



DEQ Air Quality Inspection Report

GENERAL INFORMATION

Facility Information:

Facility Name	Intel Corporation
Site Address	Aloha Campus 3585 SW 198th Ave. Aloha, OR 97007 Ronler Acres Campus 2501 NW 229th Ave. Hillsboro, OR 97124
County	Washington
Permit Number	34-2681-ST-01
Permit Type (ACDP, ACDP-SM80, Title V)	ACDP

Inspection Information:

Inspection Date/Time:	May 20 and 21, 2014 @ 9:30 am	
Inspection Type:	FCE/PCE (specify)	
	State inspection	X
	Announced	X
	Unannounced	
Reason for inspection:	Regularly scheduled inspection	X
	Complaint follow-up	
	Other (specify)	
Inspector	George Davis Environmental Engineer Oregon Department of Environmental Quality 	
DEQ Air Quality Manager/Region	David Monro/NWR 	
Facility Representatives (name, title, phone #)	Stephanie Shanley, Sr. Environmental Engineer, 503-319-6285, and Mark Mueller Jessie Taylor McKayla Garret	

FACILITY DESCRIPTION

Intel's permit covers two semiconductor manufacturing facilities that are considered to comprise a single source. The facilities are referred to as the Aloha Campus and the Ronler Acres Campus.

The Aloha Campus is located at 3535 S.W. 198th Avenue, Aloha, Oregon. The Aloha Campus was originally a high volume manufacturing facility for Intel. As semiconductor manufacturing technology evolved, much of the

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manufacturing at the Aloha Campus was relocated to other Intel manufacturing facilities including the Ronler Acres Campus in neighboring Hillsboro. In 2003 a retooling project was commenced at the Aloha Campus, establishing a new primary function for the facility. Aloha's new function is to provide finishing steps to pre-manufactured semiconductors from other Intel manufacturing facilities. Building AL 3 is office space and die prep (die prep is the process of cutting silicon wafers into individual dice and physically separating them into groups). AL 4 is partially office space and also contains SORT operations, where products are tested. Fab 15 has been retooled/repurposed to accommodate new technologies and contains both high volume manufacturing as well as research and technology development activities. Fab 15 VOC emissions are controlled by rotary concentrator thermal oxidizers (RCTO). An RCTO is a control device designed to effectively control VOC emissions in high flow rate, low concentration exhaust streams.

The Ronler Acres Campus is located at 2501 NW 229th Ave., Hillsboro, Oregon. The Ronler Acres Campus commenced construction in November 1994. The facility presently includes three Fabs (Fab 20, D1C and D1D), and is constructing a new fab, Fab D1X. Semiconductor manufacturing involves numerous production steps performed on silicon wafers which include: growth of a silicon oxide layer, application of photoresist, UV light exposure, developing, etch, deionized water rinse, doping, and acid/solvent rinse steps. The manufacturing processes emit volatile organic compounds (VOCs) from the chemicals/materials that are used. The principal VOC emitting activities are controlled by RCTO VOC abatement devices. There are also emissions of inorganic gases associated with acid etching and doping. Inorganic gaseous emissions are controlled by scrubbers. Some of the VOCs and inorganic gases are considered hazardous air pollutants. Many of the processes also use fluorine compounds (perfluorocarbons and NF_3); these compounds are classified as greenhouse gases (GHGs). GHG emissions are controlled by thermal or plasma oxidation, followed by scrubbers.

Originally, the Aloha Campus and the Ronler Acres Campus had separate product lines, functioned independently and were recognized as two separate sources. Following the retooling/repurposing of the Aloha Campus it was determined that over 50% of the Ronler Acres Campus production would be finished at the Aloha Campus and the two facilities therefore would be interdependent. The two facilities impact the same airshed, therefore, in the permit action effective 12/31/2007, DEQ combined the Aloha and Ronler Acres campuses, recognizing them as one source for the purpose of air quality permitting.

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PRE-INSPECTION REVIEW

Annual Reports (since last inspection)

34-2681

Type	Report Period (Calendar Year)	Date Received	Deviations (yes/no)	Comments
Annual-2009	2009	2/15/2010	No	
Annual-2010	2010	2/14/2011	No	
Annual-2011	2011	2/14/2012	No	
Annual-2012	2012	2/13/2013	No	
Annual-2013	2013	2/19/2014	Yes	No fluorides PSEL, and began construction of D1X without the proper approval. Both violations addressed by PEN-POR-AQ-2014-0008 and MAO AQ/AC-NWR-14-027 (see below)

Enforcement History (since last inspection):

In January, 2014, DEQ determined that Intel was responsible for the following three violations:

1. Failing to notify DEQ of its fluorides emissions for the purpose of regulating Intel as required by OAR 340-214-0110 (a Class I violation per OAR 340-012-0053(1)(b)).
2. Failing to obtain a permit to emit fluorides, a regulated pollutant, as required by OAR 340-222-0020(1) (a Class II violation per OAR 340-012-0053(2)).
3. Beginning constructing of Fab D1X and Fab 20 without first obtaining the proper construction approval as required by OAR 340-210-0240(1)(c) (a Class II violation per OAR 340-012-0054(2)(c)).

DEQ issued PEN-POR-AQ-2014-0008 and MAO AQ/AC-NWR-14-027 to address these violations.

Complaints (since last inspection):

No citizen complaints have been submitted to DEQ pertaining to the permittee. One person has notified DEQ of odors in the vicinity of the Ronler Acres Campus, but DEQ staff believe these odors may originate from other facilities in the same area.

PERMIT REVIEW AND ON-SITE OBSERVATIONS

The last compliance inspection was performed at Ronler Acres on 09/29/2009.

This inspection consisted of a site visit to the Aloha campus, followed by visits to the Hawthorne Farms and Jones Farms campuses on May 20, 2014. The Ronler Acres campus was inspected the following day.

Hawthorne Farms and Jones Farms

The purpose of these visits was to determine if these facilities were correctly excluded from the permit that covers the manufacturing activities at the Aloha and Ronler Acres campuses. At both Hawthorne Farms and Jones Farms, I visited all buildings except the support building at Jones Farm, which provides facilities support such as emergency generators and HVAC system cooling towers. All buildings included a combination of general office-type

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workspaces (i.e. cubicles and desks), offices, meeting rooms, cafeterias, workout or recreation areas, storage spaces and laboratories (labs).

As explained to me by Intel staff, the purpose of the labs is generally for testing of products. Testing covers multiple areas, including but not limited to functional testing to determine if the product performs the way it's supposed to; physical testing to see how much abuse the product can withstand; and environmental testing (i.e.. heat, cold, moisture). In some labs, some product assembly occurs before testing can be performed, such as soldering microchips to printed circuit boards.

Many of the labs are small, with 2 to 4 workbenches, with 1 to 4 workers in each during my visit. A few labs are larger, some stretching the full width of a building, with multiple workbenches or working areas and a larger number of workers in each. Between the two campuses there are a large number of labs, and I did not enter all of them, instead performing a number of spot-checks. Additionally, many of the labs have windows in the doors through which I could see as we walked by. In a couple of labs we asked workers to explain what they did there. I was given full access to all of the buildings and labs and was allowed to enter any lab I asked to.

The activities I observed were (in my opinion) consistent with testing of electronic equipment. The general appearance of the labs was workbenches or workspaces, often with exposed equipment and wiring. I did not see any areas that appeared to be set up to perform repetitive manufacturing operations; I did not see any "clean rooms" as at Aloha and Ronler Acres; I did not smell any "chemical" odors while I was there; and did not see any fume hoods where chemicals might be used. I was told a small amount of cleaning solvent (isopropyl alcohol) was used, but did not actually see any in use.

My conclusion after visiting the Hawthorne Farms and Jones Farms campuses is that these facilities do not perform manufacturing operations; they appear instead to perform testing activities as stated by Intel. These facilities are not subject to permitting and are correctly not included in the permit.

Aloha Campus

The on-site inspection focused on the emission control systems at the Aloha Campus. There are two emission control systems, one for the control of GHGs, fluorides and HF; and one for the control of VOC emissions.

The GHG, fluorides and HF emission control system begins with Point of Use (POU) control devices for each manufacturing tool in the Fab. Tools exhaust to a POU where the gases are treated in a thermal oxidizer (afterburner) or in a plasma unit which performs a similar function without a flame. POU's equipped with thermal oxidizers include a small scrubber after the thermal oxidizer; the plasma POU's do not have scrubbers. All POU's then exhaust into the main scrubbed exhaust system. The main scrubbed exhaust system duct has a "donut" shaped layout in the Fab subbasement. From the duct in the subbasement two riser ducts carry the exhaust gases to the scrubber deck, where the two risers connect to a single horizontal duct. There are six scrubbers, each attached to the single horizontal duct. Five scrubbers are operated, with the sixth scrubber off line for maintenance and to act as a backup unit in the event that one of the in-use scrubbers malfunctions. At the Aloha campus each scrubber is equipped with three recirculation pumps; two pumps are in use with the third pump as backup in case one of the in-use pumps malfunctions. The scrubbers have parametric monitoring for fan operation, pump operation, differential pressure, scrubber liquid pH, and conductivity. Alarms for failures or out of range operation are sent directly to the maintenance staff via smart phones.

The VOC control system collects the exhaust from production tools that use VOCs. As with the scrubbed exhaust system, there is a single system to collect VOCs and route them to the emission control devices via a single duct. At the Aloha campus there are two VOC emission control devices, known as Rotary Concentrator Thermal Oxidizers (RCTOs). These devices first concentrate the VOCs, which reduces the volume of air that has to be treated by thermal oxidation; the concentrated VOCs are then combusted to destroy the VOCs. A single RCTO can treat the entire VOC exhaust stream; however, the time required to bring a cold RCTO on line is about 90 minutes, so there would be a period of bypassing if one failed while the other was off/cold. Intel operates both so that if one fails, the

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other is already on line and operating. RCTOs also have parametric monitoring for fan operation and combustion chamber temperature, with a similar alarm system that notifies maintenance staff via smart phone.

Ronler Acres Campus

I have been to the Ronler Acres campus on other occasions and have viewed parts of the emissions control systems, so the inspection at this site focused on a review of the emission control systems and recordkeeping. The review consisted of viewing computerized process control schematics and discussion of system operation with the maintenance manager. The emissions control systems are similar to those at the Aloha campus, with multiple scrubbers manifolded together onto common ducts, and multiple RCTOs manifolded together onto common ducts, to ensure that emission control will continue in the event of a scrubber or RCTO failure. Parametric monitoring is done as at the Aloha campus, with alarms sent directly to maintenance staff via smart phone. We spot-checked on-line monitoring and all systems checked were operating within normal ranges.

All records requested during the review were available or were provided after the visit; no problems were noted.

We discussed reporting for permit condition 6.3.b.v., which requires calculation of an overall plant-wide VOC control percentage. However, the permit condition is not clearly written and Intel staff have interpreted it differently at different times, resulting in inconsistent reporting over the past few years. We examined the permit condition, which appears to be a rather old condition that has no basis in current rules, and we agreed upon an interpretation and calculation method. The condition is simply a reporting requirement and is not related to compliance with any other permit conditions or limits. I asked Intel to recalculate the results for 2010 through 2013 and submit them, which was done by letter dated May 28, 2014.

The agreed-upon calculation method for condition 6.3.b.v. was described in Intel's May 28 letter and copied below:

As we discussed, the permit condition is written in a way that is open to interpretation and the calculation methodology used related to this permit condition for inclusion in our annual reports has changed over the last several years. Based on our conversation during the inspection, we understand that you would like us to use the following calculation as the appropriate interpretation of this permit condition moving forward.

$$\% \text{VOC Emitted} = \frac{\text{Total Process VOC Emissions}}{\text{Total VOC Chemical Use}}$$

$$\text{Where Total Process VOC Emissions} = \text{Total VOC emissions} - \text{VOC emissions from tanks} - \text{VOC emissions from combustion}$$

$$\% \text{VOC Controlled} = 1 - \% \text{VOC Emitted}$$

The other methods Intel used for the calculation were also provided in the letter.

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Condition Number	In compliance	Out of compliance	Other	Summary of Requirement	Observations/comments (records review, monitoring data, process parameters, control device parameters, etc)
1.1	Yes			20% opacity limitation	During the inspection there were no visible emissions from any emission source at either Intel facility.
1.2	Yes			PM limit - 0.1 gr/dscf	Compliance is presumed – no visible emissions present at either Intel facility; emission units operated by permittee do not have significant PM loading; combustion units are fired with natural gas; corrosive gas exhausts are controlled by scrubbers.
1.3	Yes			Prevent fugitive dust emissions	Neither of the permittee's facilities have significant potential for fugitive emissions. Traffic areas are paved and no fugitive dust was observed during the inspection or other visits.
1.4	Yes			Prohibition of PM (> 250μ) deposition	No fugitive emissions were observed during any of my visits to the facilities.
1.5	Yes			Nuisance/odor prohibition	I did not observe any odors or any other potential nuisance causing activity during my inspection of the two Intel facilities. DEQ has not received any odor complaints that can be tied to Intel.
1.6	Yes			Fuel limitation	The permittee combusts only natural gas in its fuel burning equipment at both campuses.
2.1			x	NSPS Subpart Dc - Standards of Performance	All Subpart Dc affected Steam Generating Units at Intel are fired exclusively with natural gas and as such, there are no applicable emission standards for which these Steam Generating Units fall subject under the Subpart.
2.2			x	Aloha Campus-Existing FAB RACT/TACT	Conditional requirements no longer applicable due to all associated Fab units having been eliminated.
2.3	Yes			FAB TACT – 95% DRE	All RCTOs servicing Fabs for which normal operations have been achieved have been tested and verified to achieve ≥95% DRE.
2.4.a	Yes			RCTO Operations – Operating Temp	RCTO operating temperature is monitored and available on line. All RCTOs checked were operating within the approved temperature range.
2.4.b	Yes			RCTO Operations – pressure drop	Monitored as required, with alarms for out of range operation.

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Condition Number	In compliance	Out of compliance	Other	Summary of Requirement	Observations/comments (records review, monitoring data, process parameters, control device parameters, etc)
2.4.c	Yes			RCTO Operations – regenerator air temperature	Monitored as required, with alarms for out of range operation.
2.4.d	Yes			RCTO Operations – pressure drop/ regenerator air temp. excursion	Monitored as required, with alarms for out of range operation.
2.4.e	Yes			RCTO Operations – Aloha Campus capture efficiency	Tools are connected directly to VOC exhaust duct system, 100% capture is assumed.
2.5	Yes			Scrubber Operation And Maintenance	Scrubbers are operated and maintained as required.
2.6	Yes			Conditional pre-approval	The permittee operated in accordance with the pre-approval condition.
2.7	Yes			Boiler fuel limitation	The permittee combusts only natural gas in its boilers.
2.8	Yes			New Control Device Notification	Intel submitted information on new control devices as required.
3.1	Yes				PSEL compliance is reviewed in annual reports.
3.2			x		PSELS apply to any 12-consecutive month period (i.e. rolling).
4.1			x	NSPS Subpart Dc Testing Requirements	There are no applicable testing requirements for Subpart Dc affected facilities that are fired exclusively with natural gas.
4.2	Yes			RCTO Testing Requirements	Performance requirement was met at both campuses. All source tests demonstrated the associated RCTOs to achieve > 95% DRE.
4.3	Yes				PSEL compliance monitoring
4.4	Yes				Emission factors in section 10.0 must be used unless alternative EFs are approved.
5.1	Yes			Continuous monitoring	During my inspection I observed Intel's monitoring systems for the RCTO units and verified the identified monitoring requirements were appropriately being performed.
5.2a – c			x	Weekly Monitoring – Aloha Campus	Conditional requirements now NA due to all associated Fab units having been eliminated.
5.3	Yes			Weekly Monitoring - Scrubbers	Performance requirement was met at both campuses.

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Condition Number	In compliance	Out of compliance	Other	Summary of Requirement	Observations/comments (records review, monitoring data, process parameters, control device parameters, etc)
5.4			x	Bi-monthly Monitoring – Aloha Campus	Conditional requirements now NA due to all associated Fab units having been eliminated.
5.5.a - c	Yes			Monthly monitoring	Performance requirement was met at both campuses.
5.5.d	Yes			Monthly monitoring – PSEL compliance	Reviewed monitoring records for both facilities; the required monitoring is being performed and demonstrates compliance with conditions 3.1 and 4.3 of the permit.
5.6	Yes			RCTO Seal Gap Monitoring	Performance requirement was met at both campuses.
5.7	Yes			Pollutant Capture Efficiency	See condition 2.4.e for Aloha. Condition not triggered for Ronler Acres.
5.8	Yes			NSPS Subpart Dc Monitoring	Performance requirement was met at both campuses. Record data provided by NW Natural.
5.9	Yes			Excess emissions monitoring	
5.10	Yes			Complaint log	The permittee has not received any citizen complaints since the last inspection.
5.11	Yes			Maintenance records	I verified the permittee maintains records of major maintenance events associated with its air pollution control equipment.
5.12	Yes			Record retention, 2 years	
6.1	Yes			Excess emissions reporting	Neither facility experienced an excess emission event.
6.2			x	NSPS Subpart Dc Reporting	There are no applicable Subpart Dc specific reporting requirements for affected facilities that are exclusively natural gas fired.
6.3	Yes			Annual reports required	The permittee has regularly submitted annual reports as required by the permit. For each report period I have verified its compliance status with the permit. During my inspection I performed an audit of the permittee's records/data entry to confirm report accuracy. See table of reports above.

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OTHER DISCUSSIONS

none

COMPLIANCE STATUS OF FACILITY

Check one of the following:

	Facility is in compliance with the permit conditions described above.
X *	Facility is not in compliance with one or more of the permit conditions described above (provide additional detail below).

Is the facility under a compliance schedule to correct previous compliance problem(s)? Check one of the following:

	Facility is not under a compliance schedule to correct previous noncompliance.
X *	Facility is on schedule to correct previous noncompliance.
	Facility is not on schedule to correct previous noncompliance (provide additional detail below).

*** Facility is out of compliance due to violations discussed in Enforcement History, page 3 of this report.**

Is the facility under a compliance schedule to comply with future requirement(s)? Check one of the following:

X	Facility is not under a compliance schedule for future requirement(s).
	Facility is on schedule to meet future requirement(s).
	Facility is not on schedule to meet future requirement(s) (provide additional detail below).

