Statement of Basis

Tier II Operating Permit No. T2-2013.0062
Project ID 61551

Micron Technology, Inc.
Boise, Idaho

Facility ID 001-00044

Final

July 17 2015
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Permit Writer

The purpose of this Statement of Basis is to satisfy the requirements of IDAPA 58.01.01.et seq, Rules for the Control of Air Pollution in Idaho, for issuing air permits.

ACRONYMS, UNITS, AND CHEMICAL NOMENCLATURE

AAC	acceptable ambient concentrations
AACC	acceptable ambient concentrations for carcinogens
acfm	actual cubic feet per minute
ASTM	American Society for Testing and Materials
CAA	Clean Air Act
CAM	Compliance Assurance Monitoring
CFR	Code of Federal Regulations
CI	compression ignition
CMS	continuous monitoring systems
CO	carbon monoxide
CO_2	carbon dioxide
CO_2e	CO_2 equivalent emissions
COMS	continuous opacity monitoring systems
DEQ	Department of Environmental Quality
dscf	dry standard cubic feet
EPA	U.S. Environmental Protection Agency
FEC	facility emissions cap
gal	gallons
GHG	greenhouse gases
gr	grain (1 lb = 7,000 grains)
HAP	hazardous air pollutants
HCl	hydrochloric acid
HF	hydrofluoric acid
HNO_3	nitric acid
hr	hour
hr/yr	hours per consecutive 12-calendar-month period
H_2SO_4	sulfuric acid
H_3PO_4	phosphoric acid
IC	internal combustion
IDAPA	a numbering designation for all administrative rules in Idaho promulgated in accordance with the Idaho Administrative Procedures Act
lb/hr	pounds per hour
MACT	Maximum Achievable Control Technology
MMBtu	million British thermal units
mmHg	millimeters of mercury
MRRR	Monitoring, Recordkeeping, and Reporting Requirements
MTI	Micron Technology, Inc.
NAAQS	National Ambient Air Quality Standard
NESHAP	National Emission Standards for Hazardous Air Pollutants
NO_2	nitrogen dioxide
NO_x	nitrogen oxides
NSPS	New Source Performance Standards
Pb	lead
PM	particulate matter
$PM_{2.5}$	particulate matter with an aerodynamic diameter less than or equal to a nominal 2.5 micrometers
PM_{10}	particulate matter with an aerodynamic diameter less than or equal to a nominal 10 micrometers
ppmv	parts per million by volume
PSD	Prevention of Significant Deterioration

PTC	permit to construct
PTE	potential to emit
Rules	*Rules for the Control of Air Pollution in Idaho*
SO_2	sulfur dioxide
TAP	toxic air pollutants
T/yr	tons per consecutive 12-calendar-month period
T1	Tier I operating permit
T2	Tier II operating permit
VOC	volatile organic compounds

FACILITY INFORMATION

Description

Micron Technology, Inc. (MTI) manufactures and conducts research and development activities associated with semiconductor and other devices on silicon-based wafers. The facility constantly adapts to changing product mix, architecture, and functionality. The nature and rapid pace of constant technological change affects the type, number, and configuration of equipment (also known as "tools" in the industry) required to fabricate devices. A detailed description of the semiconductor manufacturing process, including research and development activities, is contained in the following sections.

In addition to the historical focus on integrated circuit semiconductor manufacturing, facility operations may also include manufacturing consumer products associated with semiconductor devices, other electronic devices, as well as alternative energy manufacturing opportunities. These operations incorporate semiconductor systems or other silicon-based products. Manufacturing these products is similar to the facility's historical operations and emissions are determined using established mass balance procedures. Emissions from the manufacturing of these products are controlled using existing abatement systems. The facility continues to identify and implement options for re-purposing idled manufacturing areas.

Fabrication

The wafer fabrication process consists of several steps: cleaning, diffusion, photolithography, etch, doping, metallization, other wafer fabrication steps, wafer-level packaging, fabrication of masks, assembly, test, and other finishing steps.

Cleaning

Silicon wafers are cleaned to remove particles and contaminants such as dust. Aqueous acid and base mixtures are the most commonly used cleaning solutions. Use of acids is generally necessary because of the solubility characteristics of silicon, silicon oxide, and common contaminants. A variety of acids may be used depending on the nature of the material to be removed.

Deposition

The next step in the process depends on the type of semiconductor device being produced, but commonly involves the diffusion or growth of a layer or layers of silicon dioxide, silicon nitride, or polycrystalline silicon. For example, an initial layer of silicon dioxide with the subsequent deposition of a silicon nitride layer is commonly applied to metal oxide silicon devices. Deposition processes can be conducted at atmospheric pressure or in a vacuum chamber and are typically conducted at temperatures between 400 and 1200 °C. Chemicals and gases necessary to obtain the desired effect are flowed for a limited time into the chambers where a reaction takes place, depositing a layer of the element or compound on the surface of the wafer. Wafer residence times in the chambers can range from several minutes to several hours. Products containing VOC may be used in the deposition step depending on the desired composition of the layer. As gases react in the deposition process, a small amount of particulate matter may be produced and emitted.

Photolithography

The wafer then proceeds to the photo process. Vapor priming occurs first to remove any moisture present on the surface of the wafer to prepare it for optimum photoresist adhesion. The wafer continues on to coat tracks where it is coated with a photoresist, a photosensitive emulsion, followed by a rinse to remove excess photoresist from the edges and backside of the wafer. The wafer is next exposed to ultraviolet light using glass photomasks that allow the light to strike only selected areas and depolymerize the photoresist in these areas. After exposure to ultraviolet light, exposed resist is removed from the wafer on develop tracks and rinsed off with deionized (DI) water. Some wafers may be further baked to harden the photo mask layer. This hard bake process, designed to cross-link and harden the polymers in the photoresist, occurs after the volatile constituents have been driven off. Photo allows subsequent processes to affect only the exposed portions of the wafer. Wafer residence times during chemical application in the photo process can vary from several seconds to ten or fifteen minutes.

Etch

Etching of the wafer is then conducted to selectively remove deposited layers not protected by the photoresist material. Either dry or wet etch processes may be used depending on the type of layer being removed. Dry etch uses a high-energy plasma to remove the target layer. Process gases are ionized under vacuum pressure to form plasmas capable of etching specific layers. Wet etch may also be used to remove specific layers from the wafer. Some wet etch processes, however, also perform cleaning functions and prepare the wafer for subsequent processing. Wet etch is generally conducted at atmospheric pressure. Both etch processes may be conducted at ambient temperature or elevated temperatures (400 °C or higher). Chemicals and gases used in both etch processes may be used in varying quantities depending on the specific objective of the etching being conducted. Wafer etching can be conducted for anywhere from two minutes to more than two hours. Some of the VOC-containing material used in etch processes may be discharged to either the hazardous waste or industrial wastewater collection systems.

Doping (Diffusion and Implant)

Following etch, the wafer moves on to a process where dopants are added to the wafer or layers. Dopants are impurities such as boron, phosphorus, or arsenic. Adding small quantities of these impurities to the wafer substrate alters its electrical properties. Implant and diffusion are two methods currently used to add dopants. During implant, a chemical is ionized and accelerated in a beam to velocities approaching the speed of light. Scanning the beam across the wafer surface implants the energized ions into the wafer. A subsequent heating step, termed annealing, is necessary to make the implanted dopants electrically active. Diffusion is a vapor phase process in which the dopant, in the form of a gas, is injected into a furnace containing the wafers. The gaseous compound breaks down into its elemental constituents on the hot wafer surface. Continued heating of the wafer allows diffusion of the dopant into the surface at controlled depths to form the electrical pathways within the wafer. Solid forms of the dopant may also be used.

Metallization

Metallization is a process that can be used to add metal layers to a wafer. Sputtering and vacuum deposition are forms of metallization that may be used to deposit a layer of metal on the wafer surface. In the sputtering process, the source metal and the target wafer are electrically charged, as the cathode and anode, respectively, in a partially evacuated chamber. The electric field ionizes the gas in the chamber and these ions bombard the source metal cathode, ejecting metal that deposits on the wafer surface. In the vacuum deposition process, the source metal is heated in a high vacuum chamber by resistance or electron beam heating to the vaporization temperature. The vaporized metal condenses on the surface of the silicon wafer. VOC may be used in the diffusion process, but are generally not used in the implant or metallization processes.

Other Wafer Fabrication Steps

The wafer is then rinsed in an acid or solvent solution to remove the remainder of the hardened photoresist material. Another oxide layer is grown on the wafer and the process is repeated. This photolithographic-etching-implant-oxide process sequence may occur a number of times depending upon the application of the semiconductor. During these processes, the wafer may be cleaned many times in acid solutions followed by DI water rinses and solvent drying. This is necessary to maintain wafer cleanliness. The rinsing and drying steps may involve the use of a VOC-containing material.

The wafer fabrication phase ends with an electrical test (probe). Each device on the wafer is probed to determine whether it functions correctly. Defective devices are marked to indicate they should be discarded. A computer-controlled testing tool quickly tests each circuit.

Wafer-Level Packaging

Rather than being assembled into protective packages as described below in the Assembly Section, some semiconductor devices are processed further at the wafer level. Wafer level packaging consists of extending the wafer fabrication process to include device inter-connection and device protection processes.

Fabrication of Masks

As noted above, the photo process employs photomasks. Photomasks (or masks), are very flat pieces of quartz or glass with a layer of chrome on one side. Circuit designs are etched into the chrome. The manufacturing process to produce a mask is similar to, but much simpler than the process to make a silicon-based electrical device. Production of silicon-based devices includes many steps and can take up to several months to manufacture, whereas a mask requires relatively few steps and only about a week to manufacture. Masks are produced in the "Mask Shop" (Building 80), located in the northeast portion of the site.

The major steps involved in producing a mask are:

- Lithography
- Develop
- Etch
- Strip

These steps are very similar to those discussed above and utilize similar chemicals. The mask manufacturing process has lower emissions of VOC than the wafer manufacturing process.

Assembly

After the fabrication processes are completed, most semiconductor devices are assembled into protective packages. The wafers are first mounted on tape in a metal frame where the wafer is sectioned to separate the individual devices. Devices are picked off the tape and attached to the bonding pad of a leadframe. Die attach cure ovens heat treat the die/leadframe assembly for several hours. The die is then connected to the legs of the leadframe by fine bonding wire. A protective coating is applied to the die and hardened in die coat cure ovens. The entire die is then encapsulated with a protective molding compound. The leadframe strip is trimmed and individual leads formed on each device. The legs of individual device packages are then plated to provide reliable electrical contacts. Devices may then be sold individually or assembled into memory modules. Several VOC-containing materials are used in the assembly process.

Assembly-related research and development is also conducted at the facility. Alternative assembly processes are continually evaluated and implemented.

Test

After assembly or wafer-level packaging, the complete device is run through a series of tests for classification and final checking. There are several different tests run during this phase. Tests are conducted at varying temperatures to check for early failure and to verify the speed of each device. A final visual check of the device is conducted before they are packaged and shipped. No pollutants are currently emitted by the testing process.

Other

The facility also assembles printed circuit boards, assembles custom test equipment, and provides finished product packaging, as well as other support operations as part of its Systems Integration Group (SIG).

Support Operations

Numerous operations are conducted at the facility in support of the manufacturing process. These include, but are not limited to:

- Natural gas boilers used to supply steam for general heating and humidification;
- Cooling towers used to dissipate heat from non-contact cooling water;
- An industrial wastewater treatment plant used to treat manufacturing wastewater to levels suitable for discharge to a publicly owned treatment works;
- Temporary storage of solid and liquid hazardous waste and secondary materials generated at the facility pending shipment to a licensed off-site treatment, storage, and disposal facility or for lawful reuse or other recycling;

- Storage and dispensing of unleaded gasoline and diesel fuels;
- Use of paved and unpaved roads within the facility;
- Painting and welding in support of new construction and maintenance of existing equipment and facilities;
- Maintenance and landscaping; and the
- Testing and operation of emergency generators and fire water pumps.

Application Scope and Chronology

This permit is a revision of an existing Tier II (T2) operating permit. A condition requiring operation of gas-fired boilers in low-NOx burner performance was omitted from the original permit and the applicant has requested the inclusion of the permit condition since NAAQS compliance modeling inputs reflect gas-fired boilers 100 hp or greater operating in low-NOx performance.

Summary of Application Chronology

Date	Description
June 11, 2015	DEQ received a T2 revision application.
June 18, 2015	DEQ determined that the T2 application was complete.
June 22, 2015	DEQ made available the draft T2 and statement of basis for applicant review.
July 9, 2015	DEQ issued the final T2 permit and statement of basis.

Permitting History

The following permit history was derived from a review of the permit files available to DEQ. Permit status is noted as active and in effect (A), superseded (S), terminated (T), or not applicable (n/a).

Summary of Permitting History

Issue Date	Permit Number	Project	Description	Status
February 12, 1981	001-00044	Initial PTC	Initial permit to construct (PTC) a semiconductor manufacturing plant.	A
April 9, 1993	001-00044	Initial PTC	Initial PTC implanter process units. Revised by permit 001-00044 issued May 16, 1994.	S
May 16, 1994	001-00044	Revised PTC	Revised PTC to revise process gas usage limits. Revised permit 001-00044 issued April 9, 1993. Revised by permit 001-00044 issued December 2, 1994.	S
December 2, 1994	001-00044	Revised PTC	Revised PTC to revise process gas usage limits. Revised permit 001-00044 issued May 16, 1994. Revoked April 7, 1995.	T
June 29, 1995	T2 001-00044	Initial T2	Initial T2 for three emergency generators. Revised by permit T2 001-00044 issued February 21, 1997.	S
February 21, 1997	T2 001-00044 (9503-034-2)	Revised T2	Revised T2 001-00044 (6/29/95) to modify emissions factors for the emergency generators.	S
December 24, 2002	T1 001-00044 (9504-046-1)	Initial T1	Initial Title V operating permit. Terminated by letter on 1/11/10.	T
February 26, 2008	T2-060033	Revised T2	Revised T2 to establish criteria and HAP FEC and incorporate limits from a consent order. Revised by permit T2-2009.0078.	S

December 23, 2009	T2-2009.0078	Revised T2	Revised T2 to reduce NO_x, CO and VOC FEC ("synthetic minor"), and to increase SO_2 and PM_{10} FEC. Revised permit T2-060033. Revised by permit T2-2009.0078 PROJ 60631.	S
January 11, 2010	n/a	n/a	Termination of Tier I after "synthetic minor" FEC limits were established under permit T2-2009.0078. Terminated permit T1 001-00044.	n/a
December 2, 2010	T2-2009.0078 PROJ 60631	Revised T2	Revised Tier II/PTC to increase VOC emission limits for coat tracks and IPA solvent tools, while maintaining established FEC limits. Revised permit T2-2009.0078. Revised by permit T2-2009.0078 PROJ 60920.	S
September 21, 2011	T2-2009.0078 PROJ 60920	Revised T2	Revised T2 to change facility contact information. Revised permit T2-2009.0078 PROJ 60631. Revised by permit T2-2013.0062 PROJ 60920.	S
May 13, 2015	T2-2013.0062 PROJ 61305	Revised T2	Revised T2 to reduce Pb FEC, establish $PM_{2.5}$ FEC, increase allowable short-term TAP concentrations and decrease allowable annual TAP concentrations. Revised permit T2-2009.0078 PROJ 60920.	S
July 9, 2015	T2-2013.0062 PROJ 61534	Revised T2	Revised T2 to include permit condition for low-NOx burner performance for the boilers rated at 100 hp or greater.	A

TECHNICAL REVIEW

Emission Inventories

This permitting project will not change any emissions from the facility. For more information regarding emission inventories for this facility see the statement of basis for the T2 renewal (May 13, 2015).

REGULATORY REVIEW

Attainment Designation (40 CFR 81.313)

This facility is located in Ada County, which is designated as attainment or unclassifiable for $PM_{2.5}$, PM_{10}, SO_2, NO_2, CO, and ozone. Refer to 40 CFR 81.313 for additional information.

Title V Classification (IDAPA 58.01.01.300, 40 CFR Part 70)

MTI is not classified as a major facility, as defined by IDAPA 58.01.01.008.10.[1,2]

- The facility does not emit nor have the potential to emit ten (10) tons per year or more of any HAP.

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1 Following the recent court decision in Utility Air Regulatory Group (UARG) v. Environmental Protection Agency (EPA), EPA has indicated that it will no longer apply or enforce federal regulatory provisions of the EPA-approved Title V programs that require a stationary source to obtain a PSD or Title V permit solely because the source emits or has the potential to emit greenhouse gas (GHG) emissions above the major source thresholds ("Step 2" sources). The State of Idaho incorporates the T1 program definition of "major facility" at IDAPA 58.01.01.008.10.d, in accordance with 40 CFR 70.2. In order to act consistent with our understanding of EPA's memorandum and the Supreme Court's decision, DEQ will no longer require PSD or T1 permits for "Step 2" sources, and will not continue processing applications for such permits. DEQ and EPA recognize that Idaho's SIP-approved regulations may require revision to effectuate the Supreme Court's decision.

2 Next Steps and Preliminary Views on the Application of Clean Air Act Permitting Programs to Greenhouse Gases Following the Supreme Court's Decision in Utility Air Regulatory Group (UARG) v. Environmental Protection Agency (EPA), July 24, 2014.

- The facility does not emit nor have the potential to emit twenty-five (25) tpy or more of any combination of any HAP.
- The facility does not emit nor have the potential to emit one hundred (100) tons per year or more of a regulated air pollutant.

MTI has fossil fuel boilers (or combination thereof) of more than 250 MMBtu/hr heat input; therefore the facility was classified as a designated facility as defined in IDAPA 58.01.01.006.30, and fugitive emissions are required to be included when determining the major facility classification in accordance with IDAPA 58.01.01.008.10.c.i.

Refer to Appendix A for a summary of regulated air pollutant emissions.

PSD Classification (40 CFR 52.21)

MTI is not classified as an existing major stationary source as defined in 40 CFR 52.21(b)(1) and incorporated at IDAPA 58.01.01.107.[1,2]

MTI has fossil fuel boilers (or combination thereof) of more than 250 MMBtu/hr heat input; therefore the facility was classified as a designated facility as defined in IDAPA 58.01.01.006.30 and 40 CFR 52.21(b)(1)(i)(a), and fugitive emissions are required to be included when determining the major stationary source classification.

NSPS Applicability (40 CFR 60)

The facility is subject to the following New Source Performance Standards (NSPS):

- 40 CFR 60, Subpart Dc – Standards of Performance for Small Industrial-Commercial-Institutional Steam Generating Units
- 40 CFR 60, Subpart IIII – Standards of Performance for Stationary Compression Ignition Internal Combustion Engines
- 40 CFR 60, Subpart A – General Provisions

These requirements have been incorporated by reference into the permit (Permit Conditions 7.2, 7.4, and 8.4). A list of emissions units subject to NSPS requirements will be maintained in accordance with monitoring requirements (Permit Condition 4.15).

NESHAP Applicability (40 CFR 61)

The facility is not subject to any National Emission Standards for Hazardous Air Pollutants (NESHAP) in 40 CFR 61.

MACT Applicability (40 CFR 63)

The facility is subject to the following area source Maximum Achievable Control Technology (MACT) requirements:

- 40 CFR 63, Subpart ZZZZ– National Emission Standards for Hazardous Air Pollutants for Stationary Reciprocating Internal Combustion Engines
- 40 CFR 63, Subpart CCCCCC– National Emission Standards for Hazardous Air Pollutants for Gasoline Dispensing Facilities
- 40 CFR 63, Subpart WWWWWW – National Emission Standards for Hazardous Air Pollutants: Area Source Standards for Plating and Polishing Operations
- 40 CFR 63, Subpart A – General Provisions

These requirements have been incorporated by reference into the permit (Permit Conditions 7.2, 3.17, 5.23, 8.5, and 8.6). A list of emissions units subject to MACT requirements will be maintained in accordance with monitoring requirements (Permit Condition 4.15).

Permit Conditions Review

This section describes only those permit conditions that have been added and revised as a result of this permitting action.

Revised Table 2.1 (Regulated Sources)

Table 2.1 was revised to include using low-NOx burner performance as control equipment for the natural gas-fired boilers rated at 100 hp or greater.

Revised Table 4.1 (Facility Emissions Description

Table 4.1 was revised to include using low-NOx burner performance as control equipment for the natural gas-fired boilers rated at 100 hp or greater.

Revised Table 4.2 (FEC Emission Limits)

This table had been incorrectly titled as Table 4.1. The title has been corrected to read as Table 4.2 and referenced as such in section 4.1.

Added Permit Condition 7.2

The addition of this permit condition was requested by the permittee. This permit condition requires that the burners for boilers that are rated at 100 horsepower or greater are operated using low-NOx burner performance.

PUBLIC REVIEW

Public Comment Period

Pursuant to IDAPA 58.01.01.404.04, an opportunity for public comment is only required for a revision of a Tier II permit that results in an increase in allowable emissions. Therefore, because this project will not result in a change in allowable emissions an opportunity for public comment is not required for this revision.