

# SEMI S30 Guideline

Energetic materials and methods for  
mitigating process exhaust pipe hazards

Steve Cottle  
Senior Applications Manager

David Blackman  
Project Leader

Michael Gordon  
Applications Manager



# SEMI S30 – SAFETY GUIDELINE

For energetic materials in semiconductor R&D and manufacturing processes

Many processes used in manufacturing semiconductors require reactive chemistry; some of the process chemicals used are “energetic materials”, that is, they are hazardously exothermic, pyrophoric, or water reactive. Using some process chemicals can produce by-products that are energetic materials.

Control mechanisms are in place to mitigate the risks of such materials.

This Safety Guideline is intended as a minimum set of safety criteria for the procurement, storage, handling and use of energetic materials in semiconductor R&D and manufacturing processes, in all phases of use from process chemical supply through to abatement.

This Safety Guideline is intended to be industry best practices as of its publication date.





# Understanding semiconductor process exhaust hazards

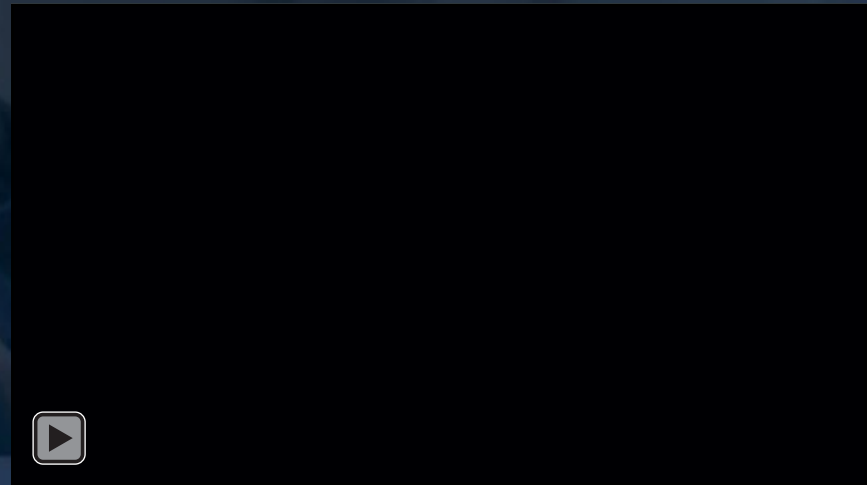
It is important therefore to understand all of the hazards that these energetic materials pose to vacuum and exhaust systems. Along with being energetic, the materials may also be highly flammable, or even extreme oxidising agents. They may be corrosive or condensable.

We therefore need to consider the design of the vacuum and exhaust management system as ONE system.

From the turbo pump, the foreline, the process vacuum pump through the exhaust line to the abatement system, we need to consider *all* aspects of system design with appropriate risk reduction.



Steve Cottle on energetic materials  
See the full video at [edwardsinnovation.com](https://www.edwardsinnovation.com)



# Assessment of an integrated vacuum and exhaust management system



HVM semiconductor process with known energetic materials

- Process gases
- Potential exhaust management issues

Design a vacuum and exhaust management system to the best-known method (BKM)

Assess the System to Semi S30 Chapter 17

Ta	W	Re	Os	Ir	Pt	Au	Hg	Tl	Pb	Bi	Po	At	Rn
Db	Sg	Bh	Hs	Mt	Ds	Rg	Uub		Uuq				
Pr	Nd	Pm	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb		
Pa	U	Np	Pu	Am	Cm	Bk	Cf	Es	Fm	Md	No		

# Integrated vacuum and exhaust management

**Atlas Helios** for abatement of deposition process gases and acid-clean gases

Includes 3" burner and atomising spray packed tower

- Factory tested leak tight pipework
- Exhaust should be kept hot
- TMS set up to 150 °C for epitaxy applications
- Keep exhaust line as short as possible with minimum bends



- Gate valve for pump isolation at PM
- Includes built-in leak check port
- Soft Start Functionality
- Foreline Purge facility (Foreline typically heated)



- iXH1220H or iXH3050H** with 96 slm purge
- Run the pump hot (at default 160 °C)
  - Online monitored N<sub>2</sub> dilution

# Integrated vacuum and exhaust management

## Control

Advanced HMI for integrated control of vacuum, TMS, abatement and services



## Communications

Internal communications between vacuum and abatement  
External communications to tool and life safety systems

## Prognostics

Measurement of typical indicators to predict and thus prevent failures



## Advanced power distribution

Facilities monitoring and safety circuits



# System Assessment to Semi S30 Chapter 17

Component	Compliance
1. Foreline	✓
2. Foreline trap	✓
3. Foreline valve	✓
4. Foreline side port	✓
5. Foreline nitrogen purge	✓
6. Valved port	✓
7. Pump	✓
8. Pump Power	✓
9. Silencer	✓
10. Exhaust purge	✓
11. Backflow prevention	✓
12. Exhaust equipment containment	✓
13. Exhaust heating	✓
14. Exhaust components	✓
15. Abatement by- pass	✓
16. Chamber over- pressure line	✓
17. Abatement	✓



# Process exhaust risk reduction



Establish standard process BKM  
(Best Known Method)

- Co-work with tool makers
- Global experience
- TDR process database

Design exhaust pipe to match  
standard BKM

- Minimum number of bends & joints
- Shortest length
- Temperature profile
- Dilution control

Build / commission / test to  
verify BKM

- Leak checking
- Dry-pump set-up
- Abatement set-up

Monitor and control

- Dilution flow rates
- Gas leak detectors
- Temperature profile
- Cabinet extraction

Expert service to ensure  
safety / reliability

- Global SOPs
- Training and experience
- Continuous improvements



# Conclusion - system assessment to Semi S30 (Chapter 17)

Integrated vacuum and exhaust management systems designed, constructed, installed and operated to:

- Best known methods
  - Safety applications procedures
  - Service operating procedures
- assessed to comply with the intent of SEMI S30 Ch17





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