TI ESH CHEMICAL SCREENING PROGRAM

EARLY INTEGRATION OF ESH IN PROCESS DEVELOPMENT

Engineering Research Center for Environmentally Benign Semiconductor Manufacturing

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Drivers for a ESH Screening Process

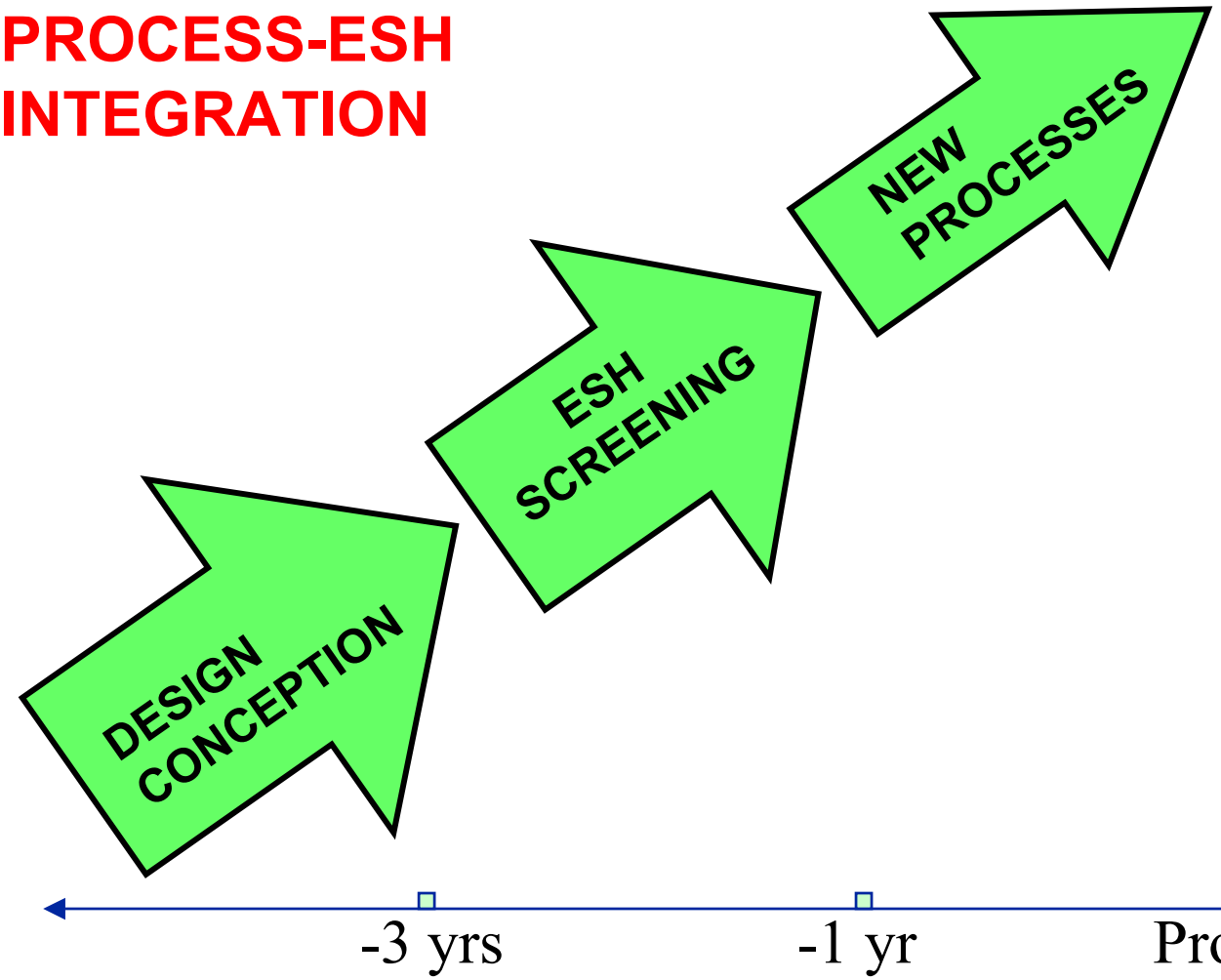
1. To support process and product development business strategy.
2. Allow comparative assessment of process alternatives, from an ESH standpoint.
3. Identify early, effective solutions to mitigate the ESH impacts to TI personnel, product, assets, community and the environment.
4. Identify materials subject to regional bans or restrictions that could adversely impact global market acceptance of TI product.
5. Document results of ESH review and allow revision at a future date when new data is available.
6. New technology nodes for semiconductor manufacturing require drastic changes in chemistry.

PROCESS-ESH INTEGRATION

SAFE
for TI'ers & community

FAST
ramp-to-market

COMPLIANT
to operate anywhere globally



Why Early ESH Screening?

1. **Support R&D and process decision-making**

2. **Fill data gaps, especially for new chemistries**
   - **Toxicology, exposure, physical / chemical data**

3. **Resolve long-lead regulatory steps such as**
   - **Toxic Substances Control Act (TSCA)**
   - **Environmental Permit Amendment and Approval**
   - **Dispersion Modeling Impact Assessment**

4. **Identify engineering controls to mitigate impact to personnel and environment** (FMEA, Process Hazard Analysis, etc)

5. **Develop changes to ESH procedures, PPE, training for affected operations personnel**

Process – Team Involvement

ESH Product and Process Development Team

-Partner with technology development teams to integrate ESH reviews early in the product development cycle

Unit Process Teams

- Develop and recommend new processes, materials and equipment to be implemented, based on review and evaluation

Business Leadership Team

– Provide the decision gate for the development & implementation of new process flows, materials, unit processes and equipment

Scenario's that trigger the screening process

1. **Material/formulation is new to TI or new to a TI site**
2. **Significant formulation/use change for an existing material**

   Material replacement in any process:

   - Change of constituent(s) in an existing formula

   - Change in concentration (that changes safety ratings)

   - Change in mode of usage

   - Other process changes identified by a Unit Process team
3. **New ESH data comes to light for a material currently used at TI**

   - Review will be escalated based on case-by-case evaluation of the nature of new data available

Outcomes

Designation of a material:

Category 1 - Expected to be Prohibited
Category 2 - Requires FMEA and approval from leadership team
Category 3 - Approved by Site ESH team with restrictions

ESH conditions for use:

Site specific

Process specific

Special conditions, if any - detection, monitoring, PPE etc.

Cycle time issues

Delays

- Insufficient Data on New Materials
- Proprietary information on datasheet
- Lack of communication to suppliers on chemical Screening Process

Resolutions to minimize delays

- Sematech Chemical Data Acquisition Project
- Supplier education
- Supplier selection criteria
- Corporate Non-Disclosure Agreements w/ suppliers
- Authorized access to datasheets

Summary

- An effective, comprehensive Material Screening Process not only benefits the Environment, Safety and Health, but contributes to Business strategies and objectives.
- The Material Screening Process must be integrated early into the manufacturing process in order to be effective.
- Any new material, significant change to an existing material or material with new safety and health data must go through the Material Screening Process.

Material Screening Request Process

Roles and Responsibilities

Requestor (ordering Engineer)

- Initiates Chemical Screening Datasheet (first page only)
- Attaches a vendor/supplier Material Safety Data Sheet

Chemical Screening Coordinator/Site ESH

- Complete ESH Screening Datasheet determining classification of chemical based on criteria
- Assist in evaluation process when classified as Category 1 or 2
- Document ESH conditions for use

ESH Chemical Review Board

- Examine requests that have been designated as a Category 1 or 2

ATTACHMENT B: CHEMICAL REQUEST FORM

****Attention Requester – Please fill out Page 1 Only, This information will be TI Strictly Private****

Choose the most appropriate request

I ASSESSMENT DOCUMENTATION	Request Order Number
1. Requester Name: Employee Number:	2. Requesting Site/Bldg: Group/Module: Department:
3. Phone Number: Pager Number: E-mail:	4. Division: Cost Center: Mail Station/PC Drop:
Need by Date:	

II CHEMICAL INFORMATION	**Requester must attach a current manufacturers MSDS (preferably electronic)*
1. Trade/Product Name:	

Composition, Information on Ingredients

Ingredient	CAS	% by Weight

**Proprietary Ingredients, CAS Numbers and %by Weight must be identified from Manufacturer before material can be ordered.*

2. Quantity Requested:		Chemical State:	Gas
Container Type:		Container Size:	Cost per Unit: *(optional)*
3. Chemical Manufacturer:			
Manufacturer Contact:		Phone:	

III PROCESS INFORMATION			
1. Functional Area:			
2. Brief Description of Process (Reason for Use):			
3. State how the chemical will be handled/dispensed (i.e. manual or automatic dispense, etc.):			
4. Process Operating Temperature:		Chemical Concentration Used in Process:	
5. Tool Type:		Tool Manufacturer:	
Tool Model:		MISTI ID#:	
6. Process Contact:		Phone:	

Requester Signature: Date:
(If not sent via electronic message)

Managers Signature: Date:
(If required by site)

To be completed by ESH for Purchasing use only

Material can be purchased by: This material has not been approved for purchase

ATTACHMENT B: CHEMICAL REQUEST FORM
ESH REQUIREMENTS

The following is to be completed by the Building/Site ESH team to emphasize special requirements for the chemical/material being requested. It is the responsibility of the requester to ensure that all of these requirements are met prior to use of the material.

Product Name:	**Part/Special Order Number:**

Order Request Status: Evaluation in Process
Final TI Classification: Pending
Re-Orders: Select most appropriate

SAFETY REQUIREMENTS:

Control Measures (SOP, Etc.): To be used in the tool only; Additional Comments:
Fixed Air Monitoring Requirements: Additional Comments:
Storage: Product to be stored in Additional Comments:
Chemical Incompatible with: Other:
Fire Extinguishing Media:
Other:

INDUSTRIAL HYGIENE REQUIREMENTS:

Personal Protective Equipment (PPE) Requirements:
Eye/Face Protection:
Skin Protection:
Type of Material:

Respiratory Protection:
NIOSH/OSHA approved (type of respirator) with for operations where prolonged or repeated respiratory exposure may occur.
Additional Comments:

Personal Air Monitoring Requirements: Additional Comments:
Ventilation: Additional Comments:
Other:

ENVIRONMENTAL REQUIREMENTS:

Waste Considerations: Additional Comments:
Air Emissions Requirements: This chemical's emissions will be connected to . Additional Comments:
Waste Water Requirements: Additional Comments:
Other:

HAZMAT REQUIREMENTS:

Emergency Response Protocol: Respond in with glove covers. Additional Comments:
Other:

REGULATORY IMPACT – GLOBAL/REGIONAL SITE REQUIREMENTS::

TSCA / International Counterpart Record Keeping Requirements: None
Other:

OTHER:

Applicable Standards/Reference Documents:	Other:
Known Pending Regulations:	Other:

EVALUATION SIGNATURES: **May vary based on building requirements.*

CHEMICAL DESIGNATION WORKSHEET

Product Name:	Part/Special Order Number:

1. Toxic Substance Control Act (TSCA) Status

	Y/N	Comments	If "Yes"	Additional Action Required
Material to be used in U.S. Manufacturing: ▪ Not on TSCA Inventory, ▪ Not on TSCA Inventory with a PMN filed, ▪ Subject to SNUR ▪ Has R&D Exemptions			Category 2	Notify TSCA Coordinator. Material may not be used in manufacturing until all components are listed on TSCA inventory and/or have Low Volume Exemptions (LVE), or Low Risk of Exposure Exemptions (LoREX).
TI manufactured chemical with the potential for export outside U.S.			Category 2	Notify TSCA Coordinator.
Material to be used in R&D: ▪ R&D Exemption			Category 3	Notify requestor/users of documentation and special use requirements (R&D use only).
Material to be used in U.S. Manufacturing or R&D: ▪ All components are listed on TSCA inventory, have Low Volume Exemption (LVE) or Low Risk of Exposure (LoREX) Exemption			Category 3	No further action required.

2. Ratings (Flammable and Reactive): *Please specify NFPA, HMIS, or Both*

Flammable: Reactivity:

Combination:	4	and	4 (time sensitive)	Category 1
Combination:	4	and	4 (not time sensitive)	Category 2
Any combination:	3 or 4	and	3 or 4	Category 2
Any combination:	1, 2, 3 or 4	and	2, 3, or 4	Category 3
Either	1, 2, 3 or 4	or	1,2, 3 or 4	Category 3

Flash Point: ° Boiling Point: °

Pyrophoric or ignites spontaneously in air at or below 130°F (54.4°C)	Category 2
Liquid /Liquefied Gas with Flash Point below 73°F (22.8°C) and boiling point at or above 100°F (37.8°C)	Category 3
Liquid with a Flash Point at or above 73°F (22.8°C) and below 100°F (37.8°C)	Category 3

3. Ratings (Health and Special Notice): *Please specify NFPA, HMIS, or Both*

Health:

Health Rating:	3 or 4	Category 2
Health Rating:	1 or 2	Category 3

Special Notice:

Special Notice:	W, OX or Other	Category 3

4. Explosive Ratings

	Y/N	Comments	If "YES"
Class 1, Division 1.1,1.2,1.3 or 1.5			Category 1
Class 1, Division 1.4			Category 2

5. Radioactivity

	Y/N	Comments	If "YES"
Neutron Emitting Source			Category 1
Transuranic Element			Category 2

ATTACHMENT B: CHEMICAL REQUEST FORM

CHEMICAL DESIGNATION WORKSHEET, Cont.

6. Health Data	Y/N	Comments	IF "YES"
Select Glycol Ethers:			Category 1
Ethylene Glycol Monoethyl Ether (EEGE), CAS#110-80-5			
Ethylene Glycol Monoethyl Ether Acetate (EGEEA), CAS#111-15-9			
Ethylene Glycol Monomethyl Ether (EGME), CAS#109-86-4			
Ethylene Glycol Monomethyl Ether Acetate (EGMEA), CAS#110-49-6			
Diethylene Glycol Dimethyl Ether (DIGLYME), CAS#111-96-6			
Select Chemicals:			Category 1
Asbestos			
Benzene			
Pentachlorophenol			
Tetramethyl ammonium hydroxide (TMAH) at a concentration of greater than 5%			
Vinyl Chloride (Monomer)			
Known or Suspect Carcinogen:			Category 2
-IARC Group 1, 2A or 2B			
-ACGIH A1, A2 or A3			
-NTP "Known carcinogens" or "Reasonably anticipated to be carcinogens"			
-Proposition 65			
Reproductive Toxin			Category 2
Highly Toxic:			Category 2
Oral: LD50___< 50mg/kg			
Dermal: LD50___< 200mg/kg			
Inhalation: LC50___< 200ppm gas or vapor			
Inhalation: LC50___< 2mg/L mist, fume, or dust			
Toxic:			Category 3
Oral: LD50___< 500mg/kg			
Dermal: LD50___< 1000mg/kg			
Inhalation: LC50___<2000ppm gas or vapor			
Inhalation: LC50___<20mg/L mist, fume, or dust			
Systemic Toxicant			Category 2
Target Organ Effector			Category 3
Biological Agent: Bio-safety Level 3 or Bio-safety Level 4			Category 1
Biological Agent: Bio-safety Level 2			Category 2
Biological Agent: Bio-safety Level 1			Category 3

7. Environmental Data	Y/N	Comments	IF "YES"
Select Halogenated Dioxins and Furans			Category 1
Persistent Organic Pollutants (POP's) Treaty List			Category 1
Ozone Depleting Substance (ODS) Class I			Category 1
Ozone Depleting Substance (ODS) Class II			Category 1
Perfluorocarbon (PFC) List:			Category 2
SF6, CF4, C2F6, CHF3, NF3, C3F8			
Hazardous Air Pollutants (HAPs)			Category 2

8. Other	Y/N	Comments	IF "YES"
Insufficient Data:			
Customer Requirements:			
Horizon Issues:			

Category 1

Category 1: Chemicals that meet one or more of the following criteria are expected to be prohibited from use at TI, as far as practically possible. Limited exceptions will only be made by the appropriate business leadership team following required review as determined on a case-by-case basis by the Chemical Review Board ("CRB").

Requires Leadership Team Approval	Safety	Health	Environmental
	• Explosive – Shipping Hazard Class 1, Divisions 1.1, 1.2, 1.3 or 1.5 as defined by UN/DOT • NFPA Reactivity rating of 4 and Flammability rating of 4 and becomes unstable over time (without human intervention)	• Neutron Emitting Sources • Confirmed Human Carcinogen IARC, Group 1 or 2A • TI Select Chemicals: EEGE CAS#110-80-5 EGEEA CAS#111-15-9 EGME CAS#109-86-4 EGMEA CAS#110-49-6 DIGLYME CAS#111-96-6 TMAH, >5%	• Ozone Depleting Substance – Class I based on Montreal Protocol
	• TI Prohibited Chemical List		

Category 2

Category 2: Chemicals that meet one or more of the following criteria require a Failure Modes and Effect Analysis ("FMEA") and approval by the appropriate business leadership team. These chemicals will be reviewed by the CRB and may be exempt from review by the business leadership team based on a case-by-case assessment. Chemicals that do not meet the criteria for a Category 1 or 2 may be elevated to the CRB due to insufficient data, "horizon" issues or regional requirements based on the professional judgment of the site ESH team.

Requires CRB Review, May Require Leadership Team Approval

Safety	Health	Environmental
• Explosive – Shipping Hazard Class 1, Division 1.4 as defined by UN/DOT • NFPA Reactivity rating of 4 **and** Flammability rating of 4 (not time sensitive) • NFPA Reactivity rating of 3 or 4 **and** Flammability rating of 3 or 4 • Pyrophoric • Liquid/Liquefied Gas with a flash point below 73°F (22.8°C) and boiling point below 100°F (37.8°C)	• Transuranic Element • Highly Toxic: -oral LD50 <50mg/kg –dermal LD50 <200mg/kg –inhalation LC50 <200ppm gas or vapor –inhalation LC50 <2mg/L mist, fume or dust • Suspect Carcinogen • Confirmed/Suspect Reproductive Toxin • Liver, Kidney, Central Nervous System, or Blood System Toxin • NFPA or HMIS Health rating of 3 or 4 • Insufficient data	• Toxic Substance Control Act (TSCA) - Used in U.S. Manufacturing or R&D: -Not listed on TSCA inventory -Not listed on TSCA inventory, PMN filed -Subject to SNUR -Has R&D exemptions -Potential for export outside U.S. • Ozone Depleting Substance – Class II based on Montreal Protocol (Does not include closed-loop refrigerants.)
• TI Identified Category 2 Chemical List		

Category 3

Category 3: Chemicals that do not meet any of the previous criteria require site ESH review only and do not require review by the CRB or business leadership team. However, these chemicals may still have requirements for additional controls, reporting and/or employee training as determined by the site ESH team. Chemicals that meet the criteria for Category 3 may still be elevated to the CRB based on the professional judgment of the site ESH team.

	Safety	Health	Environmental
Does not require CRB or Business Leadership Team Review	• Government/ Regional Regulations • NFPA Reactivity rating of 2 **and** a Flammability rating of 1 or greater • NFPA Reactivity rating of 3 or 4 • NFPA Flammability rating of 3 or 4 • Liquid with a flash point below 73°F (22.8°C) and a boiling point at or above 100°F (37.8°C) • Liquid with a flash point at or above 73°F (22.8°C) and below 100°F (37.8°C) • NFPA rating includes Special Notice designation	• Government/ Regional Regulations • Radioactive Materials that are licensable or have waste disposal issues • Toxic: -oral LD50 <500mg/kg –dermal LD50 <1000mg/kg –inhalation LC50<2000ppm gas or vapor –inhalation LC50<20mg/L mist, fume or dust • Liver, Kidney, Central Nervous System, or Blood System Effector • NFPA or HMIS Health rating of 2 • Biological Agent	• Government/ Regional Regulations • Toxic Substance Control Act (TSCA) - Used in U.S. Manufacturing or R&D: -All components of material must be listed on TSCA inventory and/or have Low Volume Exemptions (LVE), or Low Risk of Exposure Exemptions (LoREX) • Global Warming Compound on the TI/EPA Agreement List: SF6, CAS#2551-62-4 CF4, CAS#75-73-0 C2F6, CAS#76-16-4 CHF3, CAS#75-46-7 NF3, CAS#7783-54-2 C3F8, CAS#76-19-7 and #218599-63-4

Screening process check mechanisms

1. Site personnel must submit datasheet along with MSDS to request a TI part number for the material
2. Tracking (web-based) file generated for chemicals under review
3. Monthly chemical purchase reports reviewed and compared to chemical database and tracking matrix to identify chemicals that have not been screened
4. Incorporate screening process evaluation into ESH Audit protocol

Documentation and Record Keeping

- Material designations are documented in a Chemical Screening Database

- Completed datasheets are stored in a designated server location

- Datasheets are accessible to authorized personnel

- Datasheets may be updated following new use reviews or evidence of new information for a material

Exemptions

- Laboratory operations that fall under OSHA Lab Standard
- TCEQ Permits by Rule (Texas) for Laboratory Operations are not required to undergo the ESH Screening Assessment, unless deemed necessary by the Site ESH personnel
- These operations will still be subject to site-specific regulatory reviews including but not limited to MSDS review and permitting.

For further information, contact:

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