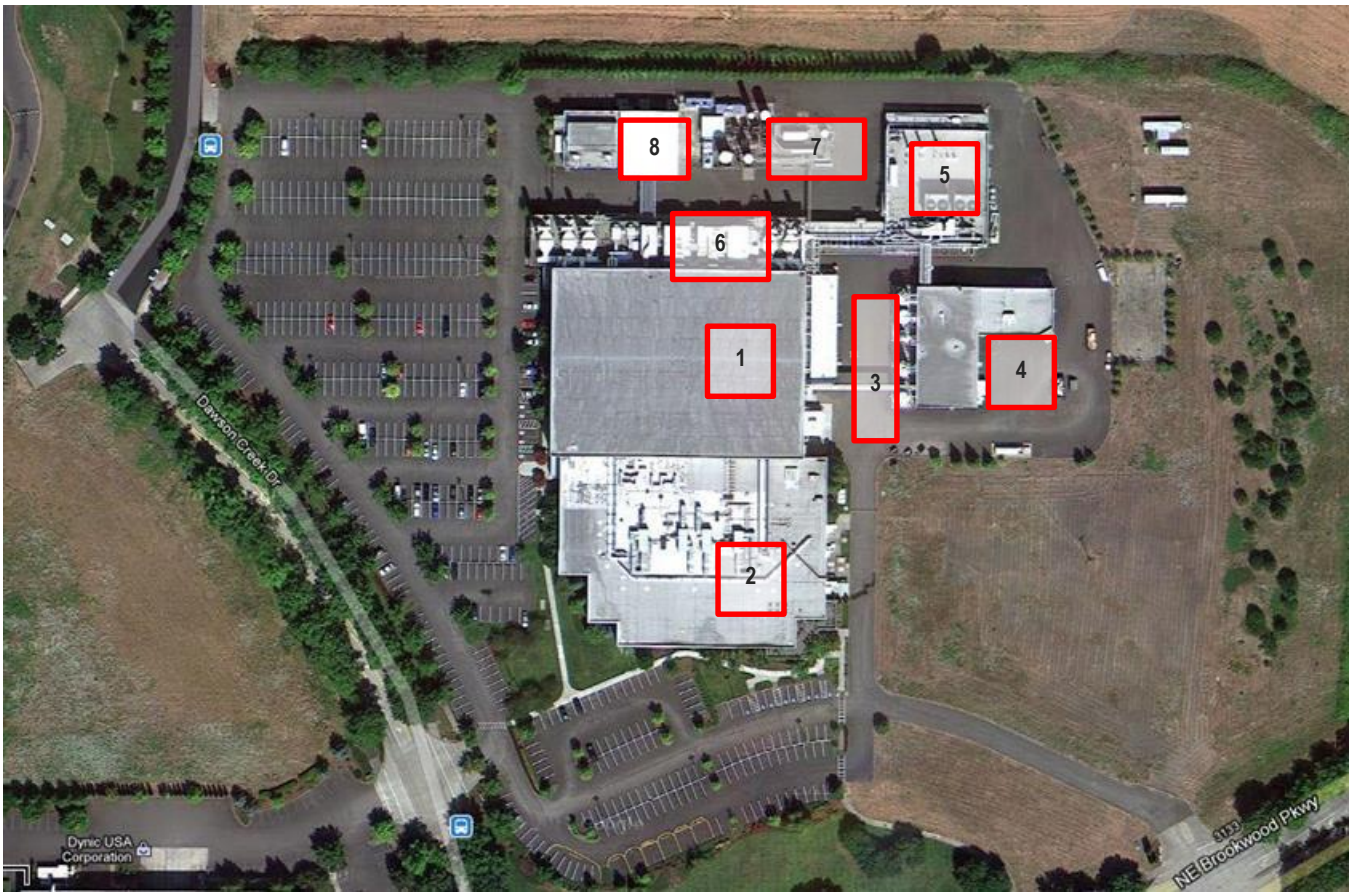
MEMO

Client Name:	**Evergreen EDC / Jireh Semiconductors**
Project Number:	M29-011A Date: June 8, 2012 - Rev1
Distribution:	Steve Nyman/Jireh
Subject:	Mike Weiby/Jireh
Referenced Codes and Standards:	Bob Spendle/EEDC
Building Name:	Evaluation of existing F1 occupancy electronic manufacturing Facility for compliance per current codes and for proposed future increase in use of TCS
Room Area Affected:	2010 Oregon Structural Specialty Code

Jireh Semiconductor T-Bay Code Review

Overview

Jireh Semiconductor a wholly owned subsidiary of Alpha and Omega Semiconductor Limited bought the Integrated Device technology (IDT) facility in Hillsboro, Oregon. This is a functioning and well-developed site with multiple buildings including semiconductor manufacturing and support structures. Jireh made interior changes to suit their manufacturing needs, but none of the alterations resulted in changes to existing occupancies. Over the life of the facility some areas with older occupancy designations such as B2 had been updated to B and F1 per the applicable codes when the changes occurred. The area being evaluated in located in the administration building and classified as F1 manufacturing area. The campus also includes H5[H6] semiconductor manufacturing facility, interior chemical and gas supply (HPM) rooms, waste treatment area, outdoor bulk gas area, central utilities plant and other manufacturing support common to these types of facilities.



	Legend
1.	FABRICATION BUILDING
2.	ADMINISTRATION BUILDING
3.	WASTE TREATMENT AREA
4.	RO/DI CENTER
5.	ENERGY CENTER
6.	MECHANICAL PLATFORM
7.	OUTDOOR BULK GAS
8.	ELECTRICAL CENTER

The T-Bay area being evaluated is located in the administration building. It is a manufacturing area which uses small quantities of hazardous materials. The current proposal continues on that path and will add manufacturing equipment that uses Trichlorosilane (TCS) in a lecture size bottle located in a cabinet in a “bubbler” as shown in examples below. TCS is classified as a flammable 1A, corrosive, unstable reactive 2, and water reactive 2 liquid. TCS will be used in a closed system.

Figure 1: Bubblers used in semiconductor manufacturing

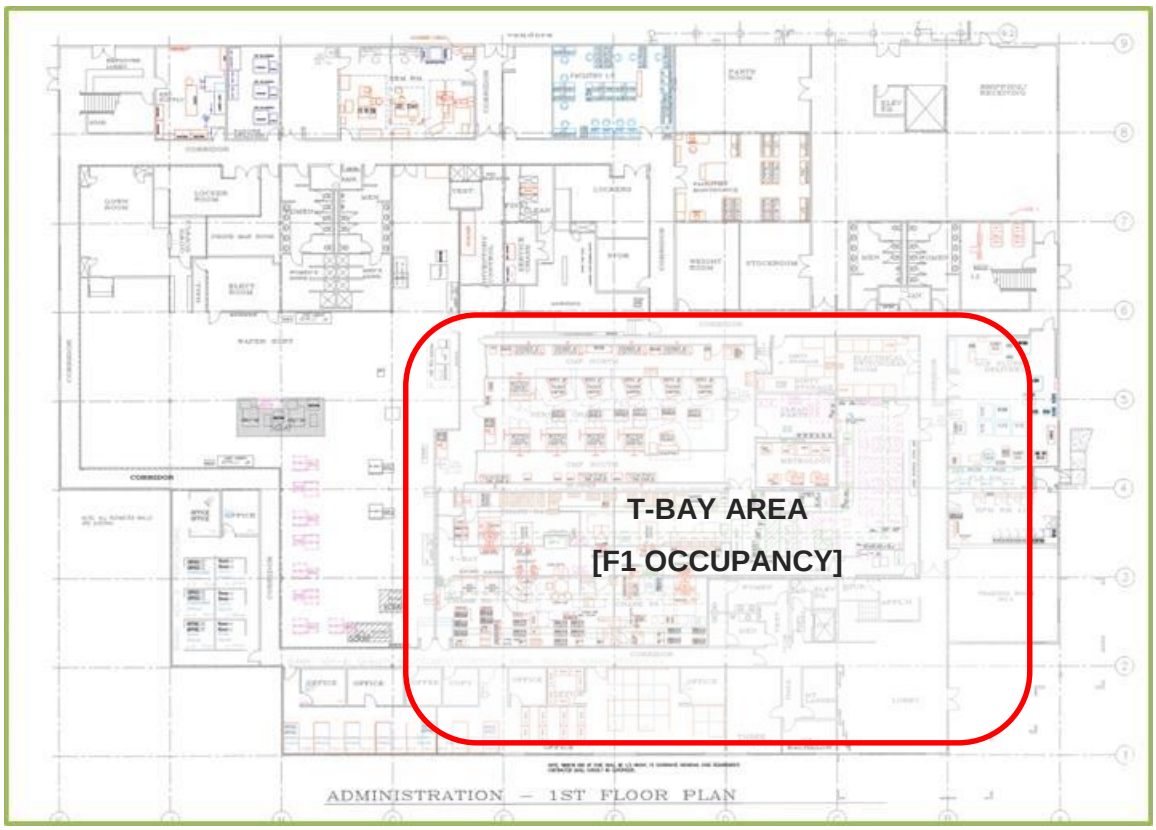


Figure 2: T-Bay area occupancy

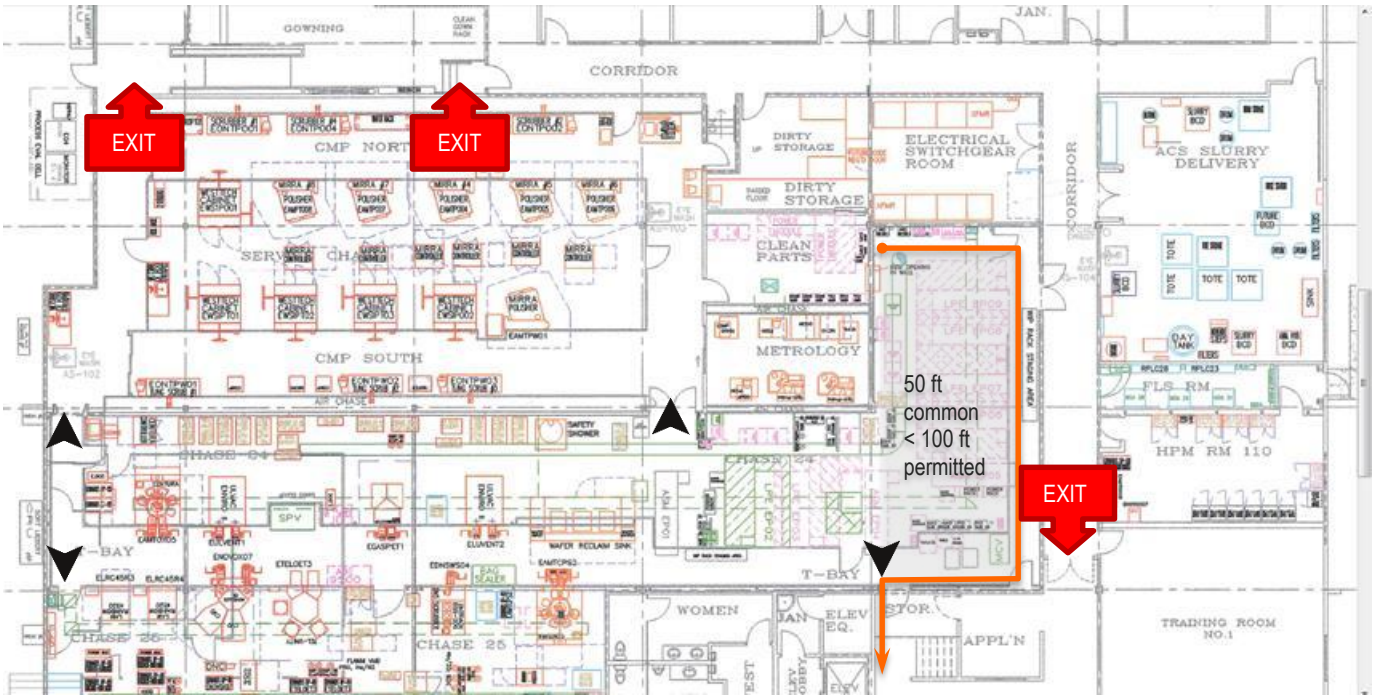


Figure 3: Partial plan of the T-Bay and metrology area

Applicable Codes

The campus buildings were constructed in 1995 and the applicable building code at the time was the 1991 Uniform Building Code with Oregon amendments. The building use and key functional areas have not changed since; therefore, there are no occupancy changes. Where there is an addition to the existing or modification of the existing that work has to follow the current codes, which are:

- 2010 Oregon Structural Specialty Code (OSSC)
- 2010 Oregon Fire Code (OFC)

Seismic Design

The existing building was designed to zone = 3. The design importance factor used was Ip = 1.5 as required by code, since the fabrication building and administration building are a single structure and the quantity of flammables, toxic, and highly toxic materials is over the exempt amounts in the H5 semiconductor manufacturing facility and the associated HPM rooms. Therefore, the T-Bay area seismic design is an existing compliant condition that is grandfathered and will not need to be upgraded.

Occupancy, Fire rated separation, and Means of egress

A T-Bay area is currently classified as a F1 Electronic Manufacturing area. This is still valid under the 2010 OSSC. There is no fire separation required between the F1 and adjacent B occupancy. The exit access corridor is separated by a 1 hour wall and 20 minute opening protection. It is recommended that the doors be upgraded to 45 minute rating to meet the control area separation under the current OSSC. This will help maintain the chemical quantities under the exempt amounts and also improve overall safety. Since this area is not an H occupancy area panic hardware is not required and doors do not have to swing in the direction of travel, but closers are required and any hardware will have to meet the new accessibility standards.

The equipment access double door has an 18 inch step down and does not serve as an exit. The owner wants to add an egress stair to use this as an exit access door. This is feasible and will need a new stair that meets 2010 OSSC and 2010 Accessibility Standards, which is possible without a significant cost impact. Existing means of egress system serving this area will meet current code requirements for travel distance (250 ft), common path (100 ft), and dead ends (50 ft).

Control Area Limits

Owner maintains a Hazardous Materials Inventory Statement for the facility, which will be updated as the proposed modifications are made. The exempt amounts for the hazardous materials that are planned to be used in the T-Bay area are listed below. The quantity limits are per a preliminary HMIS provided by Jireh. The control area limits listed are for sprinklered buildings and when stored and used in a listed cabinet.

The T Bay room is F1 occupancy and assumed to be separated from the rest of the floor as required for a single control area. The proposed amount exceeds the MAQ for the hazard classes highlighted below. These amounts still need to be confirmed; if the quantity exceeds the exempt amount then either the quantity needs to be reduced, or additional control areas will need to be created, or an alternate compliance path developed.

Hazard Class	Proposed Quantity (To be Confirmed)	Maximum Allowable Quantity (MAQ)/Closed Use	Maximum Allowable Quantity (MAQ)/Storage
T BAY ROOM - F1 OCCUPANCY CONTROL AREA			
Flammable 1A Liquid	36.98 gal (140L)	60 gal	120 gal
Corrosive Liquid	36.98 gal (140L)	1,000 gal	2,000 gal
Unstable Reactive 2 Liquid	36.98 gal (140L)	10 gal (100 lb.)	20 gal (200 lb.)
Water Reactive 2 Liquid	36.98 gal (140L)	10 gal (100 lb.)	20 gal (200 lb.)

In this instance TCS is within the permissible limits for 2 categories and exceeds the limit for other two categories. Since the TCS will not be exposed to water and it will be in a controlled environment and that individual container limits exposure for a single event, we believe that there is a good basis for asking for increased quantities for these two categories. This will be through the code permitted process of alternate materials and methods (AM&M); higher ventilation and other engineering controls are additional mitigation in support of this AM&M.

Hazard Class	Proposed Quantity (To be Confirmed)	Maximum Allowable Quantity (MAQ)/Closed Use	Maximum Allowable Quantity (MAQ)/Storage
ADMIN HPM ROOM – H4 OCCUPANCY			
Flammable gas	Approx. 3,600 cu. ft.	4,000 cu. ft.	4,000 cu. ft.
Flammable Liquid IA	Approx. 10 gal.	60 gal.	120 gal.
Toxic Gas	Approx. 2,900 cu. ft.	3,240 cu. ft.	3,240 cu. ft.
Oxidizer gas	Approx. 462 cu. ft.	6,000 cu. ft.	6,000 cu. ft.
Unstable Reactive 2 gas	2,520 cu. ft.	1,000 cu. ft.	1,000 cu. ft.
Unstable Reactive 3 gas	840 cu. ft.	40 cu. ft.	200 cu. ft.

The HPM room is classified as an H7 [H4] occupancy, which limits the quantity for Unstable Reactive Materials to MAQ limits. The recommended path on this is to upgrade the room to H2/H3/H4 occupancy. The floor area ratio will need to be verified but based on the small area of this room it is assumed to be less than 10% of the floor and therefore exempt from mixed occupancy ratio. The UR3 requires explosion control and the existing cabinet and room ventilation will most likely provide that. Since the gas room exhaust was most likely designed to meet the flammability and toxicity of the gases through an RFO. It is also likely that the gas mixture at this concentration is not considered UR3. These can be further investigated for a definitive answer.

Transport of Chemicals

In B/F1 occupancy hazardous liquids and gases are permitted to be transported through an exit access corridor if in compliance with the 2010 Oregon Fire Code section 2703.10. This section outlines the requirements for carts and trucks used for transporting hazardous materials as well as container size limit for individual cart/truck load.

Electrical Hazard and Explosion Hazard Mitigation

The T-Bay area has high ventilation and exhaust rates in addition to having all materials in closed use. This will allow the rooms to be unclassified electrically and also meet the explosion control criteria for flammable 1A liquid and flammable gas use. If the quantities are maintained under the exempt amounts, explosion control requirements will not apply.

Room Ventilation Rates

- 23 CFM/SF recirculation air
- 2.5 CFM/SF exhaust (Based on a total of 5184 SF clean bay and chase area)
- Total of 25.5 CFM/SF air flow