

DEPARTMENT OF ENVIRONMENTAL QUALITY  
AIR QUALITY DIVISION  
ACTIVITY REPORT: Scheduled Inspection

B264433305

FACILITY: Hemlock Semiconductor Corporation		SRN / ID: B2644
LOCATION: 12334 Geddes Rd., HEMLOCK		DISTRICT: Saginaw Bay
CITY: HEMLOCK		COUNTY: SAGINAW
CONTACT: Annette Lucas , Associate Environmental Specialist		ACTIVITY DATE: 02/11/2016
STAFF: Gina McCann	COMPLIANCE STATUS: Compliance	SOURCE CLASS: MAJOR
SUBJECT: HSC Section 1 of ROP MI-ROP-B2644-2011		
RESOLVED COMPLAINTS:		

I (glm) conducted a site inspection at the Hemlock Semiconductor (HSC) manufacturing facility located in Hemlock, Michigan. On January 26, 2016 a walkthrough of the Praxair section and records review of both sections 1 (HSC) and 2 (Praxair) was completed. On February 11, 2016 a follow up visit to view process and operational data at section 1, HSC. I was accompanied by HSC staff Gary Putt, Environmental Manager, and Annette Lucas, EH&S. Praxair staff Jack Edwards, Operations Director, Jerry Cabalatangan, Safety, Health & Environmental Field Specialist and Chantal Ince, Environmental Specialist also accompanied the visit on January 26, 2016.

We reviewed on site records and viewed the control devices for emissions from silicon etching and washing, polycrystalline silicon manufacturing process, large boilers, and production heater and boilers during a follow up visit on February 11, 2016. Production engineers associated with each production area joined us.

HSC was issued ROP MI-B2644-2011 on April 19, 2011. At the time of the inspection the ROP was in the renewal process. The MAERS EU descriptions are current.

#### FACILITY DESCRIPTION:

HSC produces a variety of high purity polycrystalline silicon for semiconductor and photovoltaic manufacturers. Section 1 of the ROP covers the HSC operations in Hemlock, Michigan. Section 2 of the ROP was established for the Praxair Inc. operations located at the HSC Hemlock site. Praxair Inc. produces hydrogen and nitrogen for use at HSC.

The HSC site operates several chemical vapor deposition vessels where chlorosilanes are converted to polycrystalline silicon in a batch process operated under high temperature conditions. The polycrystalline silicon manufacturing process includes raw material storage, polycrystalline silicon production, and silane and chloride recovery. A majority of the process exhaust associated with the production of polycrystalline silicon is recovered for reuse or sale via vent vapor recovery systems. Process exhaust which cannot be recovered is vented to the caustic scrubber associated with each vapor recovery system.

HSC uses nitric acid and hydrofluoric acid for etching and washing of silicon. Caustic scrubbers are used to control emission from the etching and washing activities. Emissions from material handling of hydrofluoric acid are also controlled by a caustic scrubber.

HSC operates two natural gas fired boilers, each controlled by a low nitrogen oxide burner, that provide steam for process heat. Several smaller steam and hot water boilers and natural gas fired process heaters throughout the site provide additional process heat for a variety of production activities.

The HSC facility has hydrochloric acid (HCL) stored on-site. The chlorosilanes used at the HSC facility become hydrochloric acid (HCL) upon contact with air. Only small amounts of HCL are released during normal processing but there is the potential for larger releases due to leaks and upset conditions. Some maintenance performed on site generates emissions from parts cleaners, sandblasting, and painting.

The following table lists stationary source emission information as reported to the Michigan Air Emissions Reporting System in the 2014 submittal.

#### TOTAL STATIONARY SOURCE EMISSIONS

Pollutant	Tons per Year
Carbon Monoxide (CO)	51
Lead (Pb)	0

Nitrogen Oxides (NO <sub>x</sub> )	57
Particulate Matter (PM)	13
Sulfur Dioxide (SO <sub>2</sub> )	0.35
Volatile Organic Compounds (VOCs)	6
Nitric Acid	0.03
Hydrochloric Acid	1.3
Hydrogen Fluoride	0.1
Methanol	0.5
Hexane	0

The stationary source is subject to Title 40 of the Code of Federal Regulations (CFR), Part 70, because the potential to emit NO<sub>x</sub> exceeds 100 tons per year. The NO<sub>x</sub> emission potential of over 100 tons per year is generated from the combined emissions of multiple boilers, and, the etching, washing, and polycrystalline silicon manufacturing processes.

The stationary source is not considered a major source of Hazardous Air Pollutant (HAP) emissions because the potential to emit of any single HAP regulated by the federal Clean Air Act, Section 112, is less than 10 tons per year and/or the potential to emit of all HAPs combined is less than 25 tons per year. No emissions units at the stationary source are currently subject to the Prevention of Significant Deterioration (PSD) regulations of Part 18, Prevention of Significant Deterioration of Air Quality of Act 451, because at the time of New Source Review permitting the potential to emit of was less than tons per year. However, modifications to this source may be subject to PSD regulations.

Emissions from the vapor deposition processes are monitored and controlled pursuant to Part 55, Air Pollution Control Rules, Rule 290 (R 336.1290) and the requirements contained in the ROP for Flexible Group FGRULE290

#### **FINDINGS:**

##### **EUS11ETCH: Compliant**

Silicon rods are etched using nitric acid and hydrofluoric acid prior to being placed in reactor vessels. Emissions from the etching process are captured and sent to a caustic scrubber. Emissions from on-site nitric acid tanks are also captured and sent to the scrubber.

ROP-MI-B2644-2011 limits NO<sub>x</sub> emission limits to 39 ton per year (tpy) on a 12-month rolling time period. 12-month rolling emissions data was not current for the site. Ms. Lucas made the appropriate adjustments on the spreadsheet and we were able to view all data. I viewed NO<sub>x</sub> emissions data for time period ending July 2014, December 2014, July 2015 and December 2015 and emissions are below 1 tpy, *see attached*.

The scrubber recirculation liquid has continuous reading monitors that record pH, flow and temperature once per minute. A records request was sent on January 26, 2016 and records received on February 4, 2016, *see attached documents*. I reviewed a subset of electronic records for March and December 2015, copies are attached. All required parameters were monitored and results indicate compliance with emission limits and operating restrictions in the ROP.

The facility is also required to perform non Method 9 visible emission (VE) monitoring. If a discoloration is present, the operators check process conditions. If there is not a correctable condition, the Day Operator is notified to initiate an appropriate response. Operator daily rounds include a check of scrubber VEs, and recirculation pH and flow. A copy of the operator round record for March 2015 and a copy of the Method 9 certified personnel are attached.

On February 11, 2016 on a subsequent visit, we viewed the flow & pH metering, control panel read out. In order to demonstrate compliance with the emission unit limits for NO<sub>x</sub> and hydrogen fluoride the facility is required to maintain the scrubber flow at a minimum of 150 gpm, and a minimum pH of 7. At the time of the site inspection the scrubber flow was 199 gpm with a pH of 10.7. The bath temperature was 96.8 degrees Fahrenheit or 36 degrees Celsius.

**EUS30ETCH: Compliant**

Post reaction silicon rods are broken into chunks. The chunks are etched and washed using nitric acid and/or hydrofluoric acid. Emissions from the etching process are captured and sent to a caustic scrubber. No etching was performed at this emission unit during 2015. December 2014 was the last time etching was completed.

ROP-MI-B2644-2011 limits NOx emission limits to 22.7 tpy on a 12-month rolling time period. I viewed NOx emissions data for the 12-month rolling time period ending July 2014, December 2014, July 2015 and December 2015. NOx emissions are below 1 tpy, see *attached*. The facility also has limits for hydrogen fluoride and nitric acid of 0.7 tpy and 2.1 tpy on a 12-month rolling time period, respectively. I viewed emissions for both the periods ending July 2014, December 2014, July 2015 and December 2015, emissions are below 1 tpy for each constituent, see *attached*.

The scrubber recirculation liquid has continuous reading monitors that record pH, flow and temperature once per minute. I reviewed a subset of electronic records for March and December 2015, copies are attached. All required parameters were monitored and results indicate compliance with emission limits and operating restrictions in the ROP.

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The facility is also required to perform non Method 9 visible emission (VE) monitoring. If a discoloration is present, the operators check process conditions. If there is not a correctable condition, the Day Operator is notified to initiate an appropriate response. Operator daily rounds include a check of scrubber VEs, and recirculation pH and flow. To date a Method 9 observation has not been warranted, therefore not recorded. A copy of the operator round record for March 2015 and a copy of the Method 9 certified personnel are attached. This unit was not operating on either of the visits.

**FG 130WASH: Compliant**

This flexible group was formerly named FGS130ETCH. During the 2015 ROP renewal process the name was changed. Staff reviewed the associated permit issued for this group, PTI #324-07, and discovered the naming convention was incorrect. No etching takes place in this flexible group, only washing.

Post reaction silicon rods are broken into chunks. The chunks are etched and washed using nitric acid and/or hydrofluoric acid. Emissions from the etching process are captured and sent to a caustic scrubber. Emissions from the on-site hydrofluoric acid tank farm are also captured and sent to the scrubber.

The facility is required to maintain the scrubber flow and pH in a satisfactory manner. I reviewed a subset of electronic records for March and December 2015, copies are attached. All required parameters were monitored and results indicate compliance with emission limits and operating restrictions in the ROP.

This flexible group was not operating during either visit.

**FGBOILERS: Compliant****Rule 282 emission units**

Boilers #8 and #9 with heat capacity of 98 MMBtu/hr are, FGBOILERS, are controlled by a low NOx burner. Material usage limits for the boilers is 1400 million standard cubic feet per 12-month rolling time period as determined at the end of each calendar month.

Natural gas usage values are recorded at the end of each month by a Utilities Technician and entered into an electronic tracking system. Records received for 12-month rolling periods ending July 2014, December 2014, July 2015 and December 2015 showed usage between 580 mmcf and 620 mmcf.

No. 459 & 468 Heaters are used to preheat process gas. Boilers heat thermal fluids used to preheat equipment.

**Rule 290 emission units: Compliant**

Plant vent 1 is no longer used for capture & treatment of reactor vessel emissions but is used a liquid neutralization vessel. All former Plant 1 vent emissions now go to Plant Vent2. There are GC calibration

alarms sent to the Process Control Operator if calibration is out of range. The emission calculations include each chloride group (HCL, and mono/di/tri/siltec) measured by the GC. The scrubber has 99.8 % removal efficiency.

All records from the on-site instrumentation are maintained in the Process Information System ("PI"). Alarms are set around scrubber recirculation flows.

For the month of March 2015 controlled and uncontrolled HCL emissions were 335 lbs. and 110 pounds respectively. December 2015 controlled and uncontrolled HCL emissions were 38 lbs. and 80.1 lbs. respectively.

EUS453baghouse used to control particulate emissions from silicon raw material handling. Attached are R290 particulate emissions for the months of March and December 2015.

For each emission unit that emits non-carcinogenic particulate air contaminants the facility performs a monthly visible emission observation of each stack or vent. Attached are vent inspection observations for March and 2015.

**FGCOLDCLEANERS:Compliant**

The facility currently operates and maintains 3 cold cleaners. Safety Kleen is contracted to dispose and replenish solvent. Attached are recent invoices from December and September 2015, with 2 cleaners and 1 cleaner emptied for respective months. The facility also tracks the amount of solvent, pounds in minus pounds shipped out, used for MAERS reporting.

**FGRULE287(c):Compliant**

The facility has a paint shop on site for maintenance purposes. The shop has approximately 40 different paints on hand for various jobs. In 2015 usage was 173 gallons for the year and less than 25 gallons of coatings per month.

NAME



DATE

2/11/16

SUPERVISOR

