs, provide consistent standards and content, and to document, report, and manage all ePTWs. The ePTW system is not intended to relieve the Contractor of his obligations to develop the specific content for each PTW based upon the nature of the specific work covered by the ePTW.

The ePTW shall be valid only for the day or shift unless otherwise agreed upon by the Project Architect/Micron.

The safety assessor and the Contractor appointed project manager approving the ePTW shall be separate persons. In addition, the safety assessor shall be a competent supervisory staff.

Please refer to Appendix 7 for further details.

6.3.9.2 Pre-Task Plan

The Risk Assessment (RA) or Job Hazard/Safety Analysis (JHA/JSA) process does not drill down to the tasks specifics that takes place every day at the project site. In addition, the RA/JHA/JSA also does not address risks and required controls for the non-routine activities happening on an ad hoc basis. Therefore, the Contractor shall ensure that the Pre-Task Plans (PTP) are generated and delivered to the workforce by the supervisory personnel on-site at the concerned work area just after the daily toolbox talks, just before a planned task is about to be performed and anytime in the day before work is about to commence. The workforce shall be briefed on the chronology of the day's activities, the control measures that needs to be in established, the precautions to be observed, the safe work practices to be followed, emergency procedures, and the situation that requires "Stop Work".

The Contractor is to ensure that the Pre-task Plan (PTP) is effectively implemented and communicated and provides the workforce all the necessary information that they require to perform their work in safe manner without adversely impacting the workforce, property, environment, and the public. immediately, and just before the work begins.

If night works or multiple shift works are performed, then PTP shall be conducted just after the toolbox talk for the shift work is completed.

The Contractor shall provide interpreters, where necessary, to ensure that the workers and other relevant persons of various nationalities understand the information being disseminated.

ANSI/ASSE A10.1-2011 (R2017), Pre-Project & Pre-Task Safety and Health Planning

6.3.9.3 Stop Work

The Contractor shall establish and implement a 'Stop Work' policy to allow the unsafe acts or conditions that take place at the project site to be either stopped temporarily or over a reasonable period where corrective/preventive measures can be taken to address the unsafe act or condition.

The Contractor shall extend the "Stop Work" policy to correct work activities at the project site that deviates from the original work plan.

6.3.9.4 Stand Down

Where applicable the Contractor shall conduct a 'Stand Down' sessions. This is to allow the Contractor to take stock and refocus on safety, review current work activities and its associated hazards, as well as to identify additional safety measures required to maintain high EHS standards at the project site. The Contractor may conduct the 'Stand Down' sessions on a site-wide basis or to focus on specific work activities or subcontractors at various stages of their works. The Contractor shall seek the Project Architect/Micron for approval for the 'Stand Down.'

6.3.9.5 Fall Prevention/Protection

The Contractor shall establish and implement a site-specific fall prevention plan, which is prepared for the purpose of reducing or eliminating risk of falls. The fall prevention plan may consist in parts of existing documentation (e.g., risk assessment). Contractors who implement an EHS management system in place may use the required documents to constitute a fall prevention plan.

The fall prevention plan shall fulfil the following requirements:

- Address fall from heights hazards comprehensively,
- Meet or exceed Micron's Global EHS – Work at Heights Standard
- Relevant to the specific project site covered in the fall prevention plan; and
- Readily available at the project site covered in the fall prevention plan.
- The fall prevention plan must:
- Establish clear individual responsibilities for fall prevention,
- Integrate fall prevention into the project sites EHS Management System for enhancement and sustenance of work at heights safety,
- Provide a systematic approach for eliminating or reducing risk of falling from heights,
- Ensure that all reasonable fall prevention and protection measures and methods have been taken prior to commencement of working at heights, and
- Ensure the adoption of an integrated approach to fall prevention and work at heights safety.

The fall prevention plan is to be developed by a competent person and approved by an authorized manager or an equivalent competent person. Provisions must also be made for adequate supervision to ensure that the plan is being implemented at the project site.

The fall prevention plan shall be monitored and reviewed periodically to ensure its relevance and effectiveness. It must also be properly documented and kept readily available at the project site.

Please refer Micron's 9 Critical Risks Controls, the associated checklist and Global EHS – Work at Heights Standard for further details on the expected controls.

ANSI/ASSE A10.11-2016, Safety Requirements for Personnel Nets

ANSI/ASSE A10.32-2012, Fall Protection Systems for Construction and Demolition Operations

ANSI/ASSE A10.37-2016, Debris Net Systems Used During Construction and Demolition Operations

ANSI ASSE Z359.15-2014, Safety Requirements for Single Anchor Vertical Lifelines & Fall Arrestors for Personal Fall Arrest Systems

ANSI ASSE Z359.16-2016, Safety Requirements for Climbing Ladder Fall Arrest Systems

ANSI ASSE Z359.6-2016, Specifications and Design Requirements for Active Fall Protection Systems

ANSI/ASSE A1264.1-2017, Safety Requirements for Workplace Walking/Working Surfaces & Their Access; Workplace Floor, Wall & Roof Openings; Stairs & Guardrails Systems

ANSI/ASSE A1264.2-2012, Standard for the Provision of Slip Resistance on Walking/Working Surfaces

ANSI/ASSE Z359.13-2013, Personal Energy Absorbers and Energy Absorbing Lanyards

ANSI/ASSE Z359.14-2014, Safety Requirements for Self-Retracting Devices for Personal Fall Arrest & Rescue Systems

ANSI/ASSE Z359.18-2017, Safety Requirements for Anchorage Connectors for Active Fall Protection Systems

ANSI/ASSE Z359.2-2017, Minimum Requirements for a Comprehensive Managed Fall Protection Program

ANSI/ASSP Z359.1-2020, The Fall Protection Code

ANSI/ASSP Z359.11-2021, Safety Requirements for Full Body Harnesses

ANSI/ASSP Z359.12-2019, Connecting Components for Personal Fall Arrest Systems

ANSI/ASSP Z359.3-2019, Safety Requirements for Lanyards and Positioning Lanyards

6.3.9.5.1 Scaffold

The Contractor shall comply with local legal requirements to ensure the safe use of scaffolds. The Contractor shall employ an approved scaffold contractor or competent scaffold crew to erect and dismantle scaffolds at the project site.

The Contractor shall envelope all scaffolds with screen nets to prevent debris from falling outside the scaffold work envelope. Scaffold pipe ends and joint couplings, which can cause laceration, are to be capped off to prevent injuries. Nets shall be secured by nylon cable ties only.

Local scaffold regulatory requirements shall be also applicable to the erection and dismantling of falseworks, temporary access ways and general barricades, which uses scaffold components.

The Contractor shall use only proprietary access ladders and working platforms for system formworks. Mix and match components e.g., conventional catwalks and monkey ladders are not allowed.

The contractor appointed to erect, dismantle, or to work on scaffolds must have completed relevant competency training and where applicable is required to undergo project-specific scaffold training

delivered by a competent scaffold trainer. The appointed competent scaffold contractor or crew are prohibited from using a scaffold system they have not been trained for.

A competent scaffold supervisor shall be assigned to direct and oversee the erection, dismantling, and use of scaffolds. In addition, the competent scaffold supervisor is required to inspect the scaffolds he/she is assigned to erect, dismantle, or work on each day prior to use.

Scaffold systems used to support temporary and permanent structures shall be designed by a qualified person. The said scaffold system shall be constructed and loaded in accordance with that design where the erection shall be supervised or endorsed by the qualified person (certificate of supervision).

Stationary scaffolds over 98.4 feet (30 meters) in height and rolling scaffolds over 60 feet (18.3 meters) in height must be designed by a professional engineer.

The Contractor shall develop and implement a scaffold tagging system, which is to be used to identify safe (e.g., green tag) and unsafe (e.g., red tag) scaffolds. The tag and permit system shall be used to communicate the status the scaffold to those who erect, dismantle or work on the scaffolds. At a minimum, the system used shall inform users when a scaffold is complete and safe to be used and when a scaffold is under construction and is not ready to be used. When additional precautions are required to use the scaffold safely, for example, the use of fall protection systems, the system shall identify the precautions to be taken. The tag or permit shall be placed at each means of access to the scaffold. The competent scaffold assessor appointed by the Contractor shall be responsible for the tag and permit system.

The competent scaffold supervisor shall utilize the pre-task plan to brief the scaffold crew on the work planned for the day, the associated risk, control measures and safe work method to be followed.

Scaffolds and its components must be capable of supporting, without failure, their own weight and at least four (4) times its maximum intended load.

The location where the scaffold is to be erected must be inspected to determine ground conditions, strength of supporting structure, proximity of electric power lines, overhead obstructions, wind conditions, the need for overhead protection or weather protection.

Supported scaffolds must be set on base plates, mudsills, or other suitable firm foundation. Scaffold frame or footing spacing and mudsill size shall be determined after the total loads to be imposed on the scaffold and the strength of the supporting soil or structure are calculated and considered. This analysis must be done by a qualified person.

Base plates or screw jacks with base plates must be in firm contact with both the sills and the legs of the scaffold. Screw jacks with base plates are to be used to compensate for uneven ground. Do not use unstable objects such as blocks, loose bricks, etc., to compensate for uneven ground.

Scaffolds and its components must be inspected for visible defects before each shift by a competent scaffold assessor, and after each occurrence that could affect a scaffold's integrity (such as being struck by a crane or severe weather).

The Contractor shall maintain the scaffold, its components and materials temporarily kept on the scaffold to facilitate work (e.g., paint roller extensions, building material) at a safe clearance distance from the overhead power lines. Portable electric equipment used on scaffolds to facilitate work must be equipped with ground-fault circuit interrupters (ELCBs/GFCI) or grounded appropriately.

Suspended scaffolds consist of one or more platforms suspended by ropes or other non-rigid means from an overhead structure(s). The common requirements for suspended scaffolds are addressed here; the

competent scaffold supervisor trained on suspended scaffold erection and dismantling shall ensure the suspended scaffold specific requirements are adhered to in addition to the requirements outlined above.

Each employee on a multi-point or two-point adjustable suspended scaffold must be protected by both a guardrail system and a personal fall arrest (PFA) system. The personal fall-arrest systems used on scaffolds shall be attached to a double lanyard and in-turn hooked-on to a vertical lifeline, horizontal lifeline, or scaffold structural member.

Guardrail systems must be installed along all open sides and ends of platforms and must be in place before the scaffold is released for use to those personnel, other than erection/dismantling crews, who use the scaffold to perform their work. The Contractor shall ensure fall prevention/protection is extended to the scaffold erection/dismantling crew.

ANSI/ASSP A10.8-2019, Scaffolding Safety Requirements

6.3.9.5.2 Ladders, Staircase & Manlifts

The Contractor shall use step platforms instead of portable ladders for works at height and establish a Permit-To-Work system for such works. In addition, for works more than three (3) meters high, the Contractor shall demonstrate the stability of these step platforms to prevent toppling.

Ladders (step ladders and vertical ladders) shall comply to EN131 and local regulatory requirements. They shall be used for access only and shall not exceed three (3) meters in height. (1. Portable ladders may be used to access heights and as a work platform without additional fall protection if the ladder is being used per the manufacturer's recommendations). The Contractor shall implement a step platform/ladder inspection procedure requiring an identification method displaying company name, unique number, inspection frequency and inspection status.

The Contractor shall ensure that the staircases at the project site are designed and fitted with handrails when it is being casted.

Manlifts used at the project site must be certified safe by a qualified person and where applicable conform to local regulatory requirements. The manlifts must be operated by a trained operator in the presents of a trained spotter.

ANSI ASC A14.3 / ANSI/ASSE A1264.1 - Safety requirements for Fixed Ladders and Workplace Surfaces Package

ANSI ASC A14.2 / ANSI ASC A14.5 / ANSI/ASSE A10.8 Portable Ladder and Scaffolding Package

ISO 14122-3:2016 Safety of Machinery - Permanent Means of Access to Machinery - Part 3: Stairs, Stepladders and Guard-Rails

EN 131-2:2017, Ladders - Part 2: Requirements, Testing, Marking

CAN/CSA B311-2002 (R2018) Safety Code for Manlifts

6.3.9.5.3 Floor Openings & Open Edges

The Contractor shall barricade all excavation, bored holes, voids, and open edges of structure under construction where a worker is liable to fall with secured and effective guardrails, barricades, and covers.

The Contractor shall post “Danger” warning signs on the barriers and barricades erected. The word “Danger, Risk of Fall, Do Not Remove” shall be stenciled or painted on all floor opening covers.

Where traffic flow is to be maintained over temporary road opening or crossing, the Contractor shall provide suitably designed steel cover or decking over it. The Contractor’s Professional Engineer shall design and submit the cover or decking proposed to the Project Architect/Micron for acceptance prior to commencement of the excavation.

The Contractor shall note that there are varying sizes of slab openings at the project site ranging from very small to very large. The openings are categorized into three (3) groups based on the size:

- Group 1: 300mm wide x any length:
  a) Too narrow for a person to fall through, but wider than their foot and therefore possible to fall into with potential injuries to shin, knee, thigh, or hip.
- Group 2: 300mm – 1000mm wide x any length:
  a) Big enough for a person to fall through, with potentially grave consequences, but too small to be of used as a service opening. Sumps, pits, and future access hatches are excluded from this group and shall be treated as Group 3 openings.
- Group 3: Greater than 1000mm x any length:
  a) Stairwells, air shafts and service openings are the most common in this category.

For each of the groups of openings outlined above, the Contractor shall comply with the ‘standard’ solution stipulated here:

- Group 1: 300mm wide x any length:
  a) A plywood cover (12 or 18mm thick) bolted or nailed down. Cover to be painted in a distinctive color or pattern.
- Group 2: 300mm – 1000mm wide x any length:
  a) A13 mesh, fixed to the top steel and cast into the slab. After casting, a plywood cover can be fitted and secured to prevent debris from falling through,
  b) Mesh cast with slab provides immediate protection against fall and cannot be accidentally removed,
  c) Design load on A13 mesh must be taken as 1.5KN. This is a commonly used load in ‘Dead and Live Load Tables’ for human traffic,
  d) Mesh is capable of spanning 1200mm under 1.5KN, but has been limited to 1000mm,
  e) Mesh to be hot dipped galvanized,
  f) Embedment length to be 425mm in short span direction,
  g) Plywood cover of sufficient thickness; and
  h) Cover fitted to prevent debris and materials from falling through. If cover is removed or becomes damaged the opening is still secure. Cover should be cut to fit inside the opening thus reducing the trip hazard and allowing other works to pass over it.
- Group 3: Greater than 1000mm x any length:
  a) Standard railings (top and mid rails), toe boards and netting to be provided. Height of railings to be at least 1.2 meters high,
  b) The Contractor shall note that the Stop-end below the mesh should be removed during striking of formwork. Stop-end above the mesh can be removed at the same time or left to serve as a stop-end for future screening works (if any). Plywood cover can be cut to suit,
  c) Removal of mesh shall be undertaken by the Contractor only when the opening is required by the relevant subcontractor,

d) After removing the mesh, the Contractor should grind the remnant steel flush to the opening and make good to the exposed ends using an acceptable anti- corrosion treatment (e.g., cold galvanized paint, epoxy paint, etc.),
e) Sliding gates for protection shall be installed where appropriate. They shall be fully fabricated in factory prior to delivery and installation at the project site,
f) In the process of installation, the contractor shall provide temporary restraint to prevent any movement (that can result in overrun and toppling) of the sliding gate until the installation including the safety features (e.g., stoppers to prevent over- run, gate safety sensors, etc.) are completed,
g) The work zone around the installation of the sliding gate must be cordoned off to prevent any unauthorized personnel from approaching,
h) The manufacturer, supplier or builder of sliding gate must provide the operational manual for safe operation and maintenance of the gate,
i) Gates should be checked and maintained periodically according to the manufacturers or sub-contractor's recommendation. In addition, the track for the gate should be properly upkept to prevent debris accumulation, which could cause the derailment of the gates, and
j) The Contractor shall comply with the associated legal requirements.

Removal of tile and entry into raised floor may require a Raised Floor Entry permit. The permit will be site and location specific. Contractors shall check with Micron Construction team and site EHS for more detail on raised metal floor permit. The open area of the floor must be completely barricaded with red danger tape or supported by stanchions chains or rigid barricades prior to removing any tile. Upon exiting the open floor tile and leaving the area unattended (breaks, lunch or the end of the day), the tiles must be replaced. Barricade signage must be filled out with all the appropriate information and posted onto the barricade.

When pulling floor tiles, all workers must use proper tile lifting tools and lifting technique. When replacing floor tiles that have been removed and/or modified be sure to replace tiles and support structures exactly as they were designed. If the space beneath the raised floor contains or has the potential to contain any recognized serious safety hazard, contractor shall conduct risk assessment and identify appropriate hazard control measures.

ANSI/ASSE A10.18-2007 (R2012), Safety Requirements for Temporary Floors, Holes, Wall Openings, Stairways and Other Unprotected Edges in Construction and Demolition Operations

6.3.9.5.4 Slip, Trip & Fall

The Contractor shall keep all work areas and footpaths free of slip, trip and fall hazards. The Contractor shall not permit persons to use a passageway, scaffold, platform, or other elevated working surface which has the potential to cause slip, trip and fall at the project site. Slip, trip and fall hazards shall be promptly removed or made safe.

6.3.9.6 Hazardous Substance

The Contractor shall establish and implement a hazardous substances management program, which is expected to evaluate the suitability of the proposed hazardous substances for use, handling, storage, and disposal at the construction site. The evaluation for suitability shall ensure compliance to local legal as

well as international requirements governing the safe use, handling, storage, disposal, and emergency response.

The hazardous substances management program shall be presented to the Project Architect/Micron for approval. The Project Architect/Micron may require the removal of any hazardous substance if there are safer alternatives. In such events, the Contractor shall not be entitled to any claim for compensation or Extension of Time for Completion.

The Contractor shall ensure that all hazardous substance containers are labelled, their movement is recorded, and containers are returned to the designated storage areas when not in use. In addition, the Contractor shall ensure the used hazardous substance containers, or any residue is disposed of safely through a licensed waste disposal service provider.

Where required, the Contractor shall obtain license for the use, handling, and storage of any hazardous substances on site. A copy of the license shall be submitted to the Project Architect/Micron.

Current version of the Safety Data Sheets and a Hazardous Substances register shall be maintained by the Contractor on-site.

Diesel fuel stored on site shall be kept in drums or in bulk tanks, which in either case shall be located at a designated place away from any sources of ignition or open drain which does not lead to an interceptor and shall be properly labelled. A “No Smoking” and ‘No Naked Flame’ sign shall be displayed at the storage location and a charged fire extinguisher of correct type kept on standby. The diesel storage at the site shall not exceed 1500litres or quantity specified in the local legal requirements.

Bulk diesel tanks shall be properly supported in an elevated position to facilitate gravity discharge. They shall stand within a bund constructed to contain a volume of 110% of the volume of the tank. There shall be no breaches in the bund wall, no material shall be stored within the bund. Rainwater collecting in the bund shall be regularly removed to prevent build-up or overflow. The inner face of the bund wall shall be coated with a chemical resistant material. A chemical resistant valve, which shall always be closed, except for releasing rainwater into a storm water drain via an oil intercepting system, shall be installed at the outlet situated outside the bund, in accordance with the local legal requirement or Micron Standard.

All diesel drums on site shall be in good condition and kept closed with a lid or cap when not being used. They shall be stored on end with the lid or cap uppermost and kept within a secondary containment tray of sufficient volume to contain the contents of the largest drum in the case of accidental rupture, considering the presence of other drums within the tray.

Diesel drums shall not be rolled along the ground. They shall be transported vertically chained on a trolley or by a forklift fitted with a drum handling device and not standing unsupported on the forks or on a pallet or by crane using a safe slinging technique.

Diesel shall be transferred from the storage drum to another container, or to the tank of plant/machinery using a hand pump wherever practicable and a drip pan must be provided. Where the diesel container is light enough to be lifted by one person, it can be poured out by hand a funnel must be used to guide the liquid.

Any spillages of diesel shall be absorbed immediately using sand or other absorbent materials, which shall be disposed of as contaminated waste. On no occasion should diesel be allowed to enter the site drainage system unless this is connected to an interceptor prior to the site waste being discharged into the public sewer system.

Please refer Micron's 9 Critical Risks Controls, the associated checklist and Micron's Global EHS – Standard for Storing Flammables and Combustibles and Global EHS -Toxic Gas Monitoring and Double Containment Standard for further details on the expected controls

ANSI/ASSE Z9.3-2017, Spray Finishing Operations: Safety Code for Design, Construction and Ventilation

ANSI/ASSP Z9.2-2018, Fundamentals Governing the Design and Operation of Local Exhaust Ventilation Systems

ANSI/ASSP Z9.4-2011 (R2021), Abrasive-Blasting Operations Ventilation and Safe Practices for Fixed Location Enclosures

ANSI/ASSP Z9.6-2018, Exhaust Systems for Grinding, Polishing and Buffing

ANSI/ASSP Z9.9-2021, Portable Ventilation Systems

ANSI/ASTM D4865-2019, Guide for Generation and Dissipation of Static Electricity in Petroleum Fuel Systems

6.3.9.7 Control of Hazardous Energy

Hazardous energy is any energy, including but not limited to mechanical (e.g., power transmission apparatus, counterbalances, springs, pressure, and gravity), pneumatic, hydraulic, electrical, chemical, nuclear, and thermal (e.g., high, or low temperature) energies, that could cause injury to employees.

When working on or near any system that produces, uses, or stores hazardous energy, the Contractor is required to establish and implement Control of Hazardous Energy (CoHE) Program.

The Contractor is also required to establish a Hazardous Energy Control (HEC) procedure and submit it to the Project Architect/Micron for review and approval. HEC procedures cannot be initiated until it has been accepted by the Project Architect/Micron.

The CoHE program shall clearly and specifically outline the scope, purpose, authorization, roles and responsibilities, rules, and techniques to be used for the control of hazardous energy.

The CoHE program shall include, but not be limited to, the following:

- HEC procedures: Equipment-specific steps to control each energy source and must include isolating, blocking, verifying, and securing systems,
- Means of coordinating and communicating HEC activities with all site personnel (include contractor, sub-contractor, government, suppliers, public, visitors and any other personnel) to ensure continuity of protection,
- Procedural steps and responsibilities for the placement, removal, and transfer of locks, tags, and other control devices,
- Procedural steps, responsibilities, and a means of accounting for placing and removing personal protective grounds,
- Procedural steps, responsibilities, and requirements for testing the system to verify the effectiveness of isolation and control,
- Coordination (Shift/Schedule Change). Provisions shall be made to ensure total continuity of HEC protection during shift or personnel change,
- Details of any emergency procedures,

- Procedural steps and responsibilities for daily inspections (conducted to ensure that requirements of the HEC procedures are being followed and documented) and periodic inspections (shall be documented and shall specify the system where the HEC procedures were inspected, the date of the inspection, the names of employees performing and included in the inspections, and any deficiencies in complying with the HEC procedures), and
- The means to enforce compliance with the HEC procedures.

Testing and commissioning are a critical phase of the construction where hazardous energies will be introduced. Therefore, the Contractor shall establish a specific Testing & Commissioning EHS plan to outline controls to address potential exposure.

Please refer Micron's 9 Critical Risks Controls, the associated checklist and Micron's Global EHS – Control of Hazardous Energy Standard for further details on the expected controls

ANSI/ASSP A10.35-2020, Standard - Safe Pressure Testing of Steel and Copper Piping Systems Used in Construction and Demolition Operations.

ANSI/ASSP A10.44-2020, Control of Energy Sources (Lockout/Tagout) for Construction and Demolition Operations

ANSI/ASSP A10.7-2018, Safety and Health Requirements for Construction and Demolition Use, Storage, Handling and Site Movement of Commercial Explosives and Blasting Agents

ANSI/ASSE Z244.1-2016, The Control of Hazardous Energy Lockout, Tagout and Alternative Methods

ANSI/ASTM E329-2021, Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection

6.3.9.8 Electrical

The Contractor shall obtain licenses for using electrical power from their own generator sets.

All temporary electrical installations, equipment and tools shall be checked and certified safe for use prior to usage on site by an Authorized Electrical Worker (AEW) and thereafter monthly and after any repairs. The AEW shall provide a sticker on the equipment and tools indicating the date of inspection and that it is safe for use.

Apart from AEW certifying industrial tools, and electrical installations, the AEW shall test and certify office appliances such as water dispenser, toaster, extension adapters, microwave ovens on a quarterly basis. The Contractor shall ensure its sub- contractors comply. The Contractor shall implement a color-coding scheme for inspections in accordance with the Plant and Equipment Color Coding sub-section of this Standard.

A current photograph of the AEW(s) and their contact number(s) shall be displayed on the outside of all designated areas or rooms containing electrical distribution boards for ease of reference. These designated areas or rooms shall be kept locked with access limited to Authorized Electrical Workers only. All other personnel shall be escorted by the AEW when gaining access to the designated areas or electrical rooms.

The Contractor shall ensure that all generators and welding sets in use on site are always adequately and effectively earthed during operation.

The electrical wiring associated with the electrical distribution boxes, plants, equipment, and tools shall be suspended at least 2m above ground to prevent workers from tripping on it. Where the wires crossover a walkway or access point, it shall be elevated/buried to allow free pedestrian as well as vehicle movement. Where necessary tiger-tails are to be hung on the section of the walkway or access point. In addition, portable electrical equipment used at the project site to facilitate work must be equipped with ground-fault circuit interrupters (ELCBs/GFCI) or grounded appropriately.

Please refer Micron's 9 Critical Risks Controls, the associated checklist and Micron's Global EHS – Electrical Safety Standard for further details on the expected controls. Sections from Global EHS – Electrical Safety Standard that shall be applicable to the Contractor are as follows:

- Section 6.1 Legal requirements
- Section 6.2 Micron Requirements
- Section 6.3 Qualification of Personnel working on Electrical System
- Section 6.4 Design
- Section 6.5 Construction, Hazard Warning Labels and Temporary lighting and Power
- Section 6.8 Electrical Safe Work Practices
- Section 6.9 Personal Device Charging
- Section 6.11 Electrical Safety Auditing

ANSI/NECA 1-2006 (R2015), Standard for Good Workmanship in Electrical Construction

ANSI/NECA 200-2016, Standard for Installing and Maintaining Temporary Electric Power at Construction Sites

ANSI/NFPA 70B-2019, Recommended Practice for Electrical Equipment Maintenance

ANSI/NFPA 70E-2021, Standard for Electrical Safety in the Workplace

ANSI/NFPA 79-2021, Electrical Standard for Industrial Machinery

6.3.9.9 Hot Work

The Contractor shall comply with ANSI Z49.1, safety requirement for welding and cutting (and other operation involving the use of heat).

When cylinders are used from a pallet, then a safe distance of 6 meters shall be maintained between oxygen and acetylene cylinder pallets.

Minimum quantity of gas cylinders should be kept at work locations on site, and the remainder moved to the designated storage area at ground level. Cylinders should be secured in a vertical position and individual sets should be chained to trolleys or to a fixed support.

The Contractor shall implement a permit to work for all hot works to ensure that the equipment is safe from defects and no incompatible works are carried near the hot work area.

Liquid petroleum gas used below ground shall be subjected to the Project Architect/Micron approval. Propane shall be used in a compressed air environment. Oxygen or acetylene cylinders taken underground shall be transported back above ground at the end of each working shift and stored in the designated storage areas.

Workers carrying out welding shall be provided with face shields compatible with safety helmets so that both can be worn to mitigate the hazard of falling object as well as harmful glare emanating from the hot work.

Appropriate fire blankets conforming to ANSI/FM 4950 standard shall be provided to contain sparks arising from welding and cutting operations.

Opaque screens shall be securely positioned around any electric arc welding being carried out on project site to protect other workers and passing members of the public, either on foot or as drivers or passengers in vehicles, from the arc. Such screens shall be maintained in good condition.

Cylinder valves shall be protected from damage by protection caps, valve guards or other effective means. Such protective means shall be in place whenever the gas cylinders are not in use or not connected for use.

Please refer Micron's 9 Critical Risks Controls and the associated checklist for further details on the expected controls.

ANSI Z49.1 Safety in welding, cutting, and allied processes

ISO 3821 Gas welding equipment – Rubber hoses for welding, cutting and allied processes

ISO/TR 28821 Gas welding equipment – Hose connections for equipment for welding, cutting and allied processes – Listing of connections which are either standardized or in common use

NFPA No. 50 Standard for bulk oxygen systems at consumer sites

ANSI/UL 123-2014 (R2019), Standard for Safety for Oxy-Fuel Gas Torches

ANSI/UL 147-2021, Standard for Safety for Hand-Held Torches for Fuel Gases

6.3.9.10 Confined Space

In addition to the local regulatory requirements as well as code of practice for Confined Spaces, the Contractor shall classify manholes, enclosed formwork, culvert drains, excavations more than 4 meters deep, partially enclosed excavations and tunnels as confined spaces. The requirement stipulated in the applicable legislative requirements as well as the requirements outlined in this Standard shall apply to the said confined spaces.

The Contractor shall produce a register, which enlist the confined spaces within the construction site. Each confined space shall be assigned a unique identifier as well as the hazards. The Contractor shall ensure that those personnel who are required to work in a manhole, tank or other confined spaces have attended the mandatory training stipulated by the local regulatory requirements as well as training stipulated by the Project Architect/Micron.

The Contractor shall control access/egress points to confined spaces to prevent unauthorized access. Where practicable the Contractor shall ensure that there are at least two readily accessible escape routes from each confined space.

The Contractor shall operate a tag system to track personnel entering and exiting the confined space to perform work.

The Contractor shall ensure that there is a certified man-riding cage capable of taking a stretcher and two persons, together with an identified crane equipped with rescue equipment, on standby always whilst work is carried out in the confined space. Where this is not reasonably practicable a stretcher which is capable of being brought manually out of the confined space should be located at a convenient point.

Gas monitoring shall be conducted by a competent confined space assessor to certify that the confined space is safe for workers to enter and thereafter at every hour (1) hour intervals. The Contractor is also encouraged to install continuous gas monitoring system where possible.

In addition, the Contractor shall ensure that suitable atmospheric monitoring devices such as anemometer and wet/dry bulb thermometer are made available for the competent confined space assessor to determine the air flow, ambient temperature, and humidity level within the confined space. Where there is a risk of flammable gas forming within the confined space, the Contractor shall ensure explosion rated equipment and spark free tools.

The Contractor shall have controlled RFID tag access/egress points to confined spaces, shafts, and tunnels to prevent unauthorized access. Confine Space Attendant(s) (CSA) shall always be present at access points for monitoring purposes. The CSA shall hold a competent certification and undergone necessary trainings to perform his duties.

Please refer Micron's 9 Critical Risks Controls, the associated checklist and Micron's Global EHS – Confined Space Program Standard for further details on the expected controls.

ANSI/ASSE A10.43-2016, Confined Space Entry for Construction and Demolition Operations

ANSI ASSE Z117.1-2016, Safety Requirements for Entering Confined Spaces

ANSI/ASSE Z490.1 / ANSI/ASSE Z117.1 - Confined Spaces Safety Training Set

NFPA 350 Guide for Safe Confined Space Entry and Work, 2019 Edition

ASTM F1764-97(2018), Standard Guide for Selection of Hardline Communication Systems for Confined-Space Rescue

NFPA 1989 Standard on Breathing Air Quality for Emergency Services Respiratory Protection, 2019 Edition

ANSI/UL 121303-2020, Standard for Safety for Guide for Use of Detectors for Flammable Gases

6.3.9.11 Lifting

The Contractor shall be responsible for ensuring that all lifting operations carried out on site and any rental cranes brought onto site are done so with minimal risk of injury to persons including members of the public or damage to property.

Effective controls must be established at all stages of a lifting operation through the deployment of a competent lifting engineer, lifting supervisor, a qualified signalman, a registered crane operator and qualified trained rigger.

All lifting machines, lifting appliances and lifting gears used on site must be suitable for the task, used within their rated safe load capacity and must be in good repair.

The Contractor is to submit a list of all cranes permanently deployed on site detailing their ownership, make, identification number, maximum safe working load and the corresponding radius, lifting Machine

(LM) certificate number and date of expiry. The list must be updated on monthly basis or whenever a new lifting machinery is brought on to the project site. Alternatively, the Contractor can register their cranes using Micron's online crane registration system.

The Contractor shall implement and maintain a craneage coordination plan for the site. Such cooperation may include, but not be limited to, providing plans and forecasts for all the Contractor's crane locations, durations, lifts, operating times, swing radii and other information required to ensure that the crane operations of all contractors are coordinated to avoid conflicts. When necessary, the Contractor shall revise its crane locations or operations to maintain such coordination and safe operations.

The Contractor shall ensure that any lorry loader with articulating arm on site is only used for the delivery, collection, and removal of materials from the project site within its rated lifting capacity, and not for lowering any materials into a trench or excavation, or for raising any materials to a higher level. However, transporting materials or plant and machinery around project site may be permitted if the lorry loader with articulating arm has been tested on the project site by an Authorized Examiner.

Please refer Micron's 9 Critical Risks Controls, the associated checklist and Micron's Global EHS - Lifting and Rigging Standard for further details on the expected controls.

ANSI/ASME NOG-1-2020, Rules for Construction of Overhead and Gantry Cranes (Top Running Bridge, Multiple Girder)

ANSI/ASME NUM-1-2016, Rules for Construction of Cranes, Monorails, and Hoists (with Bridge or Trolley or Hoist of the Underhung Type)

ANSI/ASSE A10.42-2000 (R2017), Safety Requirements for Rigging Qualifications & Responsibilities

ANSI/ASME B30.26-2015 (R2020), Rigging Hardware

ANSI/ASSE A10.5-2013, Safety Requirements for Material Hoists

ANSI/ASSP A10.28-2018, Safety Requirements for Work Platforms Suspended from Cranes or Derricks

ANSI/ASSP A10.5-2020, Safety Requirements for Material Hoists

ANSI/ASME B30.22-2016, Articulating Boom Cranes

ANSI/ASME B30.23-2016, Personnel Lifting Systems

ANSI/ASME B30.29-2018, Self-Erecting Tower Cranes

ANSI/ASME B30.3-2019, Tower Cranes

ANSI/ASME B30.30-2019, Ropes

ANSI/ASME B30.6-2020, Derricks

ANSI/ASME B30.9-2018, Slings

6.3.9.12 Excavation

The Contractor shall appoint enough banksmen to coordinate excavation activities and the haulage activities from the excavated pits to the at-grade level/bank. The banksman shall be appointed in writing

and should have attended appropriate training. The banksman shall be properly identified on site, stationed at-grade, and have overall control of the excavation works.

Communication in the form of walkie-talkie sets shall be established between the banksman and the excavator operators. The banksman shall be equipped with a loud hailer with siren alarm function to communicate during an emergency. No one shall be within any excavator's swing radius. All excavators shall be fitted with rear view camera for safe rear view monitoring.

Long arm excavators shall be provided with an extended reflective mirror in front of the operator's cabin to enhance operator's visibility and shall not operate without the presence of the banksman. All excavators shall also be fitted with a camera mounted on the long arm to further enhance the operator's view.

Excavator performing any excavation work in flammable environment shall be equipped with spark arrestor to prevent emission of flammable debris and naked light that will cause fire. A fire extinguisher with full capacity and in working order shall be placed in the operator's cabin.

Excavators within the excavation pit shall have falling object protection system (FOPS) fitted by the original equipment manufacturer, which is capable of withstanding impact from falling objects from the top of the excavation. Movement of excavators within the excavated pit shall be coordinated by the Contractor.

The designated locations at walers and struts, if any, used by the instrumentation contractor for instrumentation reading and monitoring shall be provided with two (2) rows of horizontal rigid guardrails to prevent persons falling from height. Openings within struts are to be covered. The vertical distance between the two (2) rows of horizontal guardrail shall be not more than 600mm. Toe boards are to be provided accordingly.

An alternative source of power and emergency lighting system shall be provided to allow emergency securing operations and evacuation safely in the event of a primary power failure. An adequate number of lamps shall be located at key points underground.

Where any worker in an excavation is exposed to the hazard of falling or sliding material from any bank or side more than 1.5m high above his footing, adequate piling and bracing shall be provided against the bank or side to eliminate such hazard. The excavation shall be checked by a designated person after every rain, storm or other hazard increasing occurrence and the protection against slides or cave-ins shall be increased if necessary.

Excavated material and other superimposed loads shall be placed at least one (1) meter back from the edge of open excavations and trenches and shall be so shored or retained that no part thereof can fall into the excavation or cause the banks to slip or cause the upheaval of the excavation bed. Banks shall be stripped of loose rock or other materials which may slide, roll, or fall upon persons below.

Please refer Micron's 9 Critical Risks Controls, the associated checklist and Micron's Global EHS - Excavation Standard for further details on the expected controls

ANSI/ASSE A10.12-1998 (R2016), Safety Requirements for Excavation

6.3.9.13 Traffic

The Contractor shall provide and maintain all site access roads at the project site, including site office/laydown area and worksites. The Contractor is to travel only on such designated site roads, which

may change from time to time to suit the needs of the project. The Contractor shall comply with speed limits and traffic safety measures stipulated in the Traffic Management Plan. The Contractor to ensure workforce entering the project site comply with speed limits, seat belt use and other traffic safety measures. Non-conformance to traffic safety requirements must be dealt with accordingly.

The Contractor shall deploy control measures to mitigate speeding. An appropriate speed limit shall be set and enforced on site.

The Contractor shall provide, install, and maintain all necessary traffic and directional signs, barriers, blinkers, rotating beacons, cones, lane markings and inform the neighbors of road works or any road lane closure within the project site that affects traffic flow.

The Contractor shall regularly maintain its site road surfaces to keep them free of snow, potholes, unevenness, etc. Mill and patch method shall be required to repair any uneven surface defects.

All site vehicles, including 4 x 4 pick-up trucks / double cabs shall have “use seatbelt” labels prominently displayed at its front and rear for passengers to comply.

The Contractor shall ensure only designated drivers operate the 4 x 4 pick-up trucks / double cabs within the project site. The said authorized operators shall be issued an identification tag with a current photograph prominently displayed for inspection purposes. A qualified mechanic is expected to inspect these vehicles monthly. The Contractor shall maintain the inspection records for verification purposes. Vehicles shall be equipped with a stocked first aid kit and serviceable fire extinguisher.

All vehicles driven on the project site shall be maintained in roadworthy condition and be registered with the appropriate authority in accordance with local traffic legislation. The vehicle operators shall hold a valid driving license, which authorizes the person to drive the class of vehicle the person is authorized to drive. Such vehicles include but is not limited to cement lorries, pick-up and flat-bed trucks, lorry loader with articulating arms, and rough terrain forklifts.

The Contractor shall appoint an appropriately trained spotter or banksman as traffic controller to control vehicle movement and congested accessway. The traffic controller shall wear a high visibility two-piece luminous yellow uniform clearly labelled “Traffic Controller” on the back of the vest or similar. To increase visibility, the Contractor shall provide the Traffic Controllers blinking LED (Light Emitting Diode) batons.

During the hours of darkness adequate lighting e.g., flood lights, etc. shall be provided at the entrances to the project site to enhance visibility. Care must be taken to ensure these lights are positioned high enough, so they do not dazzle any on-coming traffic or pedestrians or cause a nuisance to others.

Those vehicle operators making deliveries and removing materials from the project site are required to wear appropriate PPE including, but not limited to, safety footwear, safety glasses and safety helmets, always when they are outside the cabs of their vehicles.

All roads within the project site or work areas, which is used by mobile plant and vehicles, shall be constructed of hard standing and suitable material for its intended purpose.

Unauthorized parking shall be not permitted anywhere other than at the designated parking area. Only cars bearing the project related decal shall be allowed to park there. The same applies to the authorized visitors.

Consideration shall always be given to the safety of the road users. Where required barriers and gates should be positioned so that it eliminates the risk of pedestrian being exposed to vehicular traffic at road junctions, bends, etc.

A clear line of sight shall be maintained for all drivers of vehicles using the Contractor's roads, taking into consideration the speed limit of that road and the position of existing street furniture and trees / vegetation, to maximize the warning distance of approach.

Suitable mirrors shall be positioned at junctions and blind corners to enhance vision especially at busy junctions leading to and out of the project site. If deemed necessary, a traffic lane may be coned off to allow for safe deceleration.

Warning signs conforming to local traffic safety legislation shall be conspicuously displayed at appropriate distances before such gates into the project site as to give all drivers a clear understanding of the traffic hazard ahead. If vehicles entering / leaving the project site must cross a public footpath or pavement then a traffic warden must be deployed to control pedestrians as well as road traffic. Suitable warning signs should be deployed to alert pedestrians of traffic movement across the footpath.

Any routes on the site where headroom is restricted shall have appropriate warning signs posted at the approach to such restriction.

The Contractor shall ensure safe access onto and around the site for people and vehicles and plan how vehicles will be kept clear of pedestrians, especially at site entrances where it may be necessary to provide doors or gates to achieve this segregation. Doors that open onto traffic routes may need viewing panels or windows. The plan shall include how vehicles can be kept clear of pedestrians at vehicle loading/unloading areas, parking and maneuvering places and areas where drivers' vision may be obstructed.

Please refer Micron's 9 Critical Risks Controls and the associated checklist for further details on the expected controls.

ANSI/ASSE Z15.1-2017, Safe Practices for Motor Vehicle Operations

6.3.9.14 Demolition & Renovation

Demolition and renovation activities shall be performed in accordance with ANSI Standard A10.6, Safety Requirements for Demolition, local legal requirements, and this standard.

Prior to initiating demolition or renovation activities, the following survey and plan shall be carried out by the Contractor:

- Engineering Survey. An engineering survey by a Registered Professional Engineer (RPE) shall be performed of the structure to determine the structure layout, the condition of the framing, floors, walls, the possibility of unplanned collapse of any portion of the structure (any adjacent structure where employees or property may be exposed shall be similarly checked), and the existence of other potential or real demolition hazards.

Note: The engineering survey is not required for soft demolition or renovation activities if no load-bearing structure will be removed or demolished.

A demolition plan developed by a RPE and shall be submitted to the Project Architect/Micron by the Contractor for review and validation. The Plan shall be based on the engineering, lead and asbestos surveys and shall intend for the safe dismantling and removal of all building components and debris. This plan is required for all demolition and renovation activities and shall include, but is not limited to, the following basic elements: schedule; scope of work being accomplished; description of work methods, equipment, job site and key personnel; site preparation; Waste Management Plan to include Asbestos-

Containing Materials (ACM)/Other Regulated Material (ORM) Abatement Plan; Site Restoration Plan and other requirements specified in a Statement of Work or as directed by the Project Architect/Micron.

The Contractor shall ensure the workforce engaged in demolition/renovation activities are instructed in the plan so that they may conduct their work activities in a safe manner.

Electric, gas, water, steam, sewer, and other service lines affected as a result of project work shall be shut off, capped, or otherwise controlled inside and outside the building line before demolition is started. In each case:

- Affected utility company that is involved shall be notified in advance,
- The Contractor shall provide the Project Architect/Micron and the Contractor's designated personnel with an engineering drawing (e.g., site plans, utility plans) that indicates the location of all service lines and the means for their control.
- If it is necessary to maintain any power, water, or other utilities during renovation, such lines shall be temporarily relocated and protected.
- It shall be the responsibility of the Contractor to identify, and field verify the point or points for disconnection and de-energizing electrical components and electrical service lines. The Contractor must confirm that the disconnection or de-energizing has been performed prior to the start of the demolition process. De-energized electrical service shall be secured via a lock-out method and field verified by the Contractor.

If the project includes the abandonment or demolition of existing gas lines, the Contractor shall ensure that the existing lines are accurately located and the procedures and installations for removal or replacement are accomplished safely in accordance with local legal requirements or ANSI/ASME B31.8S-2020.

If the project includes fire suppression systems, the Contractor shall provide to the Project Architect/Micron confirmation or verification that the Chemical Fire Suppression (CFS) system has been deactivated and that the chemical has been removed from the system prior to the start of the renovation/demolition process. If the CFS system is found to be active after demolition has begun, the Contractor shall immediately cease work and notify the Project Architect/Micron. The Contractor shall take no action to abate or remove the CFS system or components.

The Contractor shall determine if any hazardous building materials, hazardous chemicals, gases, explosives, flammable materials, or dangerous substances have been used in any building construction, pipes, tanks, or other equipment on the property. When such hazards are identified, testing shall be conducted to determine the type and concentration of the hazardous substance and test results shall be provided to the Project Architect/Micron. The Contractor shall make arrangement to control or eliminate such hazards before demolition is started. If Hazardous Materials (HAZMAT) are found on the project site or location after demolition has begun, the Contractor shall immediately cease work and notify the Project Architect/Micron. The Contractor shall take no action to abate or remove the HAZMAT without the Project Architect/Micron approval.

The Contractor shall decide for all ACM and ORMs to be removed from structures in accordance with applicable legal requirements before renovation/demolition begins. ACM/ORM shall be taken to a controlled landfill or other licensed disposal facility. Construction and Debris (C&D) shall be taken to a general waste landfill; and Recyclable materials shall be taken to a recycle yard.

During demolition, the Contractor shall ensure continuing inspections by a Competent Person (CP) to detect hazards resulting from weakened or deteriorated floors, walls, or loosened material. The

Contractor shall not allow the workforce to work where such hazards exist until they are corrected by shoring, bracing, or other means. The frequency of inspections will be identified in the demolition/renovation plan.

ANSI/ASSE A10.18-2007 (R2012), Safety Requirements for Temporary Floors, Holes, Wall Openings, Stairways and Other Unprotected Edges in Construction and Demolition Operations

ANSI/ASSE A10.26-2011 (R2016), Emergency Procedures for Construction and Demolition Sites

ANSI/ASSE A10.32-2012, Fall Protection Systems for Construction and Demolition Operations

ANSI/ASSE A10.37-2016, Debris Net Systems Used During Construction and Demolition Operations

ANSI/ASSE A10.4-2016, Personnel Hoists & Employee Elevators on Construction & Demolition Sites

ANSI/ASSE A10.43-2016, Confined Space Entry for Construction and Demolition Operations

ANSI/ASSE A10.49-2015, Control of Health Hazards in Construction and Demolition Operations

ANSI/ASSE A10.6-2006 (R2016), Safety & Health Program Requirements for Demolition Operations

ANSI/ASSP A10.44-2020, Control of Energy Sources (Lockout/Tagout) for Construction and Demolition Operations

ANSI/ASSP A10.46.2020, Hearing Loss Prevention for Construction and Demolition Workers

ANSI/ASSP A10.7-2018, Safety and Health Requirements for Construction and Demolition Use, Storage, Handling and Site Movement of Commercial Explosives and Blasting Agents

ANSI/NFPA 241-2022, Standard for Safeguarding Construction, Alteration, and Demolition Operations

ANSI/ASME B31.8S-2020, Managing System Integrity of Gas Pipelines

ANSI/NFPA 54-2021, National Fuel Gas Code

ANSI/NFPA 56-2020, Standard for Fire and Explosion Prevention During Cleaning and Purging of Flammable Gas Piping Systems

6.3.9.15 Piling

The Contractor shall ensure piling operations are planned and executed safely at the construction sites. This includes pile extraction where required.

ANSI ASSE A10.19-2017, Safety Requirements for Pile Installation and Extraction Operations

ANSI/ASSP A10.30-2020, Safety Requirements for the Installation of Anchors and Micro-piles

6.3.9.16 Underground Services

The Contractor shall appoint a competent person or service provider to carry out Underground Services Detection to locate the proximity of buried utilities at the project site and within the project vicinity prior to excavation or ground penetration. The Contractor's responsibilities include:

- Applying with various government agencies to get the underground services drawing,
- Perform cable and other underground services detection at the project site and required locations,

- Dig trial holes to verify the locations of the underground services detected during the detection works performed by the competent person,
- Submit the summary of underground services detection works to the Project Architect/Micron for review,
- Purchase of cable route plans for the client work location from relevant authorities,
- Advise on earthworks or required diversions of the services, and
- Submitting the Notification for Commencement of Earthworks

6.3.9.17 Overhead Works

The Contractor shall organize work sequence to avoid, as far as practicable, work being performed directly beneath an existing overhead works through the permit-to-work system. Where this is not practicable, appropriate control measures shall be put in place to ensure the workers directly underneath the existing overhead work are protected from falling objects. Where works are not taking place directly beneath but in the vicinity, the area underneath the overhead works that may expose the workers to falling objects shall be barricaded or otherwise guarded to prevent inadvertent entry.

6.3.9.18 Diaphragm Wall

The Contractor shall take the necessary measures to confirm if there are any services or utilities underground and potential soil movement of any unstable ground before constructing any guide walls for diaphragm wall activities.

The Contractor shall comply with the use of shoring to any excavation that exceeds two (2) meters. This may include the provision of hard barricade around the perimeter of the activity to avoid any fall.

The Contractor shall assess all excavation areas which are near to the vehicle carriageway or pedestrian footpath along the hoarding to minimize bentonite splatter. Checks on bentonite level and excavation depth shall be done regularly. Checks shall also be performed regularly on the bentonite quality including, but not limited to the viscosity, fluid loss and gel strength.

The Contractor shall ensure the lifting supervisors, riggers signalmen and banksmen are present around the activity area before any chiseling, cutting, and grabbing work commence. In any case of substantial ground movement, the Contractor is advised to move everyone and heavy machineries to a safe and stable ground.

The Contractor shall take extra measures during the de-sanding and cage installation activities, besides ensuring that all in-house safety procedures are followed thoroughly. This includes the assembling of tremie pipes where workers are to don at least a safety belt and be tied off to prevent any fall. Contractors shall ensure his lifting supervisors are competent in executing the task which is not limited to checks on the ‘U’ bolts, the capacity of the crane and the crane lifting spreader bars.

Contractor shall maintain a soil storage area at the site to prevent the soil from overflowing and assess the need to prevent slurry from spilling onto the road or excessive spillage of soil during the transferring process.

6.3.9.19 Concrete and Masonry Work

The Contractor shall ensure concrete and masonry works are planned and executed safely at the construction sites.

ANSI ASSE A10.9-2013 (R2018), Safety Requirements for Concrete and Masonry Work

6.3.9.20 Steel Erection

The Contractor shall ensure steel erection works are planned and executed safely at the construction sites.

ANSI/ASSE A10.13-2011 (R2017), Safety Requirements for Steel Erection

6.3.9.21 Pipe Jacking

The Contractor shall ensure that no person enters a pipe of less than 1,200mm in diameter.

All work within a pipe jack shall strictly follow the safe work procedures for work within a confined space and have in place an approved permit-to-work prior to carrying out work.

All persons shall be evacuated out of the pipe when jacking is taking place and shall not re- enter until the ram is no longer in motion.

6.3.9.22 Lighting & Illumination

The Contractor shall provide temporary general illumination with a lighting level of not less than 100 lux for all work areas and comply with relevant legal requirements and standards to ensure adequate illumination is provided for workers to perform their work safely. Lighting level for vehicle and pedestrian access points as well as pedestrian walkways shall be between 30 to 50 lux.

Site layout design plan shall incorporate points of illumination/spotlights deployment to ensure sufficient coverage. The Project Architect/Micron may require the Contractor to install additional lighting.

ANSI/IES LP-7-2020, Lighting Practice: The Lighting Design and Construction Process

Table 1 Areas and Recommended Lux Levels

S/N	Area	Fc	Lux
1	General construction area	5	53.82
2	Concrete placement, excavation and waste areas, access ways, active storage areas, loading platforms, refueling, and field maintenance.	3	32.29
3	Indoors: warehouses, corridors, hallways, and exit ways	5	53.82
4	Tunnels, shafts, and general underground work areas. Exceptions apply; for shaft and tunnel heading, ten foot-candles are the requirement for mucking, drilling, and scaling. Bureau of Mines-approved cap lights are also acceptable	5 / 10	53.82 / 107.64
5	In general shops or construction plants such as screening plants, batch plants, carpenter shops, mechanical and electrical equipment rooms, rigging lofts, active storerooms, mess halls, and indoor toilets and workrooms.	10	107.64
6	First aid stations, infirmaries, and offices	30	322.92

Source: OSHA standard 1926.56(a)

6.3.9.23 Lightning

The Contractor shall install and operate a lightning warning alert system for the entire project site. Hours of operation of the system will be consistent with the working hours for the project. Information from this system is to be communicated to all contractors for their use in managing their works and safety of all their workers in the event of forecasted or actual severe weather.

ANSI/NFPA 780-2020, Standard for the Installation of Lightning Protection Systems

6.3.9.24 Fire Prevention/Protection

The Contractor shall establish initiatives focused on fire prevention/protection through the project duration to ensure that the work at the project site is undertaken to the highest standard of fire safety. As a basic guide the Contractor, where applicable, shall refer to local fire codes for construction sites or the Joint Code of Practice on the Protection from Fire of Construction Sites and Buildings Undergoing Renovation - under the title "Fire Prevention on Construction Sites" published by the Construction Confederation and the Fire Protection Association of U.K. as well as the "Technical Guidelines for Fire Safety in Temporary Buildings in Construction Sites" issued by the Singapore Civil Defense Force.

The Contractor shall ensure that all procedures, precautionary measures, and safety work method stipulated in the fire prevention/protection program are implemented, communicated, and complied with by all workers including sub-contractors and Interfacing Contractors.

The Contractor shall review and ensure the adequacy of the fire prevention/protection program as the Works progress.

The Contractor shall carry out monthly checks on firefighting equipment, test related alarms and detection devices installed on site. Tags/stickers shall be provided to indicate the monthly checks.

The Contractor shall conduct weekly inspections covering escape routes, fire engine access, firefighting facilities, and work areas to ensure that the requirements stipulated in the fire prevention/protection program are complied with.

ANSI/NFPA 241-2022, Standard for Safeguarding Construction, Alteration, and Demolition Operations

ANSI/NFPA 5000-2021, Building Construction and Safety Code

ANSI/NFPA 51B-2019, Standard for Fire Prevention During Welding, Cutting, and Other Hot Work

ANSI/NFPA 56-2020, Standard for Fire and Explosion Prevention During Cleaning and Purging of Flammable Gas Piping Systems

ANSI/NFPA 67-2019, Guideline on Explosion Protection for Gaseous Mixtures in Pipe Systems

ANSI/NFPA 68-2018, Standard on Explosion Protection by Deflagration Venting

ANSI/NFPA 69-2019, Standard on Explosion Prevention Systems

6.3.9.25 Plant, Equipment & Tools

The Contractor shall assess the EHS risks especially in terms of age, noise, emissions, condition, etc. associated with the plant, equipment, or tool and only those with acceptable EHS risks shall be brought to the project site.

The Contractor shall ensure that machinery such as Cranes, Excavators and other mobile rigs shall have guard rail barricades installed on its frame to prevent falling from heights that exceed 2 meters when any person accesses the top of the machine for maintenance and inspection purposes. Access to flatbed trailers shall be safely provided by means of steps/ladder with handrails or equivalent to mitigate the risk of fall from height. Machinery not originally fitted with such guard rails and steps shall be retrofitted at the Contractor's own cost.

The Project Architect/Micron shall stop the plant, equipment or tool from operation or require its removal if the said plant, equipment, or tool is unfit or unsafe for use. In such cases, the Contractor shall not be entitled to any claim for compensation or Extension of Time for Completion.

The Contractor shall implement a preventive maintenance program to ensure that all plant, equipment, and tools are maintained in a safe working order.

The Contractor shall implement a monthly inspection program to inspect all plant, equipment, and tools where the inspection is undertaken by suitably qualified personnel. Contractor shall conduct a thorough inspection, which shall bear a color-coded sticker or tag with the Contractor's name, equipment identification, e.g., serial number, manufacturer's model or serial number, date of recent inspection (or due date of the next inspection) and the signature of the competent person inspecting the equipment. Plant and equipment to be inspected shall include, but not be limited to, electrical tools, generators, and installation assemblies, lifting machines, lifting gears, fire extinguishers, fall protection gear, construction mobile machines, compressors. Appropriate actions are to be taken to address the discrepancies spotted during the inspections. The inspections should be documented.

Contractor is to ensure all equipment without a valid inspection or valid color coding is not used, tagged accordingly, and removed from the project site. Such removal shall be documented in the register of the plant, equipment, and tools. Should the Contractor reinstate the plant, equipment or tools removed from the project site, the Contractors reinstatement process must be re-initiated. The Contractor is expected to establish and implement a color-coding system to indicate the plants, equipment, and tools maintenance validity. Following is sample of the color-coding system that can be adopted by the Contractor.

Table 2 Month and Proposed Color Code

Month	Proposed Color Code
January, May & September	Green
February, June & October	White
March, July & November	Blue
April, August & December	Yellow

Plants, equipment, and tools that have undergone repair or maintenance shall be inspected and checked before being returned to service. Stickers or tags shall be displayed to indicate its approval for usage or otherwise. A "Not for Use" tag is to be used to identify unsafe plants, equipment, or tools. Where

applicable, the Contractor shall implement a lockout and tag-out system in accordance with ANSI Z244.1:2003 (2208), Energy Lockout and Tagout Procedure for unsafe plants or equipment.

Hand-made or modified tools of any kind shall not be used on site unless the risk associated with the tools has been accessed and appropriate controls put it place. In addition, change management shall be applied to the modification or hand-made tool.

Rotating machines and tools, including but not limited to power saws, cutting wheels, grinders, portable pumps, shall have suitable protective guards on rotating parts. Where applicable the operations of the tool shall be through a "Deadman" switch mechanism. Portable power operated hand saws shall be equipped with guards above the base plate which completely protects the operator from contact with the saw blade when in motion and with self-adjusting guards below the base plate which completely covers the saw to the depth of the teeth when the saw is removed from the cut. Where applicable, the Contractor shall ensure work bench is provided to facilitate stable and safe operation.

ANSI/ASSE A10.4-2016, Personnel Hoists & Employee Elevators on Construction & Demolition Sites

ANSI/ASSP A10.31-2019, Safety Requirements, Definitions and Specifications for Digger Derricks

ANSI Z244.1: 2003 (2008) Control of hazardous energy lockout/tagout and alternative methods

6.3.9.26 Mobile Elevated Work Platform

The Contractor shall establish adequate controls to ensure safe operations of Mobile Elevating Work Platform at the project site. Controls that shall be established at the project site by the Contractor includes but not limited to the following:

- Confined overhead working: Brief operators on the dangers, and the safe system of work to be followed. If there are overhead structures against which an operator could be trapped and then pushed onto the MEWP controls, select a MEWP that has been designed to prevent such accidental contact. MEWPs with shrouded or otherwise protected controls are available. Keeping the platform tidy will reduce the risk of the operator tripping or losing balance while in the basket.
- Ground conditions: The platform should be used on firm and level ground. Any temporary covers should be strong enough to withstand the applied pressure. Localized ground features, e.g., trenches, manholes and uncompacted backfill, can all lead to overturning.
- Outriggers: Outriggers must be extended and chocked before raising the platform. Spreader plates may be necessary – check the equipment manual.
- Guardrails: Make sure the work platform is fitted with effective guard rails and toe boards.
- Arresting falls: if there is still a risk of people falling from the platform a harness with a short work restraint lanyard must be secured to a suitable manufacturer provided anchorage point within the basket to stop the wearer from getting into a position where they could fall from the carrier.
- Falling objects: barrier off the area around the platform so that falling tools or objects do not strike people below.
- Weather: high winds can tilt platforms and make them unstable. Set a maximum safe wind speed for operation. Storms and snowfalls can also damage platforms. Inspect the platform before use after severe weather.
- Handling materials: if used to install materials check the weight and dimensions of materials and consider any manual handling and load distribution issues. You may need additional lifting equipment to transport materials to the work position.

- Nearby hazards: do not operate a MEWP close to overhead cables or other dangerous machinery or allow any part of the arm to protrude into a traffic route.

The Contractor shall ensure that the MEWP operators should have attended a recognized operator training course and received a certificate, card, or 'license,' listing the categories of MEWP the bearer is trained to operate. The expiry date of the training license or card should be checked. In addition to formal training for the type of MEWP, operators should have familiarization training on the controls and operation of the specific make and model of MEWP they are using.

The Contractor shall establish a program of daily visual checks, regular inspections and servicing schedules should be established in accordance with the manufacturer's instructions and the risks associated with each MEWP. Operators should be encouraged to report defects or problems. Reported problems should be put right quickly and the MEWP taken out of service if the item is safety critical. The MEWP must be thoroughly examined at least every six months by a competent person or in accordance with an examination scheme drawn up by such a competent person.

ANSI/SAIA A92.20-2020, Design, Calculations, Safety Requirements and Test Methods for Mobile Elevating Work Platforms (MEWPs)

ANSI/SAIA A92.22-2020, Safe Use of Mobile Elevating Work Platforms (MEWPs)

ANSI/SAIA A92.24-2018, Training Requirements for the Use, Operation, Inspection, Testing and Maintenance of Mobile Elevating Work Platforms (MEWPs)

6.3.9.27 Drowning

Where the work performed at the project, site exposes the workers or those involved in the project to the risk of drowning, the Contractor shall provide, at suitable locations, lifebuoys, life jackets and other equipment to facilitate prompt rescue and resuscitation. This is in addition to preventive control measures e.g., barricades and handrails.

6.3.9.28 Ergonomic

Contractor shall identify and take steps to mitigate ergonomic stresses encountered by its employees during scheduled work activity. Identification should include inventory of manual handling tasks and steps for minimizing or eliminating manual handling.

ANSI/ASSP A10.40-2007 (R2018), Reduction of Musculoskeletal Problems in Construction

6.3.9.29 Worker Transport

Vehicles ferrying workers driven on to the project site shall be maintained in roadworthy condition and be registered with the appropriate authority in accordance with the local road traffic legislation. The drivers shall hold a valid driving license authorizing the person to drive the class of vehicle the person is licensed to.

Transportation of personnel on flat-bed trucks, cranes, forklifts, dumpers, and similar vehicles not designed to carry passengers is prohibited.

Personnel transported on site by pick-up trucks, lorries and similar vehicle shall be seated in the cab and secured by the seat belt. Free-standing chairs shall not be used for seating. All passengers must always be seated when the vehicle is in motion and shall not have any part of their body outside the vehicle. The seating as well as safe work capacity of the vehicle shall not be exceeded.

The Contractor shall provide buses as the mode of transport for workers from dormitories or other locations to the project site and return. All workers being transported shall always be seated and have their seatbelts on. The Contractor shall coordinate with their designated transport provider on workforce arrival and departure from the project site. The Contractor shall allocate designated parking and waiting areas for the safe embarkation and disembarkation.

The Contractor will be assigned a limited number of permits allowing personal vehicles, not including motorcycles and bicycles (including motorized bicycles, scooters and similar), to drive to and from the project site. The number and duration of permits (decals) issued will be determined by the Project Architect/Micron and subjected to during the project duration to maintain efficient flow of traffic to and from within the project site.

6.3.9.30 Material Storage

The Contractor shall ensure that:

- Materials in bags, containers, bundles, or stored in tiers shall be stacked, blocked, interlocked, and limited in height so that it is stable and secured against sliding or collapse. Materials shall be stacked as low as practical and in no case higher than 20 ft (6 m) unless otherwise specified.
- Materials that could become damaged or affected by exposure to the elements shall be covered or stored indoors. Materials shall not be stored in areas that would interfere with other normal operations.
- Materials shall not be stored directly under power lines unless safe clearance/distance from all materials to the power line is achieved.
- Material storage shall follow manufacturer's recommendations.
- Materials stored inside buildings under construction shall not be placed within 6 ft (1.8 m) of any hoist way or floor opening, or within 10 ft (3 m) of an exterior wall that does not extend above the materials stored.
- Accessways shall be kept clear.
- Unauthorized persons shall be prohibited from entering storage areas. All persons shall be in a safe position while materials are being loaded or unloaded from trucks, excavator, crane, etc.
- Material shall not be stored on scaffolds, work platforms, or runways more than the safe working load.
- Materials stored in bins or hoppers that could create an engulfment hazard shall be evaluated and controls put in place to mitigate the hazard.
- Noncompatible materials shall be segregated in storage

6.3.9.30.1 Lumber

The Contractor shall ensure that storage of lumber during construction shall be in sections containing a maximum of 1 million board feet with at least a 10 ft (3 m) clearance from buildings. Lumber shall be supported on stable sills and shall be stacked level, stable, and self-supporting. Reusable lumber shall have all nails withdrawn before it is stacked for storage. Lumber piles shall not exceed 20 ft (6 m) in height and lumber to be handled manually shall not be stacked more than 16 ft (4.8 m) high.

6.3.9.30.2 Bagged Materials

The Contractor shall ensure that bagged materials are stacked by stepping back the layers and cross keying the bags at least every 10 bags high. Bags of cement and lime shall not be stacked more than 10 high without setback, except when restrained by walls of appropriate strength. The bags around the outside of the stack shall be placed with the mouths of the bags facing the center of the stack. During unstacking, the top of the stack shall be kept level and the necessary setback maintained.

6.3.9.30.3 Brick

The Contractor shall ensure that bricks are stacked on an even, solid surface. Bricks stacks shall not be more than 7 ft (2.1 m) high. When stacked loose brick reaches a height of 4 ft (1.2 m), it shall be tapered back 2 in (5 cm) in every 1 ft (0.3 m) of height above the 4 ft (1.2 m) level. Unitized brick (brick securely gathered into large standard packages and fastened with straps) shall not be stacked more than three units high.

6.3.9.30.4 Floor, Wall & Partition Block

The Contractor shall ensure that blocks are stacked in tiers on solid, level surfaces. When masonry blocks are stacked higher than 6 ft (1.8 m), the stack shall be tapered back one-half block per tier above the 6 ft level.

6.3.9.30.5 Reinforcing & Structural Steel

The Contractor shall ensure that reinforcing steel are stored in orderly piles away from walkways and roadways. Structural steel shall be securely piled to prevent members sliding off or the pile toppling over.

6.3.9.30.6 Cylindrical Materials

The Contractor shall ensure that structural steel, poles, pipe, bar stock, and other cylindrical materials, unless racked, shall be stacked, and blocked to prevent spreading or tilting. Pipe, unless racked, shall not be stacked higher than 5 ft (1.5 m). Either a pyramid or battened stack shall be used. Where a battened stack is used, the outside pile or pole shall be securely chocked. Battened stacks shall be tapered back at least one pile or pole in each tier.

Unloading of round material shall be done so that no person is required to be on the unloading side of the carrier after the tie wires have been cut or during the unlocking of the stakes.

6.3.9.31 Housekeeping

The Contractor shall implement a housekeeping regime that conforms to 6 S (Seiri, Seiton, Seiso, Seiketsu, Shitsuke, and Safety). “Seiri” means to separate needed and unneeded materials and to remove the latter. “Seiton,” means to arrange and identify needed materials for ease of use. “Seiso” means to conduct a cleanup campaign. “Seiketsu,” means to do “Seiri,” “Seiton,” and “Seiso” at frequent intervals and to standardize your 5S procedures. “Shitsuke,” means to form the habit of always following the first four Ss whereas Safety means eliminate hazards. The housekeeping shall cover vector control, site cleanliness, organization and storage of plant and materials, collection of waste, office decluttering, and recycling efforts.

The Contractor shall conduct weekly project wide housekeeping where the workforce is required to spend at least two (2) hours, preferably on a Saturday morning or the next workday if a public holiday happen to fall on the Saturday, for housekeeping works. Senior management’s active participation shall be visible. The Project Architect/Micron may waive this requirement if the Contractor demonstrates high standards of housekeeping during the week.

This mandated weekly housekeeping schedule shall not exempt the Contractor from performing housekeeping at each workday or shift. Materials shall be stored or stacked in a safe and orderly manner so as not to obstruct any passageway or emergency equipment. Where applicable storage racks must be provided to store materials. Materials should be stored at least 300mm above ground on a stable surface and in a manner where rainwater is allowed to be easily drained out.

6.3.9.32 Personnel Protective Equipment

The Contractor shall provide, maintain, and enforce the usage of personal protective equipment (PPE) for everyone involved in the project. The Contractor and sub-contractors shall provide the required PPE free of charge to their respective workforce and visitors. The following PPE shall be compulsory on site and shall conform to the international product standards e.g., European, American, etc. The Contractor shall submit its proposed PPE to the Project Architect/Micron for approval prior to purchase:

- Safety helmets with chin strap and ratchet suspension system conforming to ANSI/ISEA Z89.1: 2009 and ISO 3873:1997,
- Hand gloves complying with EN 388: 2016, D or ANSI 105:2016, A4 rated cut resistant gloves. Gloves for specific tasks, such as chemical handling, electrical works, hot works shall comply with relevant standards such as EN 374 (chemical handling), EN 60903 (electrical – depending upon voltage) and EN 12477-Type B (hot works),
- The Safety footwear shall be minimum ankle-high boots, crack resistant sole, Zipper or Elastic or Lace upper, slip, oil and chemical resistant, steel toe cap, pierce resistant and Anti-static. Shall conform with ANSI Z41 or ISO 20345:2011,
- Every person required to work in water, wet concrete or other liquid shall be provided with suitable waterproof steel toe cap and pierce resistant boots compliant to ISO 20345:2011,
- High-visibility reflective vest and uniform conforming to BS EN 471, Class 2.
- Industrial lightweight High-visibility long sleeved uniform (Top/Bottom) conforming to any combined or individual standards of (AS/NZS 1906.4, 4602.1, 2919, 4399, 1020), (EN 340, 1149, 13034) and Sun Protection SPF 40 or 50 coated.
- Where necessary, Heat and flame resist long sleeved uniform (Top/Bottom) conforming to any combined or individual standards of (NFPA 2112, 70E Category 2), (EN ISO 11612, 14116), (ASTM F1506, D6413), (AS/NZS 1906.4, 4602.1, 2919, 4399, 1020), (EN 340, 1149, 13034). Flame rating logo must be clearly visible.
- Hearing protection with its container conforming to ISO 4869-1:1990, ISO 4869:1994, BS EN 352-1:2002 and BS EN 352-2:2002 with Noise Reduction Rating (NRR) of minimum 25 Decibels.
- Eye protection glasses/ goggles conforming to ANSI Z87.1.
- Safety harness shall be used for fall protection and comply with ISO 10333-1:2000 (Personal fall-arrest systems) and, ISO 14567:1999 and ISO 156024:2005 (Personal protective equipment for protection against falls from a height – Single point anchor devices and flexible horizontal lifeline systems) or ANSI Z359. Lanyards shall not exceed one meter in total length including unexpended shock absorbing block.
- Personnel working above six (6) meters of fall height shall be issued with a pair of suspension trauma stickers attached onto their harness.
- Respirators with corresponding filters / dust masks of the appropriate standard shall be provided for activities generating dust or fume.
- Every worker required to use or handle alkaline, acid, or other corrosive substances shall be provided with suitable protective clothing and PPE.

- The Contractor shall maintain and update all PPE issuance records. Additional PPE shall be issued to personals based on the type of work risk identified i.e., Face shield, Cartridge respirator, N95 haze mitigation, welding related PPE, working with chemicals PPE etc.
- The month and year of manufacture shall be clearly indicated/stamped on the PPE. The Contractor shall consider from the manufacturer's month and year of any PPE to be replaced every two (2) years or sooner depending on its wear and tear condition. PPE brand selection for the S.O. and the Board shall be presented before procurement.
- The Contractor can standardize helmet and vest colors to differentiate the workforce at the project sites. The vest can be substituted for Hi visibility uniform of the same color:
  a) Blue helmet – EHS personnel,
  b) White helmet – Supervisor/ Foreman/ Engineer/ Management,
  c) Red helmet and high visibility luminous yellow uniform with the word 'Traffic Warden' printed on the back – Traffic Warden,
  d) Red helmet and high visibility luminous yellow uniform with the word 'Banksman' printed on the back – Banksman,
  e) Red helmet and red reflective vest with the word 'Rigger/Signalman' printed on the back – Rigger/Signalman,
  f) Brown helmet and green reflective vest with the word 'Lifting Supervisor' printed on the back – Lifting Supervisor,
  g) Green helmet and green elastic reflective vest with the word 'Welder' printed on the back – Welder, and
  h) Yellow helmet for General Workers.

ANSI/AIHA Z88.10-2010, Respirator Fit Testing Methods

ANSI/ASSE Z88.2-2015, Practices for Respiratory Protection

6.3.10 Monitoring & Measurement

6.3.10.1 Weekly Report

The Contractor shall prepare a weekly EHS report and submit to the Project Architect/Micron. The weekly report shall include the following, but not limited to, information:

- Environmental, Health & Safety Statistics for the week,
- Manpower Reports including man-hours worked,
- EHS Incidents: Nos, Type, All Recordable/ Reportable (both human and non- human related, property and utility damage, dangerous occurrences, and environmental non-conformances),
- Observations, Near-Miss Reports and Lessons Learned,
- Summary of EHS Inspections, and
- Inspection & Visits by Agencies.

6.3.10.2 Monthly Report

The Contractor shall prepare a monthly EHS report and submit to the Project Architect/Micron. The said report for the preceding month shall be submitted within the first 7 (seven) days of the following month.

The monthly report shall include the following, but not limited to, information:

- Health & Safety Statistics (Month and cumulative summaries to be presented in graphical form),

- Manpower Reports including man-hours worked,
- Analysis of incident statistics: Accident Frequency Rates (AFR), Accident Severity Rate (ASR), Days Away from Work, Restricted or Transferred,
- EHS Incidents: Nos, Type, All Recordable/ Reportable (both human and non- human related, property and utility damage, dangerous occurrences),
- Observations, Near-Miss Reports and Lessons Learned,
- Internal & External Audits - Finding Statistics (Observations, CARs, NCRs open, Ageing),
- Emergency drills and outcome of the postmortem,
- Evaluations and audits of subcontractor with actions taken,
- Training (include numbers attended): site safety induction course (SIC), other training and briefing sessions conducted,
- Safety initiatives: Celebrations, Awards, Promotions, Wellness Programs,
- Environmental:
  a) Incidents (Nos, Type),
  b) Environmental non-compliances received with details and actions taken,
  c) Status of the following environmental management programs:
     i. Noise,
     ii. Vector Control,
     iii. Air Pollution,
     iv. Construction Waste Management, and
     v. Water Discharge
  d) Summary of Environmental Inspections,
- Inspection & Visits by Agencies; and
- Public and External Complaints, Feedback, Actions Taken

6.3.10.3 Project EHS Metrics

The project EHS metrics will be used to provide visibility of qualitative and quantitative results for the project and contractor. The metrics measure each project's lagging and leading EHS performance against the established goals. The EHS metrics are reset monthly and/or annually to ensure a more accurate, up-to-date measurement and provide continual improvement opportunities.

The metrics consist of seven different key performance indicators to monitor the project EHS performance. The seven EHS metrics are:

- OSHA Rate
- Notice of violation
- Job Hazard Analysis (JHA)/Risk Assessment (RA) Audit
- Repeat EHS incidents
- EHS Observation Rate
- Incident/near miss investigation tracking
- Site EHS campaigns

The construction project team and/or Construction EHS Personnel shall use the "Project EHS Metrics" to review the performance of the construction project contractor once a month. After verifying the accuracy of the monthly EHS metrics, Construction project team and/or Construction EHS Personnel shall submit the EHS metrics to the Project Architect and Micron. Please refer to Appendix 3 Construction Project EHS Metrics for further details.

6.3.10.4 Area EHS Performance

The Contractor shall divide the worksites into designated work areas, each led by competent supervisors who will be responsible for the area's EHS performance. The EHS performance for each work area shall be assessed monthly and corrective actions shall be taken to improve on EHS performance. The monthly EHS assessment shall include, but not limited to accident statistics, substandard practices and conditions recorded during various EHS inspections for the respective work areas. The team that meets the EHS targets shall be duly recognized and rewarded. The recognitions can be in the form of voucher or non-monetary form and shall be given out at a suitable event attended by the workforce.

6.3.10.5 Rewards & Recognition

The Contractor is encouraged to aim for an exemplary environmental, health and safety performance. The Contractor EHS performance will be assessed by the Project Architect and Micron on a quarterly basis where exemplary performance will be recognized, and areas of concern will be highlighted. The Contractor is expected to undertake a root cause analysis and take necessary measures to satisfactorily address any concerns raised.

The Contractor shall ensure that the entire project team including its sub-contractors proactively takes all the necessary steps in ensuring exemplary EHS performance in the project. The Contractor is expected to gauge the subcontractors EHS performance monthly. The Project Architect/Micron shall be invited to attend the monthly subcontractor performance review session. The Contractor's role and commitment to this shall be driven and led by the senior management associated with the Project.

Please refer to Appendix 6 for EHS Reward & Recognition Strategy.

6.3.10.6 Promotion & Campaign

The Contractor shall develop an annual EHS promotional program to demonstrate the organization's commitment to advancing the EHS culture at the project site. The program shall enhance personal EHS awareness and influence attitudes and behavior of everyone involved in the project. The program shall consist of general promotional activities which are carried out as part of a day-to-day activity and high impact promotion activities which are carried out as a campaign to reinforce a particular concern at the project site. The HSE promotional program shall be revised and updated at least once a year.

The Contractor shall organize a minimum of three (3) campaign covering environmental, health, and safety related topics for each month.

The Contractor shall also continually work to raise safety awareness through recognition and competitions e.g., slogan competitions, poster designs, etc., to be held throughout the course of the project. The Project Architect/Micron shall support and attend the programs organized to witness and demonstrate support for the activities. EHS promotional activities organized must at a minimum meet the following requirements:

- Proposed event to be executed either monthly or half yearly,
- Budget allocated to include awards, prizes, meals, and refreshment,
- Specific theme that is relevant to the next phase of work, work currently being performed or specific to safety areas needing improvement to be established,
- A committee is to be set up to score competition entries and determine the winning entrants,

- The Contractor's shall ensure participation from the workforce for ideas on EHS slogans, poster drawings or ideas to improve EHS performance and to raise awareness,
- Winning entries shall be published and distributed to all work areas, and
- Where applicable winning entries/ideas shall be implemented and recognized accordingly.

The Contractor shall organize regular safety promotional and awareness recognition event annually for the overall project, inclusive of meals, refreshments, prizes, and awards.

6.3.10.7 Inspections

The Contractor shall carry out regular EHS inspections, at least once a day or at least once per shift. In addition, informal spot checks should be carried out more frequently on critical risks activities.

A written record shall be kept of the inspection findings. The results of inspections should be brought to the attention of the Project Manager together with the necessary remedial action and due date for completion. Corrective actions arising from the inspection shall be immediately implemented. The Contractor shall submit inspection report when requested by the Project Architect/Micron.

Inspection of formwork shoring, side supports of excavations and trenches, cranes and scaffolds should be carried out every time after an episode of inclement weather which may affect their stability or integrity.

The Contractor's senior site management (Project Director/Project Manager/Construction Manager) shall participate in the Project Architect/Micron's weekly, monthly, quarterly, and annual ad hoc safety inspections. The Contractor shall close out the findings arising from the inspection findings to the satisfaction of the Project Architect/Micron.

The Project Architect/Micron shall require the Contractor to suspend a part of the works or the whole of the works if it is deemed to be unsafe during the ad hoc inspection. The Contractor is responsible to rectify the substandard condition(s) or practice(s) to the satisfaction of the Project Architect/Micron. In such cases, the Contractor shall not be entitled to any claim for compensation or Extension of Time for Completion as the suspension is a result of poor work planning.

The Contractor is expected to carry inspections on environmental controls implemented at the project site to ensure that the controls implemented remains effective. The inspections shall be carried out daily where the findings and remedial actions with supporting photographs are to be submitted to the Project Architect/Micron once every fortnight.

Contractor shall also ensure that senior Contractor and subcontractor field supervisors or superintendent(s), general foremen, etc. conduct a minimum of one field inspection per week dedicated solely to evaluation of field safety conditions.

6.3.11 Communication

6.3.11.1 Toolbox Talk

The Contractor shall ensure that the Toolbox talks (TBT) are conducted daily in the morning before work commences. The toolbox talk shall be specific to the work performed at the project site and focus on a particular EHS issue that needs the workforce's immediate attention. It should be used to promote safety culture as well as to facilitate EHS discussion at the project site. During the toolbox talk session, the Contractor is expected to verify everyone's PPE for suitability, and where necessary its correct use

explained. If night works or multiple shift works are performed, then toolbox talks shall be conducted before the shift work commences.

Where necessary, pertinent information discussed in the EHS committee shall be cascaded down to the workers by the Contractor through the Toolbox Talks.

The lessons learnt from incidents that occurred at the project site and any other relevant EHS matters shall also be made known by the Contractor to the workers and other relevant persons during the toolbox talks.

The Contractor shall provide interpreters, where necessary, to ensure that the workers and other relevant persons of various nationalities understand the information being disseminated.

6.3.11.2 Notice Boards

The Contractor shall make notice boards available at strategic locations throughout the project site as it is an effective way to communicate all necessary information concerning the site in one place. The notice board shall provide clear, concise, vital EHS information including:

- Hazard identification and control,
- Minimum safety requirements or PPE required,
- Emergency information,
- Traffic management,
- Important contact information, and
- Visitor and employee instruction

6.3.11.3 Suggestions & Feedback

The Contractor shall implement a Suggestion or Feedback program focused at improving EHS at the project site to encourage the workforce to identify and communicate opportunities for improvement to project leadership for implementation. The program shall include the Contractor's team members, sub-consultants, and sub-contractors.

The Contractor shall present a token of appreciation to the individual whose Suggestion or Feedback is successfully implemented on the project, as an encouragement for all workers to contribute positively and work safely.

The Contractor is also expected to establish a mode of anonymous communication for staff and workers to report safety lapses, concerns, unsafe conditions, and acts. This will be advised to the Project Architect/Micron by the Contractor.

6.3.11.4 Hazard Communication

The Contractor shall develop and implement a Hazard Communication Plan to inform the all the stakeholders at the project site about the hazardous substance used, handled, and stored at the workplace. Examples of the substances that falls under Hazard Communication Plan shall include:

- Acids,
- Asbestos,
- Disinfectants,
- Glues,
- Lead, mercury, and other heavy metals,
- Paints,
- Pesticides,

- Petroleum products,
- Solvents, etc.

6.3.12 Subcontractor

6.3.12.1 Evaluation, Selection, and Control

The Contractor shall include legislative and Micron's project specific EHS and sustainability requirements in tender packages issued out to their potential sub-contractor selection process to communicate the project specific EHS expectations before awarding them the specific packages.

The Contractor shall select sub-contractors who have attained EHS management system certification awarded by a recognized certification. Should there be sub-contractors who do not have a certified EHS management system, the Contractor shall ensure that such sub-contractors adopt and operate in accordance with the Contractors EHS management system.

The Project Architect/Micron may participate in sub-contractor's pre-tender meetings, selection process, pre-project review and award meetings.

6.3.13 Audit

Micron acknowledges the fact that the Contractor is obligated to allow third-party auditors to audit the project site to determine the continuing suitability of the Contractor's EHS Management System. In such cases the audits shall be carried out in accordance with local legal requirements where applicable or in accordance to audit schedule established by the Contractor. The outcome of the audit shall be made available to the Project Architect/Micron and where required a presentation shall be made by the Contractor to the Project Architect/Micron.

The audit report and its corrective actions shall be brought to the attention of all sub-contractors and copied to the Project Architect/Micron. The audit shall also cover the project site specific environmental, health and safety management system.

Deficiencies identified during external and internal audits shall be corrected by the Contractor to the satisfaction of the Project Architect/Micron.

In addition, the Contractor shall facilitate an audit paid and hosted by Micron. Micron's representative will the share audit schedule as well as work together with the Project Management Team to organize and coordinate the said audit.

Information obtained, records observed, or documentations sampled during the audit shall be kept confidential by all those parties involved in the audit. All the parties concerned are expected to sign a Non-Disclosure Agreement.

ANSI/ASSE A10.39-1996 (R2017), Construction Safety & Health Audit Program

6.3.14 Emergency Preparedness & Response

The Contractor shall establish an emergency response plan to respond effectively to potential emergency situations that can arise at the project site. The plan shall be submitted to the Project Architect/Micron for approval prior to commencing construction activities at the project site and updated at least on annual basis or whenever a major change that affects the response plan takes place.

The plan which includes, but not limiting to the following shall be communicated to all personnel involved in the project:

- Emergency response procedures, including rescue operations,
- Evacuation procedures,
- Medical emergency response procedures,
- Composition of the Contractor's emergency management team including their roles and responsibilities,
- Coordination with the Project Architect/Micron including Site-wide emergency response plans and the crisis management center to be managed by the Project Architect/Micron,
- Notification of relevant parties such as the Project Architect/Micron, and relevant local authorities, and
- Crisis communications protocols with other contractors, public and the media.

In-house emergency exercises and drills shall be conducted on a quarterly basis. Where required emergency tabletop exercises with local Fire and Rescue Services department and other relevant agencies shall be held bi-annually. On-site drills shall be held at least once in every two months. The types of emergency exercises to be held include the following, where applicable to the scope of the works:

- Fire and Explosion,
- Tower Crane operator rescue from height,
- Work at height rescue,
- Confined space rescue,
- Ground/Tunnel cave in rescue,
- Disease outbreaks i.e., COVID-19, Dengue, Zika, SARS, and
- Flammable chemical spill containment.

The emergency preparedness and response plan shall also include environmental pollution scenarios such as spillages of unauthorized/pollutive materials into sewage, watercourses or land and security/terrorism related scenarios.

In the event of any emergency on the Contractor's site, the Contractor shall immediately inform the relevant authorities and the Project Architect/Micron and keep the Project Architect/Micron informed throughout the emergency response. The Contractor shall follow any instructions of the Project Architect/Micron.

ANSI/ASSE A10.26-2011 (R2016), Emergency Procedures for Construction and Demolition Sites

ANSI/ASSE Z359.4-2013, Safety Requirements for Assisted-Rescue and Self-Rescue Systems, Subsystems and Components

ANSI/ICC 500-2020, BSR/ICC 500-201x, ICC/NSSA Standard for the Design and Construction of Storm Shelters

ANSI/NFPA 704-2022, Standard System for the Identification of the Hazards of Materials for Emergency Response

6.3.14.1 Medical/First Aid Facilities

The Contractor is responsible for the establishing a medical facility at the project site in compliance to local or international standards (Managing health for field operations by OGP/IPIECA Ver. 1/October 2011).

The Emergency Response Plan established by the Contractor shall integrate and cover medical treatment for emergency first aid assessments, treatment, stabilization, local medical evacuation, and other

necessary medical provisions to conserve life to the best of ability until the injured person has reached nearest medical care facility/hospital.

The Contractor shall provide enough qualified first aiders taking into consideration the size of its total workforce including sub-contractors and legal requirements. Such persons shall be responsible for responding to each incident involving injury or possible injury to any personnel at the project site. Adequate coverage should be provided for normal as well as shift work hours. The Contractor's EHS procedures shall define the role of such persons and responsibilities for contacting emergency services.

Adequate number of approved first aid kits shall be provided and maintained at the project site. The kits shall be fully equipped to treat illness and injuries, which can normally be expected to occur at the project site. In addition, an equipped first aid station shall be established at the project site. The first aid station shall be located at the project site, readily accessible to ambulance service. Medical supplies recommended by the Occupational Health Physician shall be stocked in the first aid station.

The first aid station and the satellite first aid boxes or cupboards shall be placed under the charge of the First Aiders who shall be trained in first aid treatment. All First Aid treatment shall be recorded, and the causal factor of injury shall be assessed by the site EHS Manager to evaluate if more investigation is required.

Where work is carried out during extended hours or on shift, the Contractor shall ensure that there are sufficient trained first aiders on the project site.

The Contractor shall provide and maintain Automated External Defibrillators (AED) at strategic locations. AEDs shall be readily accessible. The Contractor shall ensure that the first aiders are trained in its correct use. Qualified first aiders shall be issued with a high-visibility vest with their appointment printed on the back of the vest.

ANSI/ISEA Z358.1 / ANSI/ISEA Z308.1 - Workplace First Aid Kits and Eyewash Package

BS 8599-1:2019, Workplace First Aid Kits Specification for The Contents of Workplace First Aid Kits

Managing health for field operations by OGP/IPIECA Ver. 1/October 2011

6.3.14.2 Compressed Air Works

In carrying out any works requiring use of compressed air, the Contractor shall ensure compliances to local legal requirements, Guidelines for Compressed Air Works, and other standards. The Contractor shall also comply with BS 6164, Construction Industry Research, and Information Association (CIRIA) Guidelines. The Contractor shall provide medical locks, compressed air facilities and other equipment at the surface, along with suitably qualified compressed air works gauge attendant(s) and medical-lock attendants.

The Contractor shall engage a competent medical officer, who is to be made responsible for medical aspects of the compressed air works including medical screening, keeping of records, compressed air medical treatment and any other medical related service. The medical officer shall be on standby when compressed air work is in progress.

It shall be the Contractor's responsibility to ensure that all personnel operating plant and equipment for compressed air works are suitably qualified and medically fit to work in compressed air environment.

The Contractor shall submit to the details of their compressed air works including plant system, method statement, decompression tables, medical and health records of workers working in compressed air,

compression/decompression records and any other related records or items as stipulated by the local legal requirements.

BS 6164:2019, Health and Safety in Tunneling in the Construction Industry. Code of Practice

6.3.14.3 Pandemic

As a response to pandemic, the Contractor shall adopt and ensure compliance to Safe Management/Distancing Measures (SMM) outlined in the local legislative requirements. As a minimum, the SMM shall include:

- Business Continuity Plans (BCPs) - BCPs should be implemented where feasible, to minimize disruptions to construction operations during the outbreak,
- Reduce Physical Interaction - Telecommuting and video conferencing shall be encouraged for non-essential and vulnerable employees (e.g., the elderly, pregnant, and those with underlying medical conditions) to enable them to work from home. Contractor shall review work processes and the IT (Information Technology) equipment and facilities required,
- Social Distancing – Introduce measures that enforces physical distancing at the worksite e.g., workstation separation, staggered sitting arrangement, limit meeting room capacity, etc.,
- Staggered Work Hours - Implemented to reduce the possible congregation of employees at common spaces,
- Shift Arrangements - Separate employees on different shifts, by implementing human traffic management measures and stepping up the cleaning of shared areas during shift changeovers,
- Scale Down – Workplace activities not critical to construction operations shall be deferred,
- Health Screening – Temperature and health screening shall be mandated,
- Travel – Where possible, travel shall be restricted to essential travel only where travel declaration shall be made mandatory,
- Contact Tracing – Ensure contact tracing applications or wearable devices are used,
- Personal Protective Equipment – Enforce the use of facemask,
- Workplace Cleaning - Increase the frequency of cleaning of areas with high human contact, such as common spaces, toilets, lift, and handrails. Provide sanitizers at high contact areas,
- Training and Communication – Contractor shall clearly communicate and explain the Safe Management Measures to employees. The training shall include good personal hygiene practices e.g., wash hands regularly with soap, cover mouth with a tissue if coughing or sneezing, and avoid touching their faces, and
- Emergency Response – Establish response plans to manage suspected and confirmed cases, including arrangement for decontamination.

6.3.15 Wellbeing

The Contractor shall ensure requirements pertaining to workers welfare outlined in the latest Responsible Business Alliance (RBA) Operations Manual are met.

The Contractor shall provide suitable and sufficient temporary facilities on the project site, which is readily accessible considering the number and distribution of workers throughout the project site. These facilities shall include:

- Toilets and hand wash basins complete with hand soap, hand dryers, and hand sanitizers,

- Adequate supply of clean drinking water, and
- Sheltered rest areas, inclusive of seating, segregated from the worksite so that workers may safely remove helmets and other PPE. Such rest areas shall have sufficient waste bins.

These facilities shall be kept in a clean and serviceable condition and be available for use during working hours. Air-condition or mechanical ventilation shall be provided where required.

In addition to constructed toilets, portable toilets shall be provided where sewer connection mains are not available. Constructed or portable toilets shall be regularly maintained.

Except for supervisory staff, the Contractor shall prohibit handphone use in all work areas except in any designated areas set up by the Contractor, which is sufficiently segregated from work areas where the location of the designated area is approved by the Project Architect/Micron.

The Contractor shall prohibit smoking at the project site except at designated areas set up by the Contractor sufficiently segregated from work areas where the location of the designated area is approved by the Project Architect/Micron. Such areas shall be sheltered and have sufficient fire prevention and fighting facilities

6.3.15.1 Occupational Noise

The Contractor shall ensure that excessive noise is always avoided to protect site personnel. The Contractor shall comply with the applicable local legislation or international standards, whichever requirement that is more stringent.

The Contractor shall establish and implement control measures to prevent hearing loss. As a minimum, the contractor shall not exceed Recommended Exposure Limits set by NIOSH. NIOSH REL for noise is 85 decibels, using the A-weighting frequency response (often written as dBA) over an 8-hour average, usually referred to as Time-Weighted Average (TWA). Exposures at or above this level is considered hazardous.

Table 3 Exposure Time and NIOSH Recommended Exposure Limits (dBA)

Exposure Time	NIOSH Recommended Exposure Limits (dBA)
8 hours	85
4 hours	88
2 hours	91
1 hour	94
30 minutes	97
15 minutes	100

ANSI/ASSP A10.46.2020, Hearing Loss Prevention for Construction and Demolition Workers

6.3.15.2 Air Quality

Air quality at the project site can deteriorate due to open burning, haze as well as uncontrolled dust generations. Therefore, the Contractor is expected establish and implement control measures to mitigate

the hazards. The Contractor is also expected to set-up a monitoring program to monitor the air quality at the project site.

6.3.15.3 Drinking Water

The Contractor shall ensure the drinking water supplied to the workforce at the project site are safe to drink. Where applicable the Contractor must plan for the water to be tested for those contaminants assessed to be at risk for the local region and operations. Drinking water testing is not required if local water utility company can attest water meets World Health Organization (WHO) Guidelines for Drinking-water Quality or equivalent standard.

The Contractor is expected to provide adequate water points throughout the project site. A suitable water container shall be provided by the Contractor for the workers to carry drinkable water with them at the project site. The use of used plastic containers e.g., cordial drink containers, mineral water bottles, etc., shall be prohibited at the project site.

6.3.15.4 Canteen

The Contractor shall ensure that all required health & safety licenses, permits, registrations and certificates related to food and sanitation are in place and an adequate and effective process is established to ensure permits and licenses are always up to date.

The Contractor shall ensure safe food handling procedures and hygiene standards (in refrigeration, storage, and preparation areas) are in place and followed. This includes adequate and effective cleaning and sanitation program, adequate and effective pest control program, adequate and effective preventive maintenance program (including emergency response supporting facilities) is in place. The Contractor shall ensure the following records are maintained at site:

- Regular monitoring and reporting of safe food handling procedures/hygiene,
- Sanitation program tracking records are available for review and up to date,
- Pest control log is available for review and up to date, and
- Preventive maintenance program logs available for review and up to date.

The Contractor shall ensure that the food service workers wear masks, hairnets, and gloves as necessary to prevent food contamination.

As far as food storage is concerned, the Contractor shall ensure food storage and preparation areas are clean where the food is stored properly (not on the floor; refrigerated if necessary), raw and cooked food are stored separately, kept covered, and it is used or disposed of before the marked expiration date.

6.3.15.5 Prayer Room

In countries and/or workplaces where a significant percentage of the workers require prayer spaces to perform religious observances, the Contractor shall provide a clean and safe prayer room at the project site to allow the workers to comply with their religious beliefs while at work or in the job application process.

6.3.15.6 Accommodation

The Contractor shall ensure the required health & safety licenses, permits, registrations and certificates related to housing are in place and an adequate and effective process is established to ensure permits and licenses are always up to date.

The Contractor shall provide the workers with sized living accommodations complete with the required amenities e.g., shower, toilets, air-conditioning, ventilation, wash basins, prayer room, recreational facilities, etc.

Worker accommodation provided by the Contractor are to be maintained clean and safe, and provided with appropriate emergency egress, water for bathing and showering, and adequate lighting, heat, and ventilation. This includes individually secured accommodations for storing personal and valuable items, and reasonable personal space along with reasonable entry and exit privileges.

The Contractor shall ensure hygiene standards are in place and followed. This includes adequate and effective cleaning and sanitation program, adequate and effective pest control program, adequate and effective preventive maintenance program (including emergency response supporting facilities) is in place. The Contractor shall ensure the following records are maintained at site:

- Regular monitoring and reporting of hygiene condition,
- Sanitation program tracking records are available for review and up to date,
- Pest control log is available for review and up to date, and
- Preventive maintenance program logs available for review and up to date.

6.3.15.7 Restroom/Toilet

Workers at the project site are to be provided with ready access to clean toilet facilities by the Contractors. Toilet facilities shall be connected to a sewer/temporary septic tank with the approval of the Sewerage Department.

The Contractor shall ensure hygiene standards are in place and followed. This includes adequate and effective cleaning and sanitation program, adequate and effective pest control program, adequate and effective preventive maintenance program is in place. The Contractor shall ensure the following records are maintained at site:

- Regular monitoring and reporting of hygiene condition,
- Sanitation program tracking records are available for review and up to date,
- Pest control log is available for review and up to date, and
- Preventive maintenance program logs available for review and up to date.

ANSI/ASSE A10.25-2017, Sanitation in Construction

6.3.15.8 Temperature & Acclimatization

Due to changes in the weather pattern, workers can be exposed to extreme weather conditions. Therefore, the Contractor shall make necessary arrangement to ensure the workforce are not exposed to extreme temperature or weather while performing work at the project site. Acclimatization, suspending work during extreme temperature or setting up work at cooler time-period are some of the control measures that the Contractor shall consider.

6.3.15.9 Working Hours

The Contractor is to ensure working hours are not to exceed the maximum set by local law. Further, a workweek should not be more than 60 hours per week, including overtime, except in emergency or unusual situations. All overtime must be voluntary. Workers shall be allowed at least one day off every seven days.

6.3.15.10 Young Workers

The Contractor shall not engage any workers younger than 18 years. The Contractor shall implement appropriate mechanism to verify the age of workers.

The Contractor shall ensure workers under the age of 18 (Young Workers) shall not perform work that is likely to jeopardize their health or safety of young workers, including night shifts and overtime. The Contractor shall ensure proper management of student workers through proper maintenance of student records, rigorous due diligence of educational partners, and protection of students' rights in accordance with applicable law and regulations. The Contractor shall provide appropriate support and training to all student workers. In the absence of local law, the wage rate for student workers, interns and apprentices shall be at least the same wage rate as other entry-level workers performing equal or similar tasks. If child labor is identified, assistance/remediation is provided by the Contractor.

6.3.16 Alcohol and Drug Use

Micron is committed to fulfilling its legal and ethical responsibility to maintain a safe and efficient working environment. Persons who work while under the influence of drugs or alcohol present a safety hazard to themselves and other employees. Drugs and Alcohol are not allowed at any time at Micron project site.

The use, sale, possession, or distribution of any illegal substance is prohibited on Micron property and project site. Any substance prescribed by a licensed medical provider that may be mistaken for, or cause, similar effects of illegal substances shall be brought to the attention of the Micron Construction team immediately.

Contractors are expected to ensure that their Contract Workers are free and remain free of any Alcohol or Drugs (including all medications which may cause impairment). Contractor shall demonstrate their intentions and actions (through testing and/other means) toward maintaining a drug-free workplace. The contractor should also ensure one hour of employee education on substance abuse is provided for all the workers, including supervisors, before they initially work on construction site.

US ONLY – For Cause Testing, including reasonable suspicion and post incident/event is required on all US construction projects.

6.3.17 Environmental Management

The Contractor shall be responsible to identify, manage and mitigate all impacts on the environment which results from the construction activities at the project site. Such impacts include any form of pollution affecting those outside the site boundary. The Contractor shall also be responsible for ensuring the health of the public who may be affected by the construction activities at the project site.

The Contractor shall comply with all relevant environmental Acts, Regulations and Codes of Practice of the country where the project is taking place, including any amendments or re-enactment thereto.

The Contractor shall appoint an environmental competent person to manage environmental concerns at the project site. A team of competent workers shall be assigned to the said competent person. The environmental team shall comprise of sufficient workers for the duration of the Project, solely for the purpose of environmental control and maintenance only. This team of workers shall not be employed to work as part of the construction team.

The Contractor shall submit operating and pollution data for his proposed plant and equipment when required by the Project Architect/Micron.

The Contractor shall include Environmental Management and Monitoring Plan (EMMP) as part of the Project EHS Management Plan. This shall include site-specific environmental management and monitoring plans for:

- Air Pollution Control,
- Vector Control,
- Waste Management,
- Noise Management,
- Water Pollution Management, and
- Environmental Risk Register complete with environmental risks and mitigation measures.

The EMMP shall take into consideration the relevant act, regulations, and Codes of Practice applicable to the project site. The EMMP, which forms part of the Project EHS Management Plan shall be submitted to the Project Architect/Micron for approval within 60 days of project commencement. The Contractor shall continuously review and revise the EMMP as required.

The Contractor shall put in place additional measures and resources as required by the Project Architect/Micron if the current measures or resources are deemed insufficient. The Contractor shall deem to have considered means and included all costs to ensure that their operations are conducted in compliance to local environmental regulations and in an environmentally responsible manner.

The Contractor shall also maintain and make available resource usage data of the project. The Contractor shall be responsible for the accuracy of the data and auditable records shall be kept for verification or as requested by the Project Architect/Micron. The Contractor shall submit the data as part of the monthly EHS Report.

6.3.17.1 Competent Person

The Contractor shall engage a full-time competent person to manage environmental concerns at the project site. The competent person shall discharge his duties set out below and advise the Contractor in the following:

- Control of disease-bearing vectors and rodents,
- Proper management and disposal of solid waste and liquid waste,
- Control of noise and dust pollution,
- Drainage Control,
- General Housekeeping, and
- Earth control measures and silt control.

The competent person shall pay attention to earth control measures and silt control at the project site and perform site checks. The competent person shall also highlight problems relating to environmental control measures to the Contractor so that reviews to the environmental control measures can be done on a timely basis.

6.3.17.2 Air Pollution

The Contractor shall ensure air emissions consisting of volatile organic chemicals, aerosols, corrosives, particulates, ozone depleting substances and combustion byproducts generated from operations at the project site are to be characterized, routinely monitored, controlled, and treated as required prior to discharge. Ozone depleting substances are to be effectively managed in accordance with the Montreal Protocol and applicable regulations.

The Contractor shall conduct routine monitoring to determine the effectiveness of the air emission control systems put in place.

The Contractor shall ensure that emissions from the plant and machinery brought on the project site does not exceed control limits specified in the local environmental act and regulations.

The Contractor shall ensure that any atmospheric pollution in the form of smoke, fumes, vapors, dust, and other pollutants shall be effectively controlled at the project site. Burning of materials at the project site is prohibited. Flammable debris and refuse (wood or others) shall be removed from the project site on a regular basis.

The Contractor shall ensure air pollution control requirements such as the concentration and rates of emission of air pollutants shall be within legal limits. The Project Architect/Micron reserves the right to request for a newer machine or an emission control device be installed if any machine or plant is deemed to be producing excessive greyish/black smoke.

Air quality on site shall be monitored on a frequency deemed appropriate by the Project Architect/Micron. Gases to be monitored include, but not limited to, carbon dioxide, methane (CH4) and other flammable gases, with emergency plans prepared in the event permissible limits are breached.

The Contractor shall ensure dusty operations are shielded and/or arrested with water at point of impact. In addition, all vehicular access shall be paved with suitable materials such as concrete, mill waste or hardcore to prevent dust generation.

6.3.17.3 Water & Land Pollution

The Contractor shall ensure no trade effluents other than that of a nature or type approved by local environmental enforcement agency are discharged into any watercourse or land.

The Contractor shall ensure that all activities involving repair, servicing, engine overhaul works etc. shall be carried out on a concreted area which shall be bunded or scupper drains provided to channel all wastewater into the sewerage system. Oil removers/interceptors shall be provided to treat oil waste from workshop areas.

Diesel drums and chemicals shall be stored under shelter within concrete bund walls or in storage containers with good ventilation. Spill trays shall be provided for all drums, plants, and machinery and potentially pollutive substances used on site. Spill trays shall be regularly maintained to prevent rain from washing out the pollutive substances.

The Contractor shall put in place a response plan to cater for accidental spillages into any watercourse. This plan shall be communicated to all project personnel. In line with the response plan the Contractor shall conduct an emergency spillage exercise at least once per year. Emergency spill kits shall be provided on site in the event of any chemical spillages. Emergency response team shall also be competent in the use of these spill kits. Accidental spillages and trade effluent discharges shall be investigated and reported to the Project Architect/Micron in a timely manner.

6.3.17.3.1 Earth Control Measures

The Contractor shall be responsible for preventing silt from being washed into public drains and the canal by implementing effective Earth Control Measures (ECM) for the project site to meet the local legislative requirements. The Contractor shall ensure that the implemented Earth Control Measures (ECM) ae effective throughout the project duration. The Contractor shall note that the ECM are meant for the containment and treatment of silty rainwater runoff only and not meant for the treatment of process water from project site arising from activities such as slurry from tunneling, pipe-jacking and bore-piling works.

The Contractor shall submit the ECM Plan within 2 weeks of project commencement, considering the various ECM requirements under the distinct phases of the construction activities. The Contractor shall engage a Qualified Professional to design and endorse the ECM plan. The Contractor shall implement ECM according to the QP's ECM plan before earth works start. Throughout the project duration, the Contractor shall engage the QP to review the effectiveness of the ECM regularly, in tandem with the various phases of construction works. The Contractor shall revise the ECM as and when advised by his QP.

The Contractor shall maintain records of the ECM operation and maintenance. The ECM shall not be removed until all works at the projects site are completed and advised accordingly by the QP. Records of approval for removal of ECM by QP shall be provided by the Contractor upon request by the Project Architect/Micron.

The proposed ECM plan shall include the following content:

- Project Brief:
  a) Project description,
  b) Name and address of site occupier,
  c) Site area and Contract period,
  d) Location map and site plan, and
  e) Construction phases and schedules.
- ECM Design Calculations.
- Erosion Control Plan.

ANSI/ASCE/EWRI 66-2017, Management Practices for Control of Erosion and Sediment from Construction Activities

6.3.17.3.2 Road Surface Contamination

A paved truck wash bay for washing vehicles leaving the worksite onto a roadway shall be provided and maintained at each vehicular egress point before commencement of works at the project site. Each truck wash bay design must enable accumulated silt to be removed periodically as well as enable the water to be reused for either washing purposes or controlling dust propagation.

Preventative measures shall be taken to limit the incidence of earth from dropping out from the vehicles designated for moving or transporting it. In the event, the earth is spilled or dropped onto a public road or drain, such earth shall be removed, and the roads or drains washed by the Contractor at his own expense to the satisfaction of the Project Architect/Micron.

Contractor shall assign personnel and establish a system of checks to ensure that all vehicles and trucks leaving the worksite do not have the potential to litter the roads from the residual soil attached to its wheels or when transporting materials.

Where it is foreseeable that water may drain out from a load of soft marine clay or similar transported wet materials that will contaminate the road surface, the Contractor shall ensure that specially designed and constructed watertight trucks are used to transport these materials.

All cement mixer trucks entering the site must have a containment system or a flap installed to prevent spillage of cement.

Please refer Micron's 9 Critical Risks Controls and the associated checklist for further details on the expected control.

6.3.17.4 Pest & Vector Control

The Contractor shall ensure that pest (rodent, stray dogs, etc.) are controlled at the project site. Source reduction shall be used as the main form of pest control. Food consumption and storage must be strictly restricted to designated areas where rubbish bins with lids shall be made available. Food must only be stored in rodent proof storage containers/ cabinets with at least 60cm clearance above the ground.

In-house pest control team led by the ECP (Environmental Competent Person) should also look out for evidence of rodents and their burrows during their rounds.

The Contractor is required to implement comprehensive vector surveillance and control at the project site, including all necessary measures to prevent the site from becoming favorable to the breeding and harboring of vectors. Accordingly, the Contractor shall undertake but not limited to the following:

- Within 3 months of Commencement, the Contractor shall submit a detailed plan for vector control. The proposal shall include the details of the Pest Control Operator (PCO) with their record of accomplishment and the proposed surveillance and control measures for this site. Chemicals to be used for treatment are subject to Project Architect/Micron approval.
- The Contractor shall engage an external licensed PCO to supplement the in-house vector surveillance and control. The PCO shall carry out vector control and surveillance at least once a week. Additional PCO services will be required during epidemic periods.
- During the construction period, the Contractor or the PCO must maintain a site register which gives an up-to-date account of surveillance and control work that has been carried out. This register must be made readily available upon request.
- Source reduction and effective drainage shall be used as the main forms of mosquito control. Environmentally friendly applications such as the use of Bacillus thuringiensis israelensis (Bti) should be used as far as possible to supplement source reduction. The personnel employed by PCO must be trained/certified in pest control measures.
- The Contractor must have an in-house pest control team to search and destroy any potential breeding grounds, especially after every rainfall, using the "zoning method". Personnel involved in vector surveillance and control shall undergo relevant trainings as specified by the local legal requirements.

- The Contractor shall ensure source reduction such as larvicide or BTI are administered to all potential areas of breeding (especially earth retaining structures such as walers and struts).
- The in-house pest control team shall carry out search and destroy activities of any potential breeding grounds, especially after every rainfall, using the “zoning method”. The team shall:
  a) Divide the construction site into appropriate number of zones for vector control particularly for mosquito control,
  b) Carry out vector surveillance and control activities in at least one zone per day, and
  c) Ensure that sub-contractors are carrying out proper housekeeping at their individual work zones to complement the in-house pest control team effort.
- The Contractor shall regularly monitor the adult mosquito population using well-maintained traps e.g., gravitraps. The traps shall be placed in an area with good housekeeping, under shade and on a levelled ground for it to be effective. The records shall be documented and submitted to the relevant agency when requested.
- Thermal fogging shall only be carried out when there is high population of adult mosquitoes and/or when there are dengue/zika outbreaks near the project site. The Contractor shall ensure that the PCO has obtained approval from local regulatory agency before fogging is carried out at the project site.
- All site offices/containers must have a sloping/pitched roof installed with the sides shielded from rain. Containers for office or storage purposes on site shall be sited on concrete paved ground with perimeter drains for effective surface water drainage.
- The Contractor shall ensure that no puddles of water are formed on the ground by using appropriate cover such as concrete paved, milled waste or steel plates.
- The Contractor shall prepare a vector outbreak response plan as a part of the overall vector control plan and shall immediately report all suspected vector outbreaks such as dengue and zika to the Project Architect/Micron.
- In the event where mosquito breeding is discovered on site by the local enforcement agency, the Contractor is to carry out a Vector Control Time-out. The Time-out is to involve a detailed search and destroy effort to eliminate any potential breeding grounds.
- The Contractor shall implement a system of tracking and maintaining an updated list of all personnel entering the site including name, nationality, and contact information. Any person found on site to be a carrier of the dengue hemorrhagic fever virus, malaria or Japanese Encephalitis or any other vector-borne disease shall be immediately removed from site to appropriate medical care to prevent the outbreak of the disease. The Contractor shall develop a response plan specifying the measures to be taken in the event there is any person found on site to be a carrier of or contracted with any vector-borne disease.

6.3.17.5 Waste Management

The Contractor is required to identify all types of waste (e.g., construction waste, chemical waste, wood waste, metal waste, plastic waste, office waste, etc.) and implement a comprehensive waste management program at the project site to ensure minimum wastage, proper disposal and prevent pollution to the environment.

The Contractor shall provide adequate number of bins of capacity not less than one cubic meter at the site for the storage of all inorganic waste such as building debris, dust, dirt, and litter. Separate scrap metal waste bins may also be provided. An adequate number of bins with air-tight covers of not less than 85 liters shall also be provided for the storage of organic waste.

The Contractor shall clear all waste at the project site as often as may be necessary to prevent build-up. The bins shall be removed from site and replaced/emptied once they have been filled.

The Contractor shall carry out effective on-site sorting of construction and demolition materials to recover inert, reusable and/or recyclable portion. The system of on-site sorting and temporary storage of construction and demolition materials shall include the following:

- Metals shall be recovered for collection by recycling contractors,
- Cardboards and paper packaging shall be recovered, properly stockpiled in dry and covered conditions to avoid cross contamination by other construction and demolition materials; and
- Excavated materials shall be sorted to recover inert portions (e.g., soil and crushed rocks) for re-use on site or disposal to designated filling areas.

The Contractor shall ensure that the construction debris are disposed of at the local government designated dumping grounds or at such other sites or locations as directed by the local environmental enforcement agency. Disposal of domestic refuse may be arranged with the local council.

Waste listed as hazardous or toxic in the local legislation shall be disposed of by an operator holding a valid hazardous or toxic industrial waste collector's license.

6.3.17.6 Noise Management

The Contractor shall ensure that excessive noise is always avoided to protect nearby residents as well as site personnel. The Contractor shall comply with the applicable local environmental legislation. The Contractor shall submit a Noise Management Plan (NMP) outlining but not limited to the following:

- Comparison charts between baseline monitoring results and anticipated noise emission levels,
- Machinery and plant to be utilized on site as well as their noise emission levels,
- Sequence of work and construction methods involved, indicating anticipated noise levels accompanying each type of activity,
- Proposed noise mitigation measures along with the estimated noise reduction levels,
- Site utilization plan,
- Scheduling of works demonstrating consideration of noisy activities,
- Contingency measures to avoid excessive noise for works to be carried out after 7pm; and
- Public relations strategies demonstrating close community relationship for any potentially affected members of the public (signboards, newsletters, circulars, complaint handling and investigation, rapport building with residents).

The Contractor shall note that the construction equipment and methods of work that causes excessive noise will not be allowed to be used on site. The Project Architect/Micron has the discretion to require the Contractor to take necessary precautions, whether specified herein or not, to maintain or to repair such construction equipment or to instruct their removal from site when it is determined that the noise level generated from the construction works fails to comply with regulations and standards as stated in this specification.

Sensitive buildings (schools, hospitals, etc.) must be identified, and mitigation measures implemented before work commences. The Contractor shall note that the Project Architect/Micron has the right to give instructions to stop any noisy work activities temporarily e.g., during school examination periods.

It is the Contractor's responsibility to ensure that the machine/ equipment is maintained and operating to the standards indicated in their respective specifications.

The Contractor shall provide all necessary competent and qualified personnel and suitable equipment for all measurements and recordings of noise levels.

Unless otherwise specified, prior to the commencement of any construction activities and major diversion works, the Contractor shall carry out a survey of noise levels for one week, on a 24-hour basis, to establish the levels of the background noise for record purposes. Locations of such noise measurements shall be as directed by the Project Architect/Micron.

Unless otherwise specified, at any time during the Contract period as directed by the Project Architect/Micron and after the project is completed and opened to traffic, the noise survey or part of it shall be repeated to establish any change in the noise levels.

Noise measurements will be required for occupied buildings within 50m from the Contract limits. Noise levels at buildings shall be measured 1m away from the nearest façade of the building to the road and readings shall be taken from at least 3 distinct levels (1st level, intermediate level, and top level) or as directed by the Project Architect/Micron.

Unless otherwise specified, the Contractor shall install real time "live" monitoring device to monitor the noise levels for the entire project duration. In addition, the Contractor shall monitor the noise levels for the whole duration of noisy activities and night works using portable noise meter.

The Contractor shall while preparing the program for the project, consider the non-working restriction and the site layout to minimize noise as far as possible including but not limited to considering using materials and other intermediate stages of construction as noise barriers, etc.

While planning for the project, the Contractor shall review the working hours and consider the effects of construction noise on personnel working in or around the site as well as the neighborhood within proximity of the project site. The Contractor shall consider the nature of the land use in the area, duration of works and the effect of lengthening works period or other nuisances which may affect the neighborhood. The Contractor shall take all practicable steps to reduce noise arising from site activities to the minimum. These steps shall include, but not limited to:

- All machinery and plant must be sound reduced prior to entering the site,
- Noisy plant must be housed in an acoustic shed,
- Noisy activities must be barricaded with portable sound barriers/panels,
- Plant/machinery/equipment must be pasted with a weather-proof sticker clearly indicating its noise emission level (at source) under normal operating condition,
- All machinery in operation must always have their covers properly shut,
- Noise barriers should be erected before any work commences if the site is within proximity to residences and/or sensitive buildings or as directed by the Project Architect/Micron,
- The Contractor shall commit sufficient effort and time into public relation works to establish good rapport with the affected community. Such activities shall be subject to the approval of the Project Architect/Micron,
- If applicable to the location of the site, the Contractor shall note that all construction works, which generate substantial noise, shall not be carried out during the school examination periods.

Compressors, generators, welding sets etc. shall be of sound reduced models fitted with properly lined and sealed acoustic covers which shall be kept closed whenever the machines are in use and all ancillary

pneumatic percussive tools shall be fitted with mufflers or silencers of the type recommended by the manufacturer.

Machines in intermittent use shall be shut down or throttled down to a minimum in the intervening periods between works.

Pile driving shall be carried out with a recognized noise reducing system. Rotary drills and busters actuated by hydraulic or electrical power shall, where practicable, be used for excavating hard material. Noisy construction plant such as cement batching plant, shall be sited as far away as possible from occupied buildings with noise barriers erected, specifying the proposed location for the noise barriers.

Care shall be taken when loading or unloading vehicles, dismantling scaffolding, or moving materials to reduce impact noises. Access to the working areas shall be such as to ensure a minimum disturbance to persons in occupied buildings. The Contractor shall not execute any of the works or carry out maintenance of construction plant in such a manner as to cause nuisance unless the work is necessary for the saving of life or property or for the safety of the works in which case the Contractor shall immediately advise the Project Architect/Micron.

ANSI/ASSP A10.46.2020, Hearing Loss Prevention for Construction and Demolition Workers

7 Appendices

Appendix 1 Project EHS Readiness Checklist - Policy and Procedure

This checklist may be used to track evaluation and implementation of critical contractor EHS procedures prior to project kickoff.

Category	Policy / Procedure	Sub-Heading	Applicable?	Status
Fatality Prevention	Control of Hazardous Energies			
	Cranes/Hoists/Rigging			
	Confined Space Management	Energized Electrical Work		
		Testing and Metering		
	Fall Protection and Prevention	Safe Ladder Use		
		Raised Floor Openings		
		Unprotected Edges and Holes		
		Working from Heights		
	Mobile Elevated Work Platform			
	Safe Scaffold Erection and Use			
	Trenching and Excavation			
General Safety	Barricading and Safety Signage			
	Ergonomics and Soft Tissue Injury Prevention			
	Fire Prevention	Non-Electrical Hot Work		
		Temporary Structures		
		Temporary Heaters		
		Welding/Cutting/Brazing		
	Heat/Cold Stress Management			
	Illumination/Construction Lighting			
	Impalement Prevention			
	Motor Vehicle Operation			
	Personal Protective Equipment	Specialty Eye Protection		
		Specialty Hand Protection		
	Safe Tool Use	Hand Tools		
		Powder-Actuated Tools		
		Power Tools		
	Temporary Electrical Power			

Category	Policy / Procedure	Sub-Heading	Applicable?	Status
Chemical / Environmental	Compressed Gases			
	Decontamination and Disconnect / Demolition of Chemical Systems and Utilities			
	Hazard Communication			
	Safe Liquid Nitrogen Use			
	Silica Exposure Prevention			
	Waste Management	Hazardous Waste		
		Recycling		
		Solid Waste		
Administrative	Overtime and Holiday Policy			
	Meal and Break Facilities			
	Parking, Access, and Logistics			

Appendix 2 Project EHS Readiness Checklist - Program Management

This checklist may be used to track evaluation and implementation of critical contractor EHS procedures prior to project kickoff.

Project Name:		Reviewer:	
Contractor Name:		Mobilization Date:	

Review Module	Evaluation	Applicable? (Y/N)	Discussion, Instructions or Comments	Follow-up actions needed	Accepted? (Y/N)	Target Date (MM/DD/YYYY)
1.0 Project Key Performance Indicators						
1.1	Has project defined EHS performance indicators?					
1.2	Do lagging indicators include first aid cases, recordable and lost day cases?					
1.3	Has project established a set of leading indicators?					
1.4	Has the project established any lagging or leading environmental indicators to monitor environmental performance?					
2.0 EHS Staffing						
2.1	Project EHS staffing strategy developed?					
2.2	Staffing/plan in place?					
2.3	Project EHS/Site EHS teaming strategy developed?					
2.4	Permit Coordinator assigned, if needed?					
3.0 EHS Requirements in Contracts						
3.1	EHS requirements in subcontracts?					
3.2	Project-specific exceptions/additions defined?					
3.3	Clear policies and procedures defined for project and included by reference in contract language?					
3.4	EHS expectations communicated in pre-bid/pre-construction reviews?					
3.5	Plan in place to ensure effective "flow-through" of requirements to lower-tier subcontractors?					
3.6	Contractor EHS Plans reviewed for comprehension/inclusion of Micron performance expectations prior to construction start?					
3.7	Fatality Prevention and/or Zero Tolerance items recognized and communicated?					
4.0 EHS Budget Development and Authorization						
4.1	EHS project needs defined?					
4.2	Budget developed and authorized?					
4.3	Budget spending process and owner defined?					

Review Module	Evaluation	Applicable? (Y/N)	Discussion, Instructions or Comments	Follow-up actions needed	Accepted? (Y/N)	Target Date (MM/DD/YYYY)
5.0 EHS Contractor Qualification/Selection Processes						
5.1	EHS contractor pre-qualification and selection process established?					
5.2	EHS selection criteria and scoring established?					
5.3	Resourcing for subcontractor qualification evaluation process established?					
5.4	Effective strategy for selection and management of multi-tier subcontractors defined?					
6.0 EHS Roles and Responsibilities						
6.1	Clear EHS performance expectations established for defined project roles?					
6.2	Roles communicated?					
6.3	Accountability methods established?					
7.0 Incident Investigation Methods						
7.1	Investigation methods established?					
7.2	Accountable employees trained in investigation expectations/techniques?					
7.3	Internal incident communication systems established to ensure effective shared learning's?					
7.4	Intra-company or cross-site incident communication systems established?					
8.0 EHS Policies and Procedures						
8.1	Are all project policies and procedures applicable for the defined scope of work established?					
8.2	Written?					
8.3	Available in all applicable languages?					
8.4	Readily available?					
9.0 Contractor Company Discipline Systems						
9.1	Is there a contractor (company) discipline system established that can be used to address EHS performance issues?					
9.2	Is contractor EHS discipline managed within the established procurement contractor management processes?					
9.3	Is project management visible in any contractor disciplinary systems and actions?					
10.0 Inspections and Observations						
10.1	Safety Inspection Program in place?					
10.2	Safety Inspection Process training available?					

Review Module	Evaluation	Applicable? (Y/N)	Discussion, Instructions or Comments	Follow-up actions needed	Accepted? (Y/N)	Target Date (MM/DD/YYYY)
10.3	Is Safety Inspection Process focused on "management field presence visibly communicating personal commitment?"					
10.4	Safety Inspection process established?					
10.5	Core Safety Inspection observer personnel identified?					
10.6	Safety Inspection Process observers trained in effective techniques, including field performance coaching?					
10.7	Technical project reviews (compliance) implemented?					
11.0 Core Environmental Management Systems						
11.1	Solid Waste Management					
11.2	Pollution Prevention					
11.3	Hazardous Waste Management					
11.4	Air Pollution Control					
11.5	Hazardous Material Control					
11.6	Waste Water Management					
12.0 Co-Occupancy Management System						
12.1	Process established to proactively address concerns resulting from a co-occupied work environment (i.e. Micron personnel and Construction personnel in co-occupied spaces)?					
12.2	Communication systems established to communicate team's work?					
13.0 New Contractor Orientation						
13.1	New employee/contractor orientation processes established?					
13.2	Instructors and delivery methods planned/established?					
13.3	Training environment conducive to learning?					
13.4	Project management visible in delivery?					
13.5	Plan established to process all employees through project-specific training?					
14.0 Project EHS Planning						
14.1	Does project have a strategy for completing scope specific job hazard analysis (JHA)?					
14.2	Does project have a strategy for daily or scope specific pre-task planning (PTP)?					
14.3	Are JHA's documented and used to support PTP?					
14.4	Does JHA and PTP work in concert with any project permits?					
14.5	Has training been developed for JHA and PTP?					

Review Module	Evaluation	Applicable? (Y/N)	Discussion, Instructions or Comments	Follow-up actions needed	Accepted? (Y/N)	Target Date (MM/DD/YYYY)
14.6	Copies of subcontractor JHA's provided to and reviewed by GC?					
15.0 Progressive Motivation						
15.1	Incentive Programs - if project has an incentive program, is it based on rewarding behaviors rather than rewarding lagging indicators?					
15.2	Recognition - does the project have a process for recognizing and publicizing desiring behaviors and good ideas for safety improvements?					
16.0 Employee Training						
16.1	Strategy established for defining contractor employee training needs?					
16.2	Strategy established for defining project management (non-trade) training needs?					
16.3	Is contractor employee training scope specific?					
16.4	Training QA/QC methods established?					
16.5	How are employees trained on PTP?					
16.6	Mock-ups Model used?					
17.0 EHS Operational Readiness						
17.1	Is Commissioning/EHS Room/Building/System Readiness in scope?					
17.2	Has project management agreed to project EHS readiness methods, such as Equipment Commissioning, room inspection prior to occupancy, etc.?					
17.3	Had EHS Room/Building/System Readiness criteria been established?					
17.4	Has Room/Building/System Readiness criteria been integrated into design?					
17.5	Have Room/Building/System Readiness milestones been integrated into project schedule?					
17.6	Has project documented an EHS resourcing strategy to support readiness methods?					
18.0 Project Communication Systems						
18.1	Critical EHS project communication systems established for the following:					
18.2	Management to Field					
18.3	Field to Management					
18.4	General EHS information to field (newsletters, etc.)					

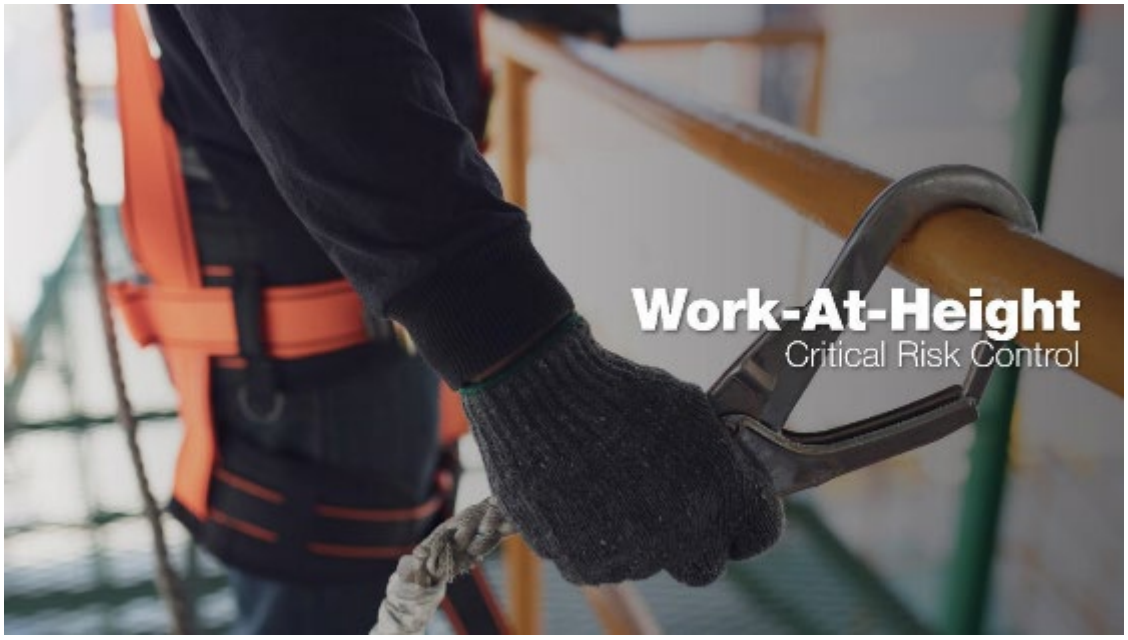
Review Module	Evaluation	Applicable? (Y/N)	Discussion, Instructions or Comments	Follow-up actions needed	Accepted? (Y/N)	Target Date (MM/DD/YYYY)
18.5	Urgent EHS information to field (emergencies, weather, etc.)					
18.6	Foreman to Field					
18.7	Field to Field					
18.8	Worker to Micron					
18.9	Worker to CM/GC					
19.0 Incident Communication / Escalation System						
19.1	Are incident communication / escalation expectations documented?					
19.2	Do communication systems include customer/project/regional and corporate management as appropriate?					
19.3	Does project have a public relations strategy or is it integrated into established site strategy?					
19.4	Are communication/escalation systems periodically tested?					
20.0 Medical/Case Management						
20.1	Project medical services available?					
20.2	Medical case management systems defined?					
20.3	Project medical infrastructure adequate, if applicable (trailer, materials, etc.)?					
20.4	Relationship established with proposed external medical support?					
21.0 Emergency Preparedness						
21.1	Emergency Preparedness strategy developed?					
21.2	Preparedness effort adequately equipped?					
21.3	Emergency preparedness team adequately resourced?					
21.4	Roles and responsibilities established?					
21.5	Training established and functioning?					
21.6	Are drill process and frequency established?					
22.0 Quality of Life Measures						
22.1	Contractor eating facilities / break areas established / managed?					
22.2	Restroom areas convenient and cleaning systems established?					
22.3	Janitorial plan developed?					
22.4	Ready access to clean drinking water?					
22.5	Walking / parking / site access areas established and convenient?					

Review Module	Evaluation	Applicable? (Y/N)	Discussion, Instructions or Comments	Follow-up actions needed	Accepted? (Y/N)	Target Date (MM/DD/YYYY)
23.0 Hazard Communication						
23.1	Hazard Communication systems clearly established and visible?					
23.2	Hazard communication signage in all appropriate languages?					
24.0 Physical Project Security						
24.1	Comprehensive site control plan implemented and complete prior to mobilization?					
24.2	Coordination between Micron Security and Contractor Security?					
24.3	Escalation to local authorities process established?					
25.0 Others						
25.1						
25.2						
25.3						
25.4						
25.5						
End						

Appendix 3 Construction Project EHS Metrics

EHS Metrics	Target	Explanation Notes
OSHA Rate	Project Duration: • < 1.2 (On Target) • 1.2 to 1.8 (At Risk) • > 1.8 (Behind)	The OSHA Recordable Incident Rate is calculated by multiplying the number of recordable incident cases by 200,000, and then dividing that number by the number of man hours for the project.
Life Altering Injuries	Monthly: • = 0 (On Target) • ≥ 1 (Behind)	Life Altering Injuries, might also be described as "catastrophic" injury, are generally defined as injury that are so serious that they result in some form of permanent disability, chronic problems, and/or a reduction in the victim's life expectancy.
Notice of Violation	Monthly: • = 0 (On Target) • = 1 (At Risk) • ≥ 2 (Behind)	Formal written notice of violation from a regulatory agency as a result of an EHS-related incident or regulatory agency direction to stop or interrupt site operations.
Repeat EHS Incidents	Monthly: • Zero Repeat Incident (On Target) • 1 Repeat Incident (At Risk) • ≥ 2 Repeat Incident (Behind)	Examples of an EHS-related incident include but are not limited to work-related injury, release of material to the environment and others. This includes serious near miss which may have had the potential for a severe injury.
Risk Management & Pre-task Planning Non-Compliance	Monthly: • = 0 Non-compliance (On Target) • ≥ 1 Non-compliance (At Risk)	Risk management tools (Risk Assessment, Job Hazard Analysis, Pre-task Planning etc.) which are utilized to determine the hazard identification and assessment of risks and opportunities. Site needs to ensure effective execution of risk management tools onsite.
Safety Observation Rate	Monthly: • ≥ 50% of manpower, capped at 1000 (On Target) • 35% to 50% of manpower (At Risk) • < 35% of manpower (Behind - Monthly)	Safety observation rate is part of the behavior safety program, establish to enable project employees and workers to record safety observations, most importantly, stopping of work that is unsafe during the safety observation.
Incident, nonconformity & corrective action	Project Duration (average): • < 7 Days (On Target) • 7 to 9 Days (At Risk) • > 9 Days (Behind)	Establish and implement processes, including reporting, investigating, and taking action, to manage incidents and nonconformities. The timely action is to enable hazards to be eliminated and associated EHS risks to be minimized asap.
Site EHS Campaigns	Monthly: • ≥ 3 EHS Campaigns (On Target) • 2 EHS Campaign (At Risk) • < 2 EHS Campaign (Behind)	Organize and conduct specific EHS campaigns to promote the safety awareness and proactively identify and manage workplace hazards. This does not include daily/weekly toolbox briefings and EHS related trainings.

Appendix 4 Micron's 9 Critical Risks Control Protocol



#	Critical Risk	Type of Controls	Controls
1	**Work-At-Height**	Elimination	• Eliminate Work-at-Height e.g., place equipment at ground level, adopt pre-cast module, pre-assembled module, etc. • Fall prevention e.g., covers for holes and openings, etc.
		Substitution	• Use MEWP • Reduce fall distance
		Engineering Control	• Design for Safety • Fall Arrest or Fall Restraint system • Purpose designed and certified anchor points. • Edge Protection e.g., guardrails complete with toe-board incorporated during formwork installation. • Tools securing mechanism e.g., tool lanyard, tool bag, toe-board, safety net, etc. • Secondary Guarding for MEWP e.g., "skyguard", "liftguard", etc. • Stable and even ground condition for MEWP operation. • Purpose designed floor openings control. • Enhanced illumination • Safe materials transfer
		Administrative Control	• Fall Prevention Plan. • PTW & Rescue Plan. • Approved Method Statement with RA or JHA before starting work. • Disciplinary action – ZERO Tolerance. • Competent work crew. • Pre-start inspection. • Spotter for MEWP. • Work coordination and sequencing • 100% tie-off • Compliance inspection • Limit duration of WAH
		Personal Protective Equipment	• Full body harness complete with shock-absorbing lanyard • Self-retracting lifeline / inertia reels. • WAH rescue kit

#	Critical Risk	Type of Controls	Controls
2	**Confined Space**	Elimination	• Eliminate work in confined space e.g., work from outside
		Substitution	• Explore alternative work method e.g., use vacuum pump to suck out sludge. • Explore alternative power source e.g., battery operated/ electric driven equipment vs diesel powered. • Prevent atmospheric contamination e.g., substitute weld connection with bolt and nuts.
		Engineering Control	• Design for Safety • Apply LOTO to control hazardous energies • Ventilate workspace. • Test and continuous monitoring of atmospheric gases. • Effective communication system between entrant and attendant. • Leak check all valves, connectors and joints. • Intrinsically safe tools / equipment. • Tripod
		Administrative Control	• Confined space register • PTW & Rescue Plan.. • Tabletop drill exercise. • Ventilation plan • Approved Method Statement with RA or JHA before starting work. • Competent workers (confined space safety assessor, attendant and entrant) • Verification of Competencies • Personnel gas detector assigned to lead worker to monitor possible change in work atmosphere • Pre-start inspection • Work coordination and sequencing • Limit duration of work • Compliance inspection • Gas detector calibration certificate
		Personal Protective Equipment	• Respiratory protective devices e.g., supplied air respirators, SCBA, respirators, etc. • Full body harness. • Chemical resistant protective clothing. • Rescue kit

#	Critical Risk	Type of Controls	Controls
3	**Electrical**	Elimination	• Eliminate 'Live' electrical works e.g., shutdown
		Substitution	• Alternate power source e.g., battery operated vs electrically powered tool
		Engineering Control	• Design for Safety • Apply LOTO to control hazardous energies – electricity • Equipment protected by over-current or overload protective devices • Emergency Stop Device and interlocks functional. • Approved calibrated tool used for testing and commissioning • Certified and approved distribution board and connection for temporary power supply • Rated rubber mats for 'Live' distribution board. • Machinery, equipment and temporary distribution board are grounded. • Approved cables, plugs, sockets and other electrical appliances. • Electrical cables elevated 2m above ground • Equipment & cabling installed based on local code and OEM recommendation • UVIR Scanning
		Administrative Control	• Electrical hazards signage during installation and commissioning. • Electrical room and panel access control. • Installation workers trained and certified by OEM e.g., PIU installation • Effective supervision by competent Licensed electrical person. • PTW & Rescue Plan.. • Tabletop drill exercise. • Approved Method Statement with RA or JHA before starting work. • Competent personnel (workers, supervisor & authorized person) • Verification of Competencies • Pre-start inspection • Work coordination and sequencing • Limit duration of work • Compliance inspection • Test equipment calibration certificate • P&ID / Single-line drawing
		Personal Protective Equipment	• Arc flash PPE based on Incident energy level & task • Rescue kit

#	Critical Risk	Type of Controls	Controls
4	**Environmental Control**	Elimination	• Eliminate the use of resources that can result in adverse environmental impact
		Substitution	• Off-site processes to reduce environmental impact e.g., noise, hazardous waste, resource consumption. • Alternate construction methodology to reduce environmental impact e.g., demolition methodology resulting in lesser dust. • Substitute with less hazardous substances. • Alternate power source e.g., battery powered vs diesel engine. • Storage of soil and hazardous materials at off-site storage locations.
		Engineering Control	• Environmental Impact Assessment & control • Design for Safety • Drainage for stormwater run-off • Silty water containment & treatment • Storage for hazardous substance/wastes • Secondary containment. • Pest control.. • Designated storage for excessive soil with controls e.g., cover, seeding or water spraying. • Noise absorber/barrier
		Administrative Control	• Environmental Control Plan • Haze Management Plan • Pest Control Plan. • Waste Management Plan. • Pre-start inspection • Work coordination and sequencing • Compliance inspection • Pollution monitoring e.g., noise, dust, fume, etc.
		Personal Protective Equipment	• Respirators • Hearing Protection Device

#	Critical Risk	Type of Controls	Controls
5	**Excavation**	Elimination	• Eliminate the need for excavation work.
		Substitution	• Alternate excavation methodology e.g., vacuum excavation etc.
		Engineering Control	• Design for Safety e.g., Earth Retaining Support Structure • Excavation > 1.5m – benching, shoring, bracing, etc. • Excavation > 4.0m – protection designed by qualified engineer • Adequate access and egress • Ventilation. • Dewatering systems. • Hard barricades & guardrails system • Engulfment protection & soil management • Man-cage deployment for rescue • Designated stockpile area • CoHE and LOTO procedures for energized works • Roll Over Protection & Falling Object Protection for Machinery • Underground service detection, identification (trial holes) and protection • Adequate lighting • Protection against impalement hazard
		Administrative Control	• PTW & Rescue Plan. • Marked underground services plan • Tabletop drill exercise. • Approved Method Statement with RA or JHA before starting work. • Competent personnel (workers, supervisor & machine operator) • Verification of Competencies • Pre-start inspection • Work coordination and sequencing • Compliance inspection
		Personal Protective Equipment	• Anti-slip safety rubber boots

#	Critical Risk	Type of Controls	Controls
6	**Hazardous Substances**	Elimination	• Eliminate the use of hazardous substances
		Substitution	• Substitute with less hazardous substances.
		Engineering Control	• Splashguard for machinery and equipment. • CoHE and LOTO procedures for hazardous substances (gas & chemicals). • Designated storage • Double containment • Leak/spill detection system. • Ventilation and fume scrubber system • Fume hoods or air extraction system. • Safety shower and eye wash • Emergency shutdown system • Decontamination of existing lines using flush and purge. • Co-axial pipe with either vacuum or pressure monitoring • Testing & commissioning with inert substances e.g., water, nitrogen, etc.
		Administrative Control	• Permit to work, risk assessment, safe work procedure and method • Safety Data Sheet • Hazardous substances hazards signage. • Equipment and lines decontamination sign-off and safe tagging. • Access control • Emergency Response Plan and Spill Clean-up kit • Tabletop drill exercise. • Approved Method Statement with RA or JHA before starting work. • HazCom competent personnel (workers,& supervisor) • Verification of Competencies • Pre-start inspection • Work coordination and sequencing • Compliance inspection
		Personal Protective Equipment	• Chemical resistant aprons/coverall. • Chemical resistant gloves. • Face shield for chemical. • Safety goggles. • Respirators.

#	Critical Risk	Type of Controls	Controls
7	**Hot Work**	Elimination	• Eliminate hot works
		Substitution	• Alternative method e.g., cold cut, off-site welding, etc. • Alternative welding process e.g., TIG instead of SMAW to reduce spatter and fire risk • Automate welding process • Substitute jointing methods e.g., compression fitting vs welding.
		Engineering Control	• Design for safety • Designated welding stations • Ventilation & fume extraction • Work piece earthing • Provision of fire extinguisher, fire blanket and fire watchman. • Gas cylinder storage cages • Hose crimping • Flash back arrestors • Leak check
		Administrative Control	• Deploy fire-watchman. • Incompatible works prohibited • Permit to work, risk assessment, safe work procedure and method • Work area barricade and hazards signage. • Emergency Response Plan. • Competent personnel (welder, fire-watchman,& supervisor) • Verification of Competencies • Pre-start inspection • Work coordination and sequencing • Compliance inspection
		Personal Protective Equipment	• Welding shield/face shield. • Fire-retardant coverall.

#	Critical Risk	Type of Controls	Controls
8	**Lifting**	Elimination	• Eliminate lifting
		Substitution	• Alternate method e.g., cargo lift, long reach forklift, hoisting cage or container. • Load management e.g., break the bulk
		Engineering Control	• Design for Safety • Crane within acceptable age • Lifting appliances tested by authorized person. • Periodical regulatory inspection • Functional safety components e.g., safety limit switch, load indicator, etc. • Designated lifting points • CoHE and LOTO procedures for energized works
		Administrative Control	• 2-way communication and signaling system. • Lifting plan • Effective supervision by Lifting Director/Lifting Supervisor. • Pre-lift inspection checks on crane and lifting appliances. • Level and stable ground conditions. • Exclusion zones • Permit to work, risk assessment, safe work procedure and method • Work area barricade and hazards signage. • Emergency Response Plan. • Competent personnel (Lifting Supervisor, Crane Operator, Signalman & Rigger) • Verification of Competencies • Pre-start inspection • Work coordination and sequencing • Compliance inspection
		Personal Protective Equipment	• Safety helmet and goggles. • Cut resistant gloves. • Visible vest or overalls.

#	Critical Risk	Type of Controls	Controls
9	**Traffic**	Elimination	• Designated pathway.
		Substitution	• One-way traffic • Manage delivery schedule
		Engineering Control	• Design for Safety • Car park areas away from the work areas. • Reverse parking • Storage and loading areas near to entrance, so that vehicles do not have to cross the site. • Separate entry, walkways and exit gateways for pedestrians and vehicles. • Clear signed and lit crossing point. • Speed limiting bumps. • Vehicles with reverse buzzer and rotating strobe light. • Traffic lights and speed indicator. • Parabolic mirror at blind spots. • Auto/manual barrier at entrance and traffic crossing.
		Administrative Control	• Traffic management plan. • Road safety signage. • Traffic marshal, banksman and controller equipped with traffic baton lights. • Control vehicle entry. • Competent vehicle operators..
		Personal Protective Equipment	• High visible safety vest.

Appendix 5 for EHS Training Requirements

To enhance worker understanding of high-risk safety activities, the Contractor shall provide, operate, and maintain a safety training facility within the project site, which shall include safety hazard simulators as defined below. The Contractor shall include the simulators within the mandatory Site-wide safety induction course defined in this specification so that course attendees experience each of the simulators.

STAFFING

The training facility shall be managed by a competent safety and health officer assisted by safety and health coordinator/supervisor and an administrator. The roles and responsibilities of the staffs shall be as follows:

Safety and health officer:

- Carry out training needs analysis and generate training matrix specific to the project needs,
- Schedule training programs and assign appropriate resources,
- Communicate training plan and schedules regularly,
- Generate weekly and monthly report on training deployment status,
- Manage site identification card issuance and related activities,
- Manage the training facilities to ensure its continued availability to cater for the training needs of the project site,
- Facilitate EHS induction, training on hazard simulators, and other EHS training programs,
- Identify and deploy competent trainers to facilitate training programs listed in the training matrix,
- Develop as well as review the training and instructional materials to ensure the quality is maintained, and
- Ensure the hazard simulators and training equipment are well maintained and are in safe operating condition.

Safety and health coordinator/supervisor:

- Assist the safety and health officer to execute his/her roles and responsibilities,
- Maintain training attendance record,
- Carry out periodic inspection to identify and correct unsafe conditions within the training facility,
- Brief the trainees on safety requirement prior to undergoing training on the hazard simulators, and
- Coordinate repair and maintenance works concerning the training facility.

Administrator:

- Process workers training registration,
- Collect pertinent data for issuance of site identification card/enabling biometrics access,
- Issue identification card / notify trainees upon successful biometrics activation,
- Send out training confirmation, and
- Maintain training related documents and records

ROOMS & EQUIPMENT

The training facility shall consist of following:

S/N	Description	Qty	Remarks
1	Reception & Admin Area	1	The reception and admin area shall be fitted with a reception counter. The area immediately in-front the reception shall be equipped with chairs to cater for the workers who will be waiting for their registration to be processed. Equipment: • A laptop c/w a 20" video display unit • 20 units of chair with foldable tabletop • A 40" video display unit mounted on the wall next to the reception counter displaying pertinent safety message.
2	Audio Visual Room	1	A room big enough to cater for 5 pax located at the reception area. It is to be used to facilitate safety induction for delivery personnel, escorted visitors as well as government officials who need to access the site. Equipment: • Comfortable chairs/sofa set to accommodate 5 pax, • A 40" video display unit mounted on the wall to play safety induction video
3	Training Room	4	The training rooms shall be sized to facilitate 20 workers at one time. One out of the 4 rooms shall be reserved for Virtual Reality (VR) training facilitation. Each training room shall be equipped with adequate emergency exits. Equipment: • 1 unit of laptop connected to the projector for each training room • Overhead projectors mounted on the ceiling, one each for the training rooms including the room designated for VR, • 20 units of chair with foldable tabletop per room • Audio system for each room • VR equipment for VR room • 2 units of Whiteboard and 1unit flipchart for each room • 1 set of table and chair for each room • 1 set of lockable cabinet for each room
4	Hazard Simulator Area	1	It shall be a design-build steel and metal prefabricated structure of fifteen (15) meters wide by forty (40) meters long by seven (7) meters high with sloped roof and roller shutter access door 3.5 meters wide by 4 meters high. At least two aluminum slide windows shall be provided in the front wall of the facility. It shall have a concrete floor with slip resistant finish and foundation designed to accommodate loading of persons and simulators. Equipment: • Safety hazard simulators shall be procured from a commercial vendor specializing in the design, manufacture, installation, and maintenance of such simulators. The Contractor shall provide, operate, and maintain the

S/N	Description	Qty	Remarks
			following eight (9) safety hazard simulators. The simulators shall provide a realistic experience that exposes the user to high-risk safety hazards within a controlled and safe environment. The Contractor shall include all power, controls, lighting, enclosures, installation hardware, equipment, material, and consumables required for the operation of the simulators. The simulators shall be designed by qualified engineers, fully tested, and certified by the vendor to meet the performance requirements in a fully safe and secure manner without injury risk to persons using or operating the simulators: o Fall arrest with safety harness. This shall be an electro-mechanical device that simulates falling, being fall arrested 200mm above ground, and suspended in a safety harness. The device shall accommodate multiple (at least 4pax) persons at the same time. The operation including lift, speed and height shall be controlled by the operator. The simulator shall include fail-safe mechanism to prevent impact of suspended persons with the simulator structure. o Electrical safety. This shall be a station with multiple simulations of various electrical safety scenarios which shall include at a minimum the following: impacts of electrical shocks, earthed vs. unearthed power tools, measurement of voltage, current and power of power tools, proper and improper wiring, lock out-tag out. o Safety guardrail. This shall be an electro-mechanical device that simulates a sudden partial and controlled collapse of a guardrail for working at height. It shall be designed to accommodate a minimum of two persons at a time on an elevated platform with guardrail mechanism. The operation shall be controlled by the operator with sensor to detect presence of users. o Overhead Lifting and Falling objects. This shall be an electro-mechanical device that simulates the hazards from overhead objects including objects falling on persons. The intent of this simulator is to demonstrate an overhead lifting and risks from entering the zone of influence where overhead object may fall onto them. The device shall accommodate a minimum of two persons at the same time. o Crushing. This shall be an electromechanical device that simulates being stuck and crushed between a moving machine and a wall. The device shall accommodate two persons at a time. It shall include a wall with padding, a machine-like device (simulated excavator or forklift) that moves backward on rails up against the users standing against the wall. The operation including shall be controlled by the operator. The simulator shall include fail-safe mechanism to prevent injury to users. o Confined Space. This shall be a device that demonstrates the hazards associated with confined space including suffocation, fire, and explosion due to harmful gases. The device shall demonstrate the measures to detect presence of different types of harmful gases and how they concentrate and diffuse. It shall also include demonstration of use of confined space safety equipment including breathing apparatus o Fire Fighting. This shall be situated outside the training facility and enable workers to practice using fire extinguisher on controlled fires

S/N	Description	Qty	Remarks
			o First Aid training. This shall be a station that shall train persons on basic first aid including use of Automatic External Defibrillator (AED), cardiopulmonary resuscitation (CPR), and other basic first aid treatments. The station shall provide for a minimum of four persons training simultaneously. • In addition to the eight (9) simulators specified above, the Project Architect/Micron may instruct the Contractor to provide, operate and maintain two (2) additional simulators for other safety hazards which shall also be located within the safety training facility. The two (2) additional simulators shall be of comparable performance to the eight (9) specified above. The Contractor shall submit its proposed design for the safety training facility and simulators for Project Architect/Micron approval. The facility shall be completed and ready for operation within two (2) months from the Project Commencement Date.
5	Pantry	1	A pantry big enough to sit 20 pax shall be constructed. Equipment: • 2 x Coffee Dispenser, • 2 x Washbasin, • Tables and chairs • 1 x Kitchen cabinet • 1 x drink vending machine • 1 x food vending machine • 1 x Refrigerator
6	Toilets	1	The Contractor shall install toilet facilities for male and female considering the potential occupancy. Equipment: • Lockers for 20 pax – male toilet • Lockers for 10 pax – female toilet • 2 x hand dryers for each toilet
7	Parking	20	The Contractor shall allocate at least 20 parking slots. Parking shall be by reverse only.
8	Office Space	3	The Contractor shall provide office space for 3 pax. Equipment: • 1 x laptop for each staff, • 1 x 20” video display unit for each staff • 3 x cabinet for document storage
9	Server Room	1	The Contractor shall provide a dedicated room for server placement to facilitate training document and data storage. Equipment: • 1 x Server
10	Storeroom	1	The Contractor shall provide a dedicated storeroom for material storage.

S/N	Description	Qty	Remarks
			Equipment: • Storage rack.
11	Meeting Room	2	The Contractor shall provide a 2 meeting rooms with a capacity for 5 pax each Equipment: • 1 x round table • 5 x chairs

UTILITIES

The Contractor shall design and install power, lightning protection, lighting, air conditioning, ventilation, toilets, drainage, and sanitary.

The facility shall comply with all application laws and regulations for such facilities including fire and life safety systems. Potable water shall be provided to the toilets with separate water cooler potable water with drinking cups available in the facility.

The safety training facility will be used for the duration of the Contract period. The number of training sessions in the facility will vary over the course of the Contract in accordance with the needs for the Site-wide safety induction course.

ILLUSTRATION OF SAMPLE TRAINING SIMULATION MODULES

Figure 1 Work-at-Height

Training scaffolding module with access and working platform for Working at Height and Rescue training and exercise.

Figure 2 Confined Space

Confined Space Awareness Training Module box with ventilation blowers, access, air monitoring devices and rescue equipment.

Figure 3 Floor Opening

Floor Opening mockup with guardrails, opening cover, toe board and warning signages for awareness training

Figure 4 Electrical
Electrical Mockup Panel for "Live" electrical works and portable electrical tool testing training.

Figure 5 Lifting
Lifting and Rigging training mockup

Figure 6 Hazardous Substance
Chemical Handling mockup unit with spill kits for training

Appendix 6 for EHS Reward & Recognition Strategy

General Requirements

This strategy outlines a structured process to deal with outstanding good safety behavior, noteworthy safety achievement and initiatives, and non-conformances relating to, unsafe acts, unsafe conditions, and lack of contractor management commitment in attending to unsafe acts and conditions observation, inspections, and audits.

The reward and recognition strategy, which shall include disciplinary measures, implemented by the Contractor must be just, support reporting and applicable to individuals, supervisors, and the company.

EHS violations should be immediately reported by any Team Member and/or Contractor to his/her immediate supervisor or any staff of the site EHS Department verbally.

The supervisor concerned should investigate to find out facts of the EHS violations and notify his/her Manager and the EHS Manager as soon as reasonably practicable.

EHS Reward & Recognition Model

To enable continual improvement, the Contractor shall maintain an environment of integrity and transparency where it is safe to report and learn from mistakes and system flaws. In addition, behaviors and decisions need to be understood and acted upon, recognizing:

- Positive actions and behaviors should be encouraged and rewarded,
- People do make mistakes,
- Patterns of behavior can be observed, and actions applied to address unsafe behaviors prior to an incident occurring,
- Behaviors that exhibit willful disobedience must be identified and treated, and
- Both negative and positive actions can be influenced by the working environment and supervision.

In all the above instances, a consistency in applying EHS Reward & Recognition Model is required. The Model shall be used by the Contractor to provide guidance on interpreting actions and initiating the appropriate response following an event/s where an individual, be it a worker, a supervisor, or contractor, meets or exceeds EHS expectations or falls below EHS expectations. It shall promote the following beliefs:

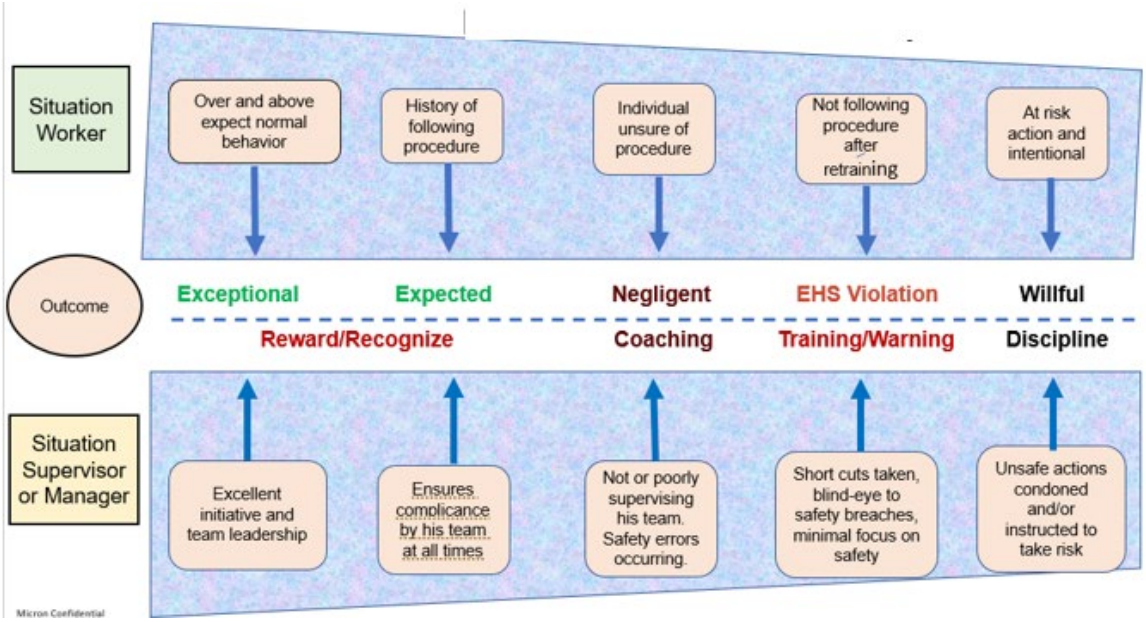
- Appreciation and recognition for outstanding behavior in site EHS.
- Appropriate action and discipline for unintentional violation is counterproductive,
- Open communication and reporting of mistakes and errors is encouraged,
- 'No Blame' is rejected in favor of 'fairness' (with appropriate consequences),
- Willful and negligent behavior will not be tolerated, and
- Management and employees share accountability and responsibility for behavioral choices.

The model is appended in this strategy and shall be used by the Contractor in interpreting actions associated with positive observations/actions, non-conformance, and Micron’s 9 Critical Risk Control requirement breaches for both the workforce as well as the contractor company. It can also be utilized to respond to other occasions, or as part of the incident investigation process.

Micron project management team and the Contractor shall use the Project EHS Committee to decide upon reward, recognition, and disciplinary action concerning the project. The Committee shall be chaired by the Contractor Project Manager or designate.

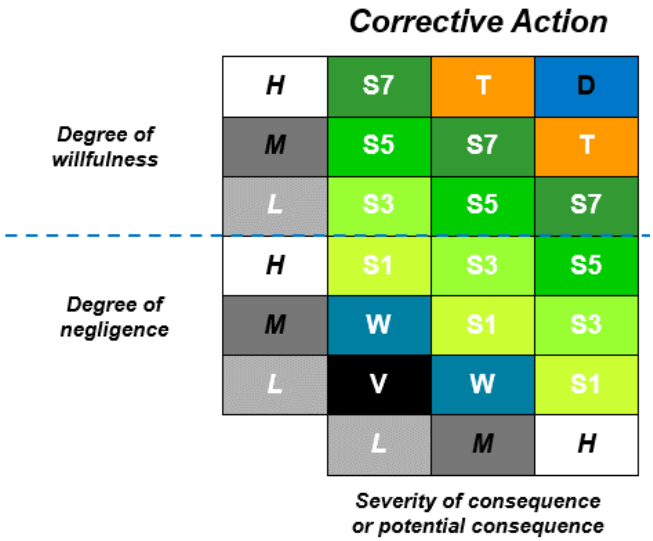
Communication and training associated with the Reward & Recognition Strategy and the Model shall be included as part of the Contractor Reward, Recognition and Compliance Standard.

Reward & Recognition Model



Decision Matrix

Degree of Willfulness:	
Low (L)	Forgetfulness or absence minded
Low (L)	With no ill intention but took shortcuts and calculated risks to get the job done quickly.
Medium (M)	With calculated intention to challenge the company's policies and guidelines but with no ill intention to cause harm to personnel, the environment, or damage to company property.
High (H)	With willful and calculated disregard to cause harm to personnel, the environment or damage to company property.
Degree of Negligence:	
Low (L)	Forgetfulness or absence minded
Medium (M)	Carelessness
High (H)	Grossly careless and failure to take proper precautions
Severity of Consequences or Potential Consequence:	
Low (L)	No significant EHS consequences caused or potentially cause minor injuries, safety, and environmental incidents
Medium (M)	Moderate EHS consequences, caused or potentially cause more than minor injuries, safety, or environmental incidents
High (H)	Serious EHS consequences, caused or potentially cause serious or fatal injuries, catastrophic safety, or environmental incidents



Recommended Action

Notation	Action
V	Verbal warning by immediate supervisor and/or Manager
W	Written Warning by immediate supervisor and/or Manager
S1	Training with 2nd written warning
S3	Training with 2nd written warning
S5	Training with 2nd written warning
S7	Training with 2nd written warning
T	Termination
D	Dismissal

Note: Contractors shall ensure wage deduction is not made a part of Reward & Recognition Strategy.

Terms and Definitions

Terms	Definitions
EHS Violation	Failure to comply with or observe the established EHS standards, rules, procedures, or work practices.
Negligence	Condoning of EHS violations by managerial and supervisory staff to progress work activities in contradiction to establish EHS standards, rules procedures or work practices.
Willful	Unintentional act due to forgetfulness, absence mindedness, or carelessness.
Termination	Done deliberately; intentional; willful disobedience.
Dismissal	Micron employee: termination of employment contract with pay in lieu of notice
Unintentional violation	GC employee or sub-contractor: permanent expulsion from project's work site

Appendix 7 Electronic Permit-To-Work System (ePTW)

Purpose

Mitigate hazards arising at the project site by coordinating and managing high risk activities through an electronic permit-to-work system.

Scope

The electronic permit-to-work system is to be deployed at Micron's construction project site(s).

Requirements

The General Contractor is required to establish and implement an Electronic Permit-To-Work system (ePTW) at the project site to coordinate and manage high-risk activities. The ePTW system shall cover work activities performed by the General Contractor and the Sub-contractors at the project site. Please refer to Figure 7 for Permit-To-Work Process Flow and Figure 8 for Permit-To-Work System Governing High Risk Activities.

The General Contractors is expected to work with assigned Micron representative(s) to identify pre-requisite that needs to be met by the workforce to gain access both to the site office as well as active work area with the project site.

The ePTW shall be integrated with the site access control system, which utilizes facial recognition system, to prevent unauthorized entry to the project site as well as safety critical high-risk areas within the project site. Please refer to Figure 9 for Containerized Access Control System.

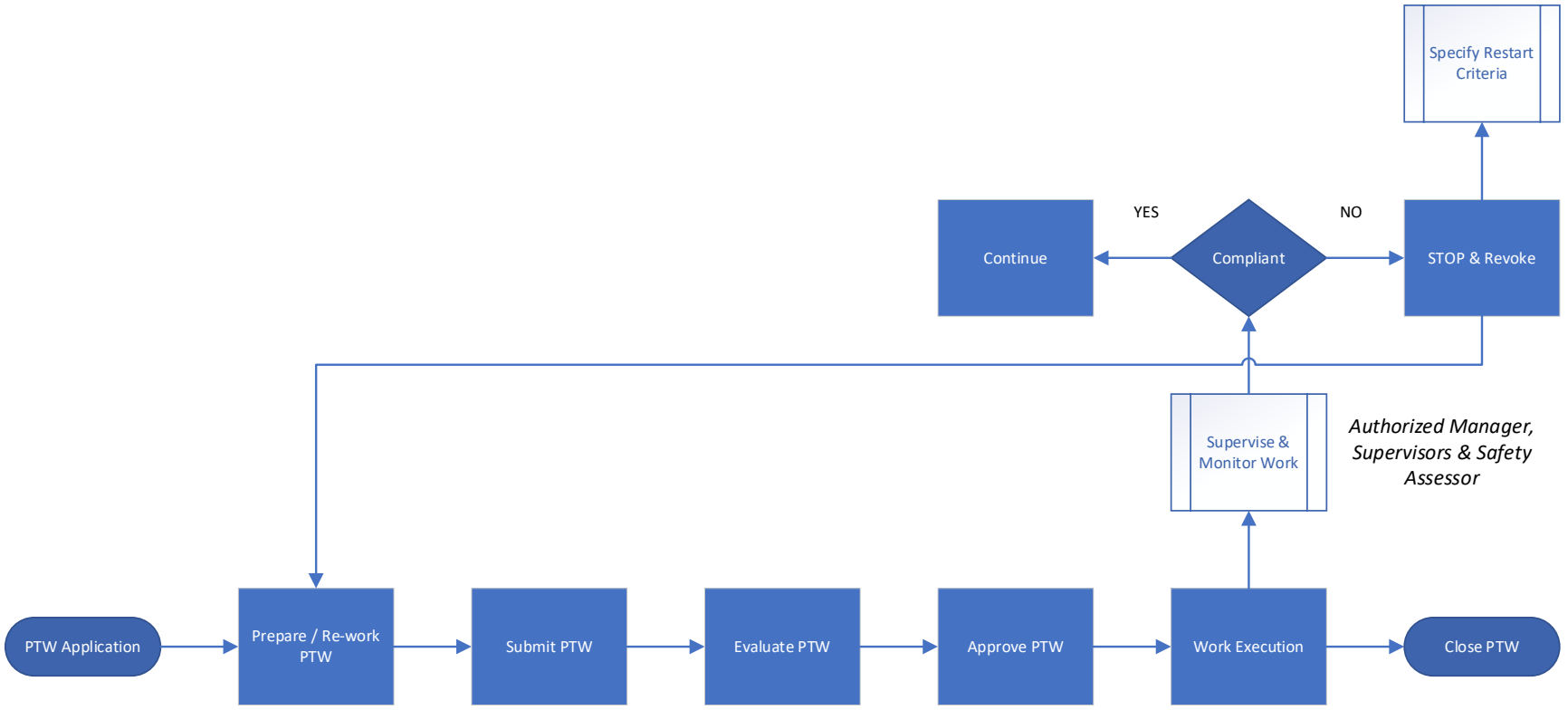
The ePTW shall be accessible via laptops, desktops and mobile devices running Windows, Mac, iOS or Android. The ePTW system shall facilitate the submission, review, approval, and periodic validation of high-risk activities performed at the project site. In addition, the ePTW system shall allow the users to take photographs, reject or revoke the ePTW as well as attach pertinent documents e.g. fall protection plan, risk assessment, work method statement, pre-task plan, etc.

The ePTW shall be capable of detecting and highlighting incompatible work and simultaneous operations (SIMOPS) so that the person-in-charge and the authorized ePTW approver can take necessary action to manage those work activities at the project site.

The system shall incorporate a dashboard that provides visibility to the status of the permits e.g. high risk, medium risk, low risk, approved, pending, rejected, revoked, in-progress, closed, ePTW work category – work-at-height, excavation, lifting, etc. The dashboard view shall be made accessible to the project management team. The users shall also be able to view the high, medium, and low risk work activities superimposed on the project plan with corresponding color codes. The details to be displayed shall include type of work, permit to work number, attachments as well as the permit itself.

The ePTW system implemented at the project site shall be compliant to the local legal requirements as well as Micron's expectations.

The ePTW system shall be made available in multiple languages, including English.



Supervisors to:

- *Consult workers & engineers*
- *Assess work area*
- *Prepare and complete PTW*
- *Attach relevant documents*
- *Coordinate with stakeholders*

Safety Assessor to:

- *Evaluate PTW,*
- *Ensure PTW conditions are met,*
- *Reject incomplete PTW*

Authorized Manager to:

- *Approve/Reject*
- *Revoke/Stop work*
- *Set criteria for restart*

Figure 7 Permit-To-Work Process Flow

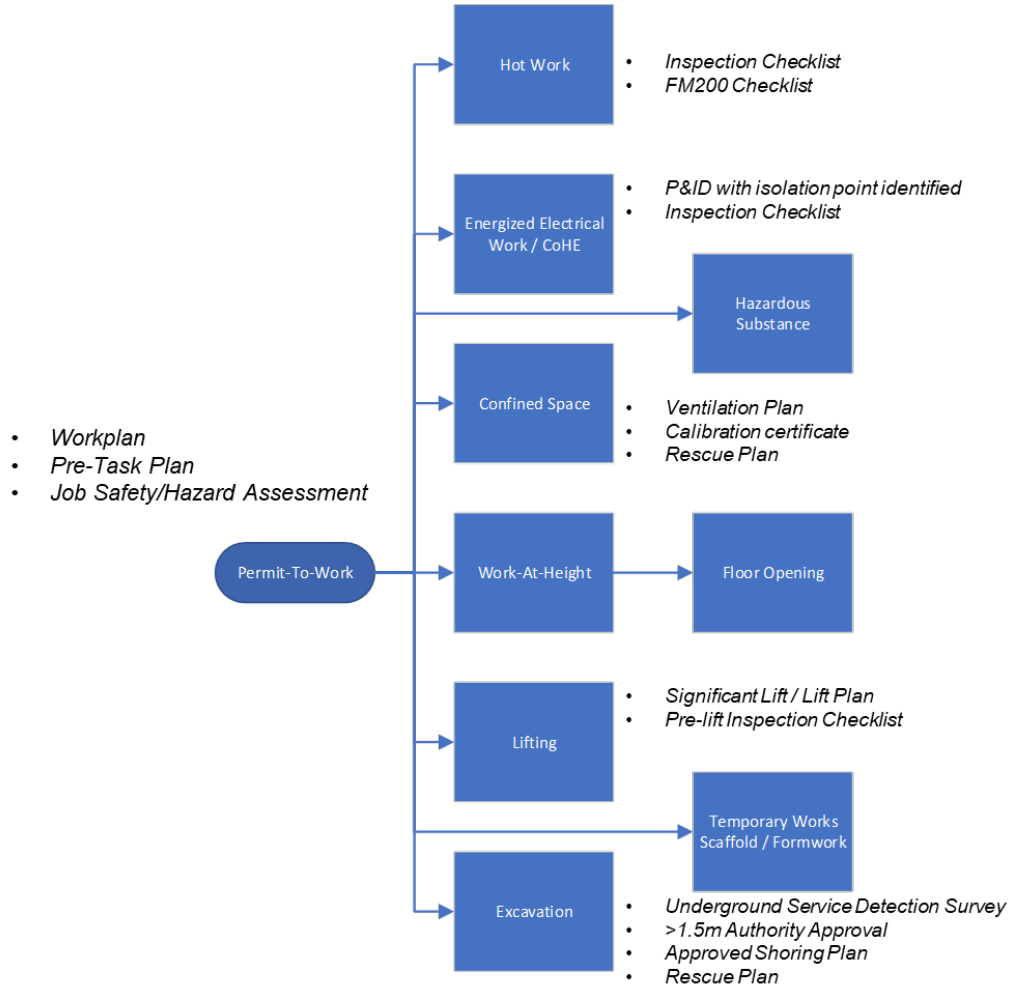


Figure 8 Permit-To-Work System Governing High Risk Activities

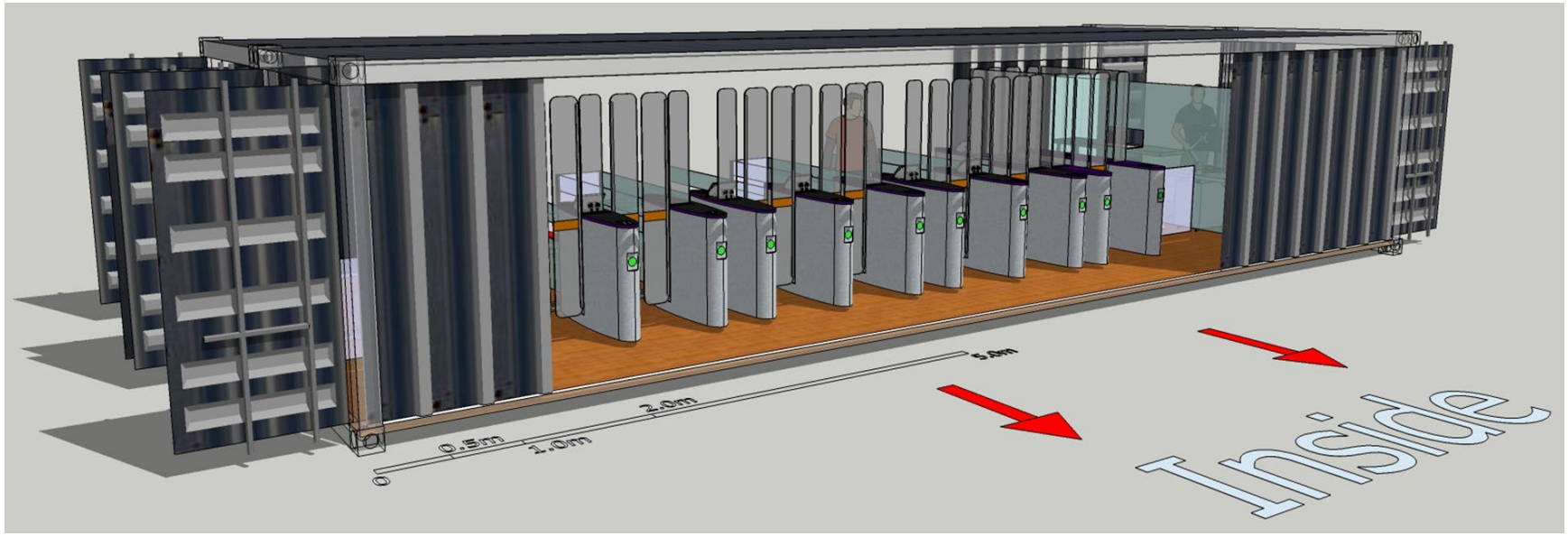


Figure 9 Containized Access Control System

8 Document Control

Items	Details
ECN Facility	CORP EHS
ECN Area	EHS CONST
Approval	This document is approved by: GLOBAL_EHS_SEAL_LT
Notification	Notification of changes to this document is managed through Micron's Engineering Change Notification (ECN) process to the following: **Leadership Team** • FLT • ATLT **EHS** • GLOBAL_EHS • GLOBAL_EHS_MANAGERS • GLOBAL_EHS_SEAL_LT • GLOBAL_EHS_TEAM_MEMBERS **Facilities** • GLOBAL_FAC_MANAGERS • GLOBAL_FAC_NOTIFY • GLOBAL_FAC_ALL_SITES_NOTIFY • GLOBAL_FAC_PM_MANAGERS • GLOBAL_FAC_CONSTRUCTION **GFTT / FCT Chem & Gas** • GFTT_CHEM • FCT_GAS • FCT_CHEM **Procurement** • GP_ALL_LEADERS
Review	This document will be reviewed at least biennially (once per two years) by Global EHS / PSM through the Periodic Document Review (PDR) process.

9 Revision History

Rev	Date	Description	Requestor
0	28 Jun 2019	**ECN Number**: 101026652 First published version	JLAWSON
0	28 Jun 2019	**ECN Number**: Not workflowed **Was**: 6.3.10 Project Personnel Protective Equipment (PPE): Heavy-duty, leather work boots **Is**: 6.3.10 Project Personnel Protective Equipment (PPE): Heavy-duty, work boots or shoes	JLAWSON
1	25 Nov 2019	**ECN Number**: 101042101 Removed Lost Day Case Rate as a pre-qualification item as it is not measured outside US, Added Section 6.2 Project EHS Metrics and Appendix 1 Construction Project EHS Metrics from Global EHS - Contractor EHS Requirements. **Was**: • 6.2 Managing Project Environmental Health and Safety ... • 6.2.1 Contractor EHS Pre-Qualification Requirements Lost Day Case Rate <= 1.0 for the previous 3 years (or equivalent local country severity incident rate) • No existing appendices **Is**: • 6.2 Project EHS Metrics • 6.3 Managing Project Environmental Health and Safety • 6.3.1 Contractor EHS Pre-Qualification Requirements <removed> • Appendix 1 Construction Project EHS Metrics from Global EHS - Contractor EHS Requirements	JLAWSON
2	30 Jun 2021	**ECN Number**: 101096506 Combined Global EHS - Construction EHS Requirements (obsoleted) and Global EHS - Construction Contractor EHS Minimum Performance Requirements (renamed to Global EHS - Construction Minimum Performance Standard). Major revision with substantial amount of changes have been made throughout the document to streamline the requirements to existing programs.	BRAMAN
2	30 Jun 2021	**ECN Number**: Not workflowed Removed "Minimum" from "Minimum Performance Standard" to avoid misinterpretation. **Was**: Global EHS - Construction Minimum Performance Standard **Is**: Global EHS - Construction Performance Standard	BRAMAN
2	15 Sep 2021	**ECN Number**: Not workflowed Updated Appendix 3 Construction Project EHS Metrics	ROBINLOW
3	04 Oct 2022	**ECN Number:** 101127737 Included information and specification of ePTW as part of the tender document for the upcoming construction projects. **Was:** • 6.3.9.1 Permit- to-Work • Appendix 7 - Nil **Is:** • 6.3.9.1 Electronic Permit-to-Work (ePTW) o Replaced information of Permit-to-Work with ePTW • Appendix 7 Electronic Permit-To-Work System (ePTW) - Added	PURENDRANATH
3	26 Oct 2022	**ECN Number:** Not workflowed Added new clause 6.3.16 Alcohol and Drug Use	ROBINLOW

3	26 Oct 2022	**ECN Number:** Not workflowed Added definition on “Greenfield Construction Site”	BRAMAN
3	16 Oct 2024	**ECN Number:** Not workflowed Periodic Document Review (PDR) completed. No changes required.	BRAMAN

End of Document