AIGA 2005 Meeting

AHA



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Electronic Specialty Materials

A typical Semiconductor Fab uses over 100 Electronic Specialty Materials (ESM) which include:

Electronic Specialty Gases (ESG) Electronic Specialty Liquids (ESL)

- There are over 300 different Electronic Specialty Materials in common use. These have a wide variety of hazards, with many having multiple hazards.
- In some cases these are new materials which have limited data.
- These are supplied in a wide variety of packages ranging from small bubblers (50 gms) to large ISO containers (18,180 kg)



Air Products Supplies Electronic Specialty Gases which have a Variety of Hazards

Ammonia Argon Arsine **Boron Trichloride Boron Trifluoride Carbon Dioxide Carbon Tetrafluoride** Chlorine **Chlorine Trifluoride** Diborane **Dichlorosilane** Disilane **Fluorine** Halocarbon 23, 32, 116

Helium Hydrogen **Hydrogen Bromide** Hydrogen Chloride Hydrogen Fluoride Hydrogen Iodide Hydrogen Selenide **Methyl Fluoride** Methyltrichlorosilane Nitrogen Nitrogen Trifluoride **Nitrous Oxide** Octafluorocyclobutane Oxygen

Perfluoropropane **Phosphine Phosphorus Pentafluoride** Silane Silicon Tetrachloride Silicon Tetrafluoride Sulfur Hexafluoride Sulfur Tetrafluoride Tetrafluoromethane **Trichlorosilane Trimethylsilane Tungsten Hexafluoride Xenon**



Air Products Supplies Electronic Specialty Materials which have a Variety of Hazards



Ammonium Hydroxide Bis(tertiarybutylamino)silane Diethoxymethylsilane Octamethylcyclotetrasiloxane Pentakis(dimethylamide)tantalum Tantalum (5+) salt ethanol Tetrakis(diethylamino)titanium **Tetraethyl Orthosilicate** Trimethylphosphite 1,3,5,7-tetramethylcyclotetrasiloxane Dimethyldimethoxysilane trans-1,2-dichloroethylene Ethanol

ric Acid

Arsenic

Trimethylvinylsilyl)hexafluoroacetylacetonato Hafnium Tetrachloride **Phosphorus Tribromide Phosphorus Oxychloride** 1,1,1-Trichloroethane **Triethylarsenate Titanium Tetrachloride** Trimethylphosphate Isopropanol **Methanol**

Boron Tribromide Antimony Trioxide Hydrofluoric Acid Red Phosphorus Triethylborate Triethyl Phosphate Trimethylborate Tetramethylsilane tris-t-pentoxysilanol Hydrogen Peroxide **Hydrochloric** Acid



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Nitric Acid

Key Hazards of ESM

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- Pressure
- Extreme Cold
- Health
- Toxicity
- Corrosivity
- Flammability
- Reactivity

- Oxidizing
- Water Reactive
- Asphyxiant
- Pyrophoric
- Explosive
- Self Reacting





Cylinder and Container Sizes



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Liquid Containers











Bulk Supply





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Bulk ESG, NH₃, SiH₄, NF₃

For high flow and continuous supply, many sites now pipe the gas in from bulk ISO systems





ESM Product Life Cycle ER Preplans



Emergency Response Best Practices



Air Products has an extensive ER Program in place for ESM products

- Equipment or Procedure in place for high priority products (toxic, pyrophoric, corrosive) or package handled at each location
- Design ER Equipment if none available
- Training of Responders
- Training of local Public Agencies
- Site Specific ER Plan
- Generic ER preplans for Package/Product Combinations
- Specialized Package and/or Product Training
- Translation of MSDS and Safetygrams into local language
- Translation of key Medical Treatment protocols into local language
- Training of Medical Facilities
- Donation of Reference Manuals to Public Agencies and Hospitals
- Mutual Aid





Challenges



- ER is a part time activity
- We cannot control the time, problem or location of the incident
- The cost for ER Equipment and Personal Protective Equipment (PPE) is significant
- Level of knowledge (Many new products and variety of hazards)
- Cultural (ER requires independent thinking and action)
- Experience (We don't have enough incidents!)
- Systems to Overcome these issues
 - Regular Training Procedures
 - Standard Equipment
 - Standard Phrases
 - Mentoring
 - **Technical Support**







Air Products' Worldwide Emergency Response Effort

- Air Products has a worldwide network of ER Teams and Equipment to assist local customers or public agencies.
- Sites have an extensive ER
 Equipment inventory available for
 ESM Products
- Assistance is immediately available through a 24 hour ER Center located in Allentown, PA
- Translation Services available from AT&T
- Each country has a national ER number



800-523-9374 Continental U.S., Canada and Puerto Rico

610-481-7711 Other Locations

24 Hours/Day 365 Days/Year





Emergency Communications Center Allentown, PA

- Operates 24/7
- Also responsible for Global Security
- Crisis management
- Goal is to connect caller and a ER Coordinator within 5 minutes of the call
- Call documentation
- MSDS Source





Air Products ESM ER Teams Far East



Emergency Response Containment Vessel (ERCV), Primary Cylinder ER Device







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ERCV's Worldwide







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Typical Site Air Products ESG Emergency Response Equipment



Portable ER Scrubber



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Leaking Cylinder

Cap

Other ER Equipment









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Typical Cold Coil Transfer

The Leaking Cylinder can be bagged with MacGuyver Bag to contain leak The Leaking Cylinder should be secured From rolling and lifted high enough for Valve handwheel to be turned To prevent over fill, weigh both cylinders before and after. If transfer stops, isolate coil and vent gas from receiving cylinder to

cool

Purge Leaking Cylinder with gas at 100 psig a minimum of 3 times and 5 times for Hydride gases



PRODU

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ER Vehicle and Equipment

The following are some examples from around the world

Some teams prefer the extra storage and work space from a trailer

No matter which you choose, the vehicle must be capable of the following

•Transporting a minimum of 2 fully equipped responders (SCBA, Level A, B, Boots, Gloves, etc)

•Transporting the ERCV and other ER Equipment. Must have a means of securing these

•Tools

•Gas Detection

Reference Books

•Miscellaneous, Cylinder Carts

Some nice to haves

•Work table and Vise

•Cable Winch or lift gate to offload ERCV

Emergency Generator

Exterior Lighting



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Shah Alam, Malaysia



Hometown, PA

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DAIDO AIR /. PRODUCTS

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Osaka, Japan

Ulsan, Korea





AIGA

Tuas, Singapore

Kulim, Malaysia PRODUCTS



Shiwha, Korea

KOREA SPECIALTY GASES LTD

EMERGENCY RESPONSE TEAM T.0345-433-3070

Shanghai, China

ER Trailers Tualatin, OR & Santa Clara, CAa











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ER Equipment Storage



All of the PPE and ER Equipment will not fit on the ER Vehicle. A dedicated storage area is used

Easy to maintain and inventory
Secure
Equipment is stored in climate controlled conditions
Easy to grab and run



Shiwha, Korea



Shenzen, China





Shanghai, China AIR PRODUCTS

