Beyond R & D: Development of a Chemical Review Forum for High Volume Manufacturing

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Presentation Agenda

The Situation
• There is an ongoing need for early identification of chemical proliferation issues for new high volume manufacturing (HVM) processes

The Potential Issues
• Gaps in chemical review leading to potential employee exposure, regulatory issues with chemical importation and waste, resulting in production delays

The Resolution
• Creation of chemical review forum that implemented a systematic evaluation process of manufacturing chemicals at the optimal stage in the development cycle. The forum utilizes unique tools and involves all required stakeholders.
Situation - Background

Chemical Evaluation Process

• EHS evaluates *all* chemicals prior to arrival at company facilities to ensure safe use (e.g., transport, storage, handling, disposal) at a site level

Problem Statement

• There was no comprehensive, cross-site evaluation process for new high volume manufacturing chemicals
• This gap can lead to regulatory issues and to production delay
Challenges

- Selecting right time in process development to conduct comprehensive, cross-site chemical review

![Diagram showing process flow]

- Research/Collaboration
- Path Finding
- Technology Development
- High Volume Manufacturing
- Chemical Evaluation
  - EHS provides potential use restrictions to Research Engineers
  - Chemical Evaluation for On & Off site chemical use (R&D)
    - ~5000 Chemicals Annually
  - Chemical Evaluation for HVM Chemistries
    - ~200 Chemistries
More Challenges

- **Obtaining new process chemical list:**
  - Closely guarded complete list of process chemicals
  - Lacking partnership with Materials Organization to obtain list at optimal stage in development

- **Stakeholders:** Developing a forum with meeting format that incorporates the correct stakeholders for each process

- **Roles and responsibilities** of forum members: need clear definitions to streamline chemical evaluation process

- **Chemical Review tools:** Need the right tools for the job

- **Proprietary information:**
  - De-centralized collection, dissemination, and storage
  - Intellectual property (IP) information collection challenges lead to chemical review delay
Resolution Overview

Formation of Chemical Review Forum

- Partnership with process engineers and materials organization
- Review forum involves technology development site EHS and the receiving site EHS
- Team charter defines the roles and responsibilities of team members
- Designed tools that perform a comprehensive chemical evaluation
- Developed an application to store proprietary information
Resolution Detail: Information Acquisition

Communication with process engineers and materials organization to acquire process chemical lists at the optimal stage in development process

• Partnership with Technology Development Process Engineers
  – Regular meetings to acquire lists of top candidates for future processes
  – This work helps to narrow the number of chemicals that will need a cross-site forum review.

• Partnership with our Materials Organization
  – Materials knows when and why we need the Materials of Record (MOR) list before technology transfer begins
  – EHS resources leveraged to conduct thorough review of MOR list
Resolution Detail: Stakeholders

*Chemical Review Forum composed of the Technology Development Site EHS and the Receiving Site EHS*

- **Core team:** Technology Development site EHS
  - Develop team charter, R & R, prepare process specific chemical review spreadsheets
  - Team’s membership: Industrial Hygienist, Environmental Engineer, Toxicologist, Materials Dept. representative, Global EHS representative

- **Full Team:** Core team plus receiving site EHS
  - Full team membership determined by the process roadmap
    - Only sites who will receive the technology need to come to a particular process’s review forum
  - Receiving site EHS: Industrial Hygienist, Environmental Engineer
Resolution Detail: Roles and Responsibilities

*Team charter defines the roles and responsibilities of team members*

- **EHS at Technology Development Site:** Identify chemicals in new process and perform primary evaluation utilizing chemical review tools
  - Provide chemical evaluations to receiving site

- **EHS at Receiving Site:** Identify any country specific and site specific regulatory issues in new process chemicals
  - Need to know site and local regulations

- **Company’s Materials Organization:** Deal with suppliers to help obtain review information, push for any re-formulations needed, TSCA certification
Resolution Detail: Chemical Evaluation Tools

Designed tools that perform a comprehensive chemical evaluation

- **Chemical Review Forum Spreadsheet:**
  - Developed for each manufacturing process
  - Main tool used by forum that serves as a repository for chemical evaluation tools results
  - Spreadsheet details chemical use description, chemical composition, and review of potential EHS issues

- **Company’s List of Lists:**
  - Identify chemicals banned from use at Intel
  - Identify the chemical use restrictions and requirements
  - Identify the chemical hazard categories of a specific chemical
  - Provide guidance to chemical requestors on specific approval processes for specific chemicals
## Chemical Review Forum Spreadsheet

<table>
<thead>
<tr>
<th>Supplier</th>
<th>XYZ</th>
<th>Component Name</th>
<th>CAS Number</th>
<th>% Composition</th>
<th>Overall EHS Concern</th>
<th>Issues</th>
<th>TSCA Status</th>
<th>Overall Chemical Description</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>XYZ</td>
<td>1-methoxy-2-propanol</td>
<td>107-98-2</td>
<td>15-20%</td>
<td>Low risk</td>
<td>flammable</td>
<td>CERTIFIED</td>
<td>Dispensed in a closed track environment, only exposed to solvent and develop chemicals on the track.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Methyl 2-hydroxyisobutyrate</td>
<td>2110-78-3</td>
<td>75-80%</td>
<td>Low risk</td>
<td>skin irritant</td>
<td>CERTIFIED</td>
<td>* This chemical contains IP in Secured Database</td>
</tr>
<tr>
<td></td>
<td>31595-1</td>
<td>Modified methacrylate polymer</td>
<td>6220011-6000P</td>
<td>1-5%</td>
<td>Medium risk</td>
<td>eye irritant</td>
<td>CERTIFIED</td>
<td>can cause CNS effect at high levels</td>
</tr>
</tbody>
</table>

- **State**: Liquid
- **Projected HVM Quantity**: 4 gal/month
- **Process**: Flash memory
- **Functional Area**: Lithography
- **Equipment**: Litho-track
- **Propose Drain line**: Solvent drain

*This chemical contains IP in Secured Database*
Resolution Detail: Proprietary Information

*Developed an application to store proprietary information*

- **Secured Database** provides centralized repository for IP information
  - Reduced redundancy and expedites IP information requests
  - Supplier inputs data directly into database when they know that our company is considering chemistry
  - Limited membership of EHS personnel at each site can access the database and review IP information
Summary

• Problem:
  – There was no comprehensive, cross-site evaluation process for new high volume manufacturing chemical leading to potential regulatory issues and impacts to production timeline

• Resolution: Chemical Review Forum
  – Utilizes a systematic process to review manufacturing process chemical lists
  – Engages all stakeholders with defined roles and responsibilities
  – Employs specialized tools that give a comprehensive review and includes review of proprietary information
Thank You

Welcome

Questions
Our company’s High Volume Manufacturing (HVM) Chemical Review Forum developed out of a need to anticipate future product manufacturing issues during the Research and Development phase. The thorough evaluation of chemicals during the R&D phase is critical in order to prevent wasted time and resources in selecting chemicals that may encounter regulatory issues or factory specific issues downstream.

The challenges we faced in developing this forum were designing the meeting format and tools to fit our needs, enlisting the correct stakeholders, and obtaining the production chemical list. The resulting meeting format is a core team of EHS professionals that regularly meet to complete the initial review of each chemical. The team consists of industrial hygienists, environmental engineers, toxicologists, and a representative from our factory materials organization. The subsequent meetings involve the core team and EHS representatives from the sites that will receive the technology. It is these sites’ responsibility to review the chemicals and identify potential obstacles due to local regulations or factory specific issues.

Our current HVM Forum has been utilized for two new product lines. Its success can be measured by the reduction in last-minute regulatory issues at the manufacturing sites, heightened and earlier assurance of adequate EHS controls for new chemicals, and improved communication with stakeholders. The improved communication has increased EHS’s ability to obtain the proprietary list of production chemicals. It has also resulted in positive feedback from the EHS staff at the manufacturing sites receiving the technology, the factory materials organization, and factory engineers selecting production chemicals.