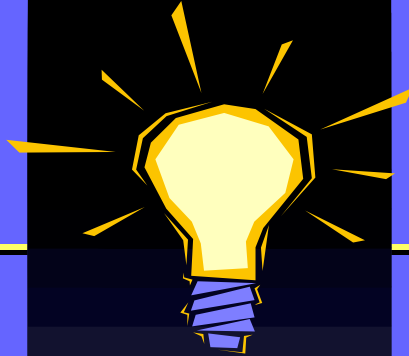


NEW MATERIAL EH&S CHALLENGES: A SUPPLIER'S PERSPECTIVE

November 15, 2001

**Engineering Research Center
for Environmentally Benign
Semiconductor Manufacturing**

WHY ARE WE HERE?



- The semiconductor industry's rapid pace of technology advances.
- Use of existing chemicals is close to optimization from technology perspective.
- New materials must be introduced to semiconductor manufacturing to achieve future technology advances.



- **Data gaps may exist**
- **Discomfort due to unfamiliarity with new materials**
- **Suitability of existing facilities**
 - Equipment
 - Processes (I.e. compatibility of by-products)
- **Potential need for regulatory approvals**

➤ **Acceptable Risk?**

- Inherent material hazards

- Worker exposure controls
 - Engineering controls
 - PPE



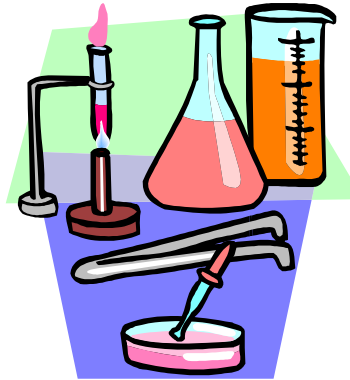
Intellectual Property (IP) Concerns

➤ **Initial Interest**

- Originates with
 - In-house technology group
 - OEM tool manufacturer
 - Device manufacturer
- Research available information
- Assess/address data gaps
 - If air/moisture sensitive consider use of information on by-products.
 - Consider use of attributes common to the chemical family.
 - Perform small scale qualitative experiments in-house.
 - Confirm with technology group that hazard assessment makes sense.

➤ Initial Interest

- Consider capabilities of manufacturing facility.
 - Open/closed system
 - Adequacy of engineering/administrative controls
 - Building codes
 - PPE



- Global regulatory Status and related issues

➤ **Key Domestic Regulatory Agencies**

- **EPA**
 - Risk Management Program (CAA)
 - SARA Title III
 - TSCA
- **OSHA**
 - Process Safety Management
 - Hazard Communication Standard
- **Department of State**
 - Chemical Weapons Convention
- **Drug Enforcement Administration**
- **State Agencies**

➤ **United States - TSCA**

- Low Volume Exemption - 30 day review
- Pre-manufacturing Notice - 90 day review
- Various rules exist which EPA may utilize.



- **European Union - 67/548/EEC (New Chemical Substances Directive)**
 - Different levels of notification are volume based.
 - Levels of notification include:
 - Annex VIIC
 - Supply at 10 - 100 kg/year
 - 2-3 months
 - Annex VIIB
 - Supply at 100 - 1000 kg/year
 - 9-12 months
 - Annex VIIA (The Base Set of data points required)
 - Supply at > 1000 kg/year
 - 12-18 months
 - Level 1 and Level 2 – Cumulative volume triggers
 - The quantity supplied
 - The results of the base set tests
 - The degree of exposure to man and the environment

- **European Union - 67/548/EEC (con't.)**
 - All levels of notification require a risk assessment.

 - Toxicity, physico-chemical data requirements vary with the level of notification.

 - Several exemptions exist.

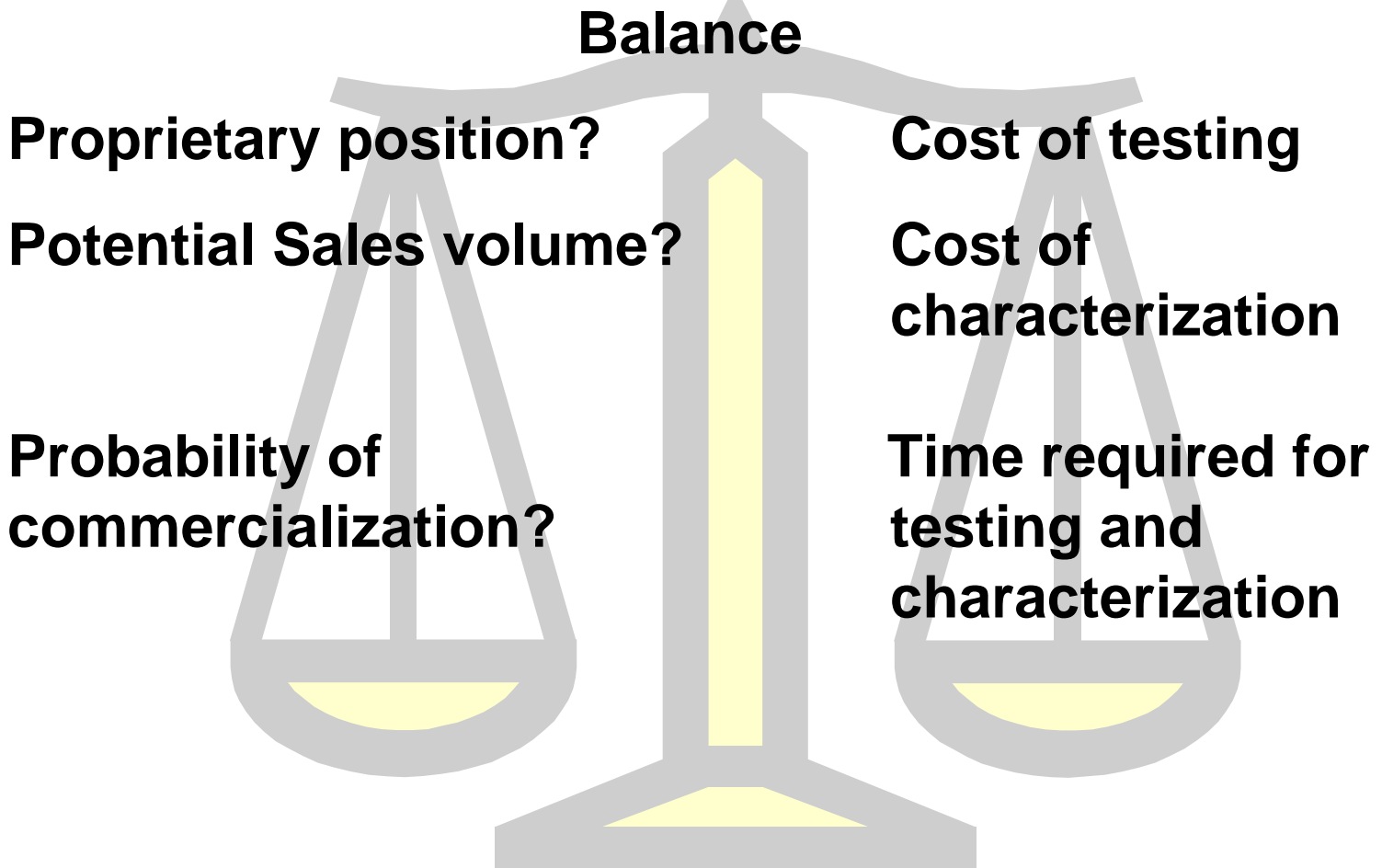
➤ Chemical Control Regulations

- Japan
 - MITI's Shin-Kashin-ho (New chemical substances control law)
 - Biodegradation scheme
 - MOL's Roan-ho
 - Modified Ames
- Other Countries with Chemical Control Regulations include:
 - Korea
 - China
 - Australia
 - New Zealand
 - Phillipines



- **Industry Concerns**
- **PFOS: Traditional chemicals may also be subject to increased scrutiny.**
 - Proposed SNUR
 - EU White Paper proposes a testing scheme for existing chemicals, similar to that of HPV/NCSN (EU)

➤ **Cost vs. Opportunity Assessment**



➤ **Example: Hi K Precursors**

- Low volume
- Low cost
- Multiple candidates

➤ Product Risk

- Risk (Defined by APCI): The likelihood and severity of adverse effects occurring.
- The magnitude of *Risk is a function of Hazard (H) and Exposure (E)*

Risk = (hazard) (exposure)



- **Exposure Assessment:**
Most probable operations to result in exposure?
What type of exposure?

- Manufacturing
- Transport
- Point of Use Handling



- **Handling at Facility**
 - Closed system
 - IH monitoring shows no detectable exposure.

- **Handling at End Use**
 - No exposure expected during routine handling.
 - Worker exposure during equipment PM would be an area of consideration.

- **Most Common Studies Sponsored for CVD Precursors**
 - Acute toxicity
 - Flammability Studies
 - Flash Point
 - AIT (Autoignition Temperature)
 - LEL/UEL (Lower Explosive Limit/Upper Explosive Limit)
 - Materials Compatibility Experiments
 - Joint Work with Detector / Glove Manufacturers

➤ Time

- Product Testing
- Preparation of Product related documents
 - MSDSs
 - Training packages
 - Promotional literature
- Preparation of Regulatory Application
- Gov't review of application

➤ Cost

- Product Testing
- Manpower in testing and coordination, document preparation.
- Manpower in application submissions



➤ Time

- Coordination of obtaining EH&S info in a manner that allows the semiconductor industry to keep up with technology advances and still allow for good EH&S decision making.



- **More and more dialogue is occurring with stakeholders on how to address these issues.**
- **Supplier/End-User Dialogue**
 - one-on-one
 - mediated by industry groups
- **Must be multi-disciplinary effort**
 - EH&S
 - Technology
 - Process
 - Commercial

LESSONS LEARNED

- **New Product Development Takes Team Work!**
- **Partnering with Colleagues is very valuable.**

