PSCI

PHARMACEUTICAL SUPPLY CHAIN INITIATIVE

# Anti-Trust Statement

While some activities among competitors are both legal and beneficial to the industry, group activities of competitors are inherently suspect under the antitrust/anti-competition laws of the US, UK and other countries in which our companies do business. Agreements between or among competitors need not be formal to raise questions under antitrust laws, but may include any kind of understanding, formal or informal, secretive or public, under which each of the participants can reasonably expect that another will follow a particular course of action or conduct. Each of the participants in this meeting is responsible for seeing that topics which may give an appearance of an agreement that would violate the antitrust laws are not discussed. It is the responsibility of each participant in the first instance to avoid raising improper subjects for discussion, such as those identified below.

It is the sole purpose of this meeting to provide a forum for expression of various points of view on topics described in the agenda and participants should adhere to that agenda. Under no circumstances shall this meeting be used as a means for competing companies to reach any understanding, expressed or implied, which tends to restrict competition, or in any way to impair the ability of members to exercise independent business judgment regarding matters affecting competition.

**Topics of discussion that should be specifically avoided are:**

- Price fixing
- Product discounts, rebates, pricing policies, levels of production or sales and marketing terms customer and territorial allocation
- Standards setting (when its purpose is to limit the availability and selection of products, limit competition, restrict entry into an industry, inhibit innovation or inhibit the ability of competitors to compete)
- Codes of ethics administered in a way that could inhibit or restrict competition
- Group boycotts
- Validity of patents
- On-going litigation
- Specific R&D, sales or marketing activities or plans, or confidential product, product development, production or testing strategies or other proprietary knowledge or information

# Pharmaceutical Industry Principles for Responsible Supply Chain Management

This document outlines the Pharmaceutical Industry Principles for Responsible Supply Chain Management (the "Principles") for ethics, labor, health and safety, environment and related management systems. The Principles may be voluntarily supported by any business in the pharmaceutical industry.

Companies supporting the Principles:

- will integrate and apply these Principles in a manner consistent with their own supplier programs.
- believe that society and business are best served by responsible business behaviors and practices. Fundamental to this belief is the understanding that a business must, at a minimum, operate in full compliance with all applicable laws, rules and regulations.
- are aware of differences in culture and the challenges associated with interpreting and applying these Principles globally. While companies supporting the Principles believe that what is expected is universal, it is understood that the methods for meeting these expectations may be different and must be consistent with the laws, values and cultural expectations of the different societies of the world.
- believe the Principles are best implemented through a continual improvement approach that advances supplier performance over time.

## Ethics

Suppliers shall conduct their business in an ethical manner and act with integrity. The ethics elements include:

**1. Business Integrity and Fair Competition**
All corruption, extortion and embezzlement are prohibited. Suppliers shall not pay or accept bribes or participate in other illegal inducements in business or government relationships. Suppliers shall conduct their business consistent with fair and vigorous competition and in compliance with all applicable anti-trust laws. Suppliers shall employ fair business practices including accurate and truthful advertising.

**2. Identification of Concerns**
All workers should be encouraged to report concerns or illegal activities in the workplace without threat of reprisal, intimidation or harassment. Suppliers shall investigate and take corrective action if needed.

**3. Animal Welfare**
Animals shall be treated humanely with pain and stress minimized. Animal testing should be performed after consideration to replace animals, to reduce the numbers of animals used, or to refine procedures to minimize distress. Alternatives should be used wherever these are scientifically valid and acceptable to regulators.

**4. Privacy**
Suppliers shall safeguard and make only proper use of confidential information to ensure that company, worker, and patient privacy rights are protected.

## Labor

Suppliers shall be committed to uphold the human rights of workers and to treat them with dignity and respect. The Labor elements include:

**1. Freely Chosen Employment**
Suppliers shall not use forced, bonded or indentured labor or involuntary prison labor.

**2. Child Labor and Young Workers**
Suppliers shall not use child labor. The employment of young workers below the age of 18 shall only occur in non hazardous work and when young workers are above a country's legal age for employment or the age established for completing compulsory education.

**3. Non-Discrimination**
Suppliers shall provide a workplace free of harassment and discrimination. Discrimination for reasons such as race, color, age, gender, sexual orientation, ethnicity, disability, religion, political affiliation, union membership or marital status is not condoned.

**4. Fair Treatment**
Suppliers shall provide a workplace free of harsh and inhumane treatment, including any sexual harassment, sexual abuse, corporal punishment, mental or physical coercion or verbal abuse of workers and no threat of any such treatment.

**5. Wages, Benefits and Working Hours**
Suppliers shall pay workers according to applicable wage laws, including minimum wages, overtime hours and mandated benefits.

Suppliers shall communicate with the worker the basis on which they are being compensated in a timely manner. Suppliers are also expected to communicate with the worker whether overtime is required and the wages to be paid for such overtime.

**6. Freedom of Association**
Open communication and direct engagement with workers to resolve workplace and compensation issues is encouraged.

Suppliers shall respect the rights of workers, as set forth in local laws, to associate freely, join or not join labor unions, seek representation and join workers' councils. Workers shall be able to communicate openly with management regarding working conditions without threat of reprisal, intimidation or harassment.

## Health and Safety

Suppliers shall provide a safe and healthy working environment, including for any company provided living quarters. The Health and Safety elements include:

**1. Worker Protection**
Suppliers shall protect workers from over exposure to chemical, biological, physical hazards and physically demanding tasks in the work place and in any company provided living quarters.

**2. Process Safety**
Suppliers shall have programs in place to prevent or mitigate catastrophic releases of chemicals.

**3. Emergency Preparedness and Response**
Suppliers shall identify and assess emergency situations in the workplace and any company provided living quarters, and to minimize their impact by implementing emergency plans and response procedures.

**4. Hazard Information**
Safety information relating to hazardous materials - including pharmaceutical compounds and pharmaceutical intermediate materials - shall be available to educate, train, and protect workers from hazards.

## Environment

Suppliers shall operate in an environmentally responsible and efficient manner to minimize adverse impacts on the environment. Suppliers are encouraged to conserve natural resources, to avoid the use of hazardous materials where possible and to engage in activities that reuse and recycle. The environmental elements include:

**1. Environmental Authorizations**
Suppliers shall comply with all applicable environmental regulations. All required environmental permits, licenses, information registrations and restrictions shall be obtained and their operational and reporting requirements followed.

**2. Waste and Emissions**
Suppliers shall have systems in place to ensure the safe handling, movement, storage, recycling, reuse, or management of waste, air emissions and wastewater discharges. Any waste, wastewater or emissions with the potential to adversely impact human or environmental health shall be appropriately managed, controlled and treated prior to release into the environment.

**3. Spills and Releases**
Suppliers shall have systems in place to prevent and mitigate accidental spills and releases to the environment.

## Management Systems

Suppliers shall use management systems to facilitate continual improvement and compliance with the expectations of these principles. The management system elements include:

**1. Commitment and Accountability**
Suppliers shall demonstrate commitment to the concepts described in this document by allocating appropriate resources.

**2. Legal and Customer Requirements**
Suppliers shall identify and comply with applicable laws, regulations, standards and relevant customer requirements.

**3. Risk Management**
Suppliers shall have mechanisms to determine and manage risks in all areas addressed by this document.

**4. Documentation**
Suppliers shall maintain documentation necessary to demonstrate conformance with these expectations and compliance with applicable regulations.

**5. Training and Competency**
Suppliers shall have a training program that achieves an appropriate level of knowledge, skills and abilities in management and workers to address these expectations.

**6. Continual Improvement**
Suppliers are expected to continually improve by setting performance objectives, executing implementation plans and taking necessary corrective actions for deficiencies identified by internal or external assessments, inspections, and management reviews.

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# PSCI - Auditor Training

**Hyderabad**

**Feb 28 – March 1, 2017**

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## Welcome and introduction

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## What is the PSCI?

**The Pharmaceutical Supply Chain Initiative**

An industry body formed by the pharmaceutical sector whose members share a vision for responsible supply chain management, to deliver better social, health, safety and environmental outcomes in the communities where they buy

abbvie, Allergan, AstraZeneca, Baxter, Biogen, Boehringer Ingelheim, Bristol-Myers Squibb, Catalent, gsk, Johnson & Johnson, Lilly, Mallinckrodt Pharmaceuticals, Merck, Novartis, Pfizer, Roche, Shire, Sanofi, Takeda, Teva, West

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## Our Vision and Mission

The PSCI was formed as a non-profit business membership organization in 2006 and is legally established in the United States.

Our **vision** is to create better social, economic, health, safety and environmental outcomes for all those involved in the pharmaceutical supply chain. This includes:

- Fair and safe work conditions and practices
- Responsible business practices
- Environmental sustainability and efficient use of resources

Our **mission** is to establish formal industry guidelines about ethics, labor, health & safety, the environment and management systems and support suppliers to build capacity to operate in a manner consistent with those expectations.

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## The PSCI Principles

**A common set of expectations for an inter-connected supply chain**

These Principles address five areas of responsible business practices and the relevant standards any business operating within the pharmaceutical supply chain is expected to uphold


Web link to PSCI Principles

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## What are your expectations for the next two days?

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## Our Expectations for the Next Two Days

- To ensure that everyone leaves this room with a clear understanding of the PSCI Principles, the available tools for conducting a PSCI Audit and the PSCI Auditing expectations with a special focus on the HSE sections
- To have an open and honest discussion about the challenges you may be facing while carrying out PSCI Audits
- To address these challenges by sharing our expertise on conducting PSCI HSE Audits and audit report writing
- To highlight certain Do's and Don'ts while carrying out PSCI HSE Audits and report writing

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## Agenda - Day - 1

| Time | Topic | Time | Topic |
|---|---|---|---|
| 8.30 - 9.00 am | Registration, Coffee/Tea | 2.00 - 3.15 pm | > Process Safety |
| 9.00 - 9.30 am | Welcome, Introduction and Meeting Expectations | | > PSM Regulations & Elements |
| 9.30 - 11.00 am | > Introduction to PSCI Key Documents related to Audits | | > Storage and Handling of Hazardous and Flammable Chemicals |
| | > Overview on PSCI Audit Process | | > Reaction Thermal Hazards & Emergency Vent Sizing |
| | > Audit Report Writing and Classification of Findings | | > Centrifuge Safety |
| 11.00 - 11.30 am | Break | 3..15 - 3.45 pm | Break |
| 11.30 am - 1.00 pm | > Group Exercise on Writing Findings and Classification of Findings | 3.45 - 4.45 pm | > Dust Hazards and Explosion Protection<br>> Montage of Previous Incidents |
| 1:00 - 2:00 pm | Lunch | 4.45 - 5.00 pm | Wrap-up of Day 1 |

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## Agenda - Day - 2

| Time | Topic | Time | Topic |
|---|---|---|---|
| 8.30 - 9.00 am | Registration, Coffee/Tea | 1.30 - 3.00 pm | Occupational Health & Safety |
| 9.00 -10.30 am | > Environment Expectations and Current Drivers<br>> Pharmaceuticals in the Environment and Waste Water | | > PSCI IH Principles and Critical Findings<br>> Start with the SDS - Do we align? |
| | > Stormwater Management | | > Fundamentals in Control Banding |
| 10.30 - 11:00 am | > Break | | > Hierarchy of controls in Pharma |
| 11:00 am - 12.30 pm | > Air Emissions Control | | > Red Flags for IH & Calibration Exercise |
| | > Waste Management | | |
| | > Spills and Releases | 3.00 - 3.15 pm | > Break |
| 12.30 - 1.30 pm | > Lunch | 3.15 - 4.00 pm | > Red Flags for Dangerous Work Programs |
| | | 4.00 - 4.45 pm | > Quiz |
| | | 4.45 - 5.00 pm | > Summary and Closing |

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PHARMACEUTICAL SUPPLY CHAIN INITIATIVE

## Ron Sethi

**Email**: Ron.Sethi@SethiAdvisory.com

- **PSCI Role:** Consultant to PSCI Audit Committee
- **Education:** Master's in Chemical Engineering
- **Professional Affiliation:** Licensed Professional Engineer in the state of NJ
- **Experience:** 50 years in Engineering, EHS & Business Resilience in pharmaceutical & chemical industries (including 35 years with Pfizer, Wyeth, American Home Products and American Cyanamid)
- **Areas of expertise:**
  - Environmental, health, safety & business resilience
  - Process & project engineering
  - Process safety (including haz-op/PHA and PSSR reviews)
  - Dust hazards evaluation & design of explosion protection of equipment
  - EHS audits and risk management of external suppliers
  - Conducted over 200 audits of API, drug products and packaging sites in USA, Canada, Puerto Rico, Mexico, Argentina, Brazil, European countries, India, China, Japan and Korea)

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## Bio

| | |
|---|---|
| PSCI Role: | PSCI Vice Chair, Board Liaison Audit WS |
| Company Role since 06/2017: | Bayer AG Corporate Health, Safety & Sustainability, Head of HSE MS, Audit Strategy & Planning |
| 09/08 | Bayer Health Care , HQ Leverkusen – Head of HSE Management Systems & Audits |
| 02/07: | Bayer Schering Pharma, Berlin: HSE Audit and Management System Responsible |
| 12/02: | Schering AG, Headquarter Berlin – GMP Auditor for APIs and Corporate HSE Lead Auditor |
| 07/02: | Schering SpA, PH Production Site, Segrate, Italy |
| 05/99 | Schering AG, Berlin – QHSE Management System, Responsible Care Coordinator |
| 02/95 | Schering AG, Production site Bergkamen, Germany: Chemical Process Development |
| 1994: | Postdoc at Nagoya University, Japan |
| 1992: | PHD in Organic Chemistry, University Karlsruhe |
| Areas of expertise: | HSE and Social Auditing, GMP Auditing, Non financial Reporting, Sustainability Reporting, OE Greenbelt |

**Dr Birgit Isabelle Skuballa**
Bayer AG, Leverkusen, Germany
Head of HSE MS, Audit Strat. & Plan.
**Email**: birgit.skuballa@bayer.com

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## Bio

| | |
|---|---|
| PSCI Role: | Chairman of the Board |
| Company Role: | Senior Director GEHS |
| Tasks: | Business Resiliency - oversees the Corporate Business Resiliency program framework covering Emergency Response, Loss Prevention, Crisis Management Business Continuity and Disaster Recovery programs<br>Business Development - provides oversight and standardization of the EH&S services and support to all Business Development projects |
| 1980 to Present: | Pfizer Inc<br>Steve has worked for Pfizer and related companies since 1980 at Toronto, Niagara Falls, New Jersey and on many foreign assignments, in various roles in Manufacturing, Engineering and EH&S.<br>His areas of expertise are Facility Management, Business Continuity, Process Safety, Environmental, Safety, Hygiene and Loss Prevention. |

**Steven Meszaros**
Pfizer Inc
Global Environment, Health & Safety
Senior Director GEHS
Business Resiliency and
Business Development
**Email**: Steven.Meszaros@Pfizer.com

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## Bio

| | |
|---|---|
| PSCI Role: | Supplier Capability Building Committee member |
| Company Role: | Elanco Animal Health HSE Advisor |
| Tasks: | External Manufacturing Network; Acquisition Integration; Vaccine Manufacturing Network |
| '11 - Now | Elanco Animal Health HSE Advisor |
| '09 – 11' | Lilly Corporate HSE - Corporate HSE Governance/Metrics/Public Policy Reporting; Emergency Response/BCP |
| '05 – '09 | Lilly Tippecanoe Lab HSE Manager – API Site (Safety, PSM, and IH) |
| '01 – '03 | Lilly Tippecanoe Labs – IH/Containment -API Network |
| '99' – '00 | Lilly Kinsale Ireland Manufacturing (API) – IH Consultant |
| '89 – '99 | Lilly Corporate IH Program Owner / Various Site IH Roles |

BS – Biology, University of Michigan
MS – Industrial Hygiene, University of Michigan

**Shelly Shope, CIH**
HSE Advisor
Elanco Animal Health Division
Eli Lilly and Company
**Email**: Shope_Shelly_H@Elanco.com

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## Bio

PSCI Role:

| | |
|---|---|
| Company Role: | Director – Environment Lead |
| Tasks: | Currently Director and Environment Lead in Pfizer's Global EHS group. Responsible for establishing environmental strategies and supporting sustainability programs for Pfizer worldwide. |
| 1982 to present | Pfizer Inc |
| 2013 | Pfizer's environment lead with focus on environmental strategy, compliance and sustainability |
| 2010 | Senior Director, Global Operations Business Mergers, Acquisitions and Divestitures |
| 2007 | Senior Director, Environment and Safety |
| 2001 | Assistant Director, EHS, Pfizer Global Research & Development Division |
| 1982 | Process Engineer; Environmental Team Leader |
| BS degrees | Chemical Engineering and Material Science |
| MBA's | Manufacturing Management<br>Environmental Management |

**Richard M. Davis**
Pfizer Inc
Global Environment, Health & Safety
Director – Environment Lead
**Email**: Richard.M.Davis@Pfizer.com

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## Bio

PSCI Role: Audit Committee Co Chair
Current Role: Global HSE Associate-Eli Lilly and Company Ltd
Tasks: HSE assessments at third party manufacturing and critical suppliers for the human pharmaceutical network. Management of the PIE program for Europe.

Career History:

| | |
|---|---|
| 2013-2015 | Six Sigma Black Belt, Production Associate and Environmental Capability program owner-Eli Lilly |
| 2008-2013 | Environmental Advisor-Eli Lilly |
| 2006-2008 | Senior Environmental Consultant-Jacobs Engineering |
| 2000-2006 | Process Industry Inspector-Environment Agency (UK) |

**Rachel Rae**
Global HSE Associate
**Eli Lilly and Company Limited**
Rachel.rae@Lilly.com

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## Bio

- Daniel is HSE Associate in the Elanco External Manufacturing API Hub Basel, Switzerland
- PhD in Chemistry from Humboldt University in Berlin, Germany with 16 years of experience in Chemical Industry, Insurance and Pharmaceutical Industry. Functional experience in R&D, HSE, Engineering and Manufacturing
- Working in Elanco for 1 year.
- Additional qualification as Fire Protection Manager

**Dr. Daniel Rehm**
HSE Associate - Elanco EEM-API
**Elanco Animal Health**
rehm_daniel@elanco.com

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## Bio

| | |
|---|---|
| PSCI Role: | PSCI Governance Committee member |
| | Supplier Capability Building Committee member |
| Company Role: | Supplier Sustainability Expert (CHS) |
| Tasks: | Supplier Sustainability Audit Program Management, Supplier development |
| 06/2016 | Bayer AG, Corporate Health, Safety & Sustainability - Supplier Sustainability Expert |
| 02/2014 | Bayer HealthCare AG Leverkusen, Germany Supplier Sustainability Expert (QHSE) |
| 06/2009 | Bayer Pharmaceuticals Private Limited; India - Sourcing Manager |
| 05/2007 | Vama Pharma - Quality control Executive |
| 05/2005 | Zim Laboratories Limited - Quality control chemist |

Masters in Pharmaceutical Technology
Bachelor in Pharmacy

**Rincy Joseph**
Bayer AG, Leverkusen, Germany
Supplier Sustainability Expert (CHS)
**Email**: rincy.joseph@bayer.com

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# General Guidance on PSCI Audits

Presented by
**Dr. Birgit Skuballa**
**Rincy Joseph**

**Bayer AG, Germany**

## Topics

01 PSCI Key Documents

02 PSCI SAQ & Audit Report Templates

03 PSCI Audit Process

04 Audit Report Writing

05 Group Exercise

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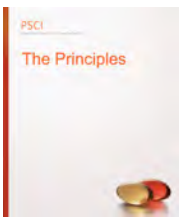
## PSCI Key Documents

## PSCI Key Documents



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## Implementing the PSCI Principles

**What**

### The PSCI Principles

Give broad descriptions of what is expected of pharmaceutical supply chain partners

**How**

### Implementation Guidance

- Further clarifies the Principles in each of the five areas
- Provides a framework for improvement
- Gives examples of how to meet the PSCI expectations

https://pscinitiative.org/resources

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## PSCI Audit Program Guidance

- Provides the methodology on how PSCI Audits are conducted and managed
- Gives a detailed overview of the audit process
- Clarifies auditor qualifications and roles/responsibilities


**Contents**



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## PSCI Homepage

You can find the PSCI Key Documents on the PSCI home page under the heading `KEY RESOURCES´

Just follow below link
https://pscinitiative.org/home

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## PSCI Self Assessment Questionnaires & Audit Report Templates

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## PSCI Protocols - based on Supplier Categories

- For auditing purposes, suppliers are categorized according to their activities:
  - "A" - service providers
  - "B" - component & material suppliers
  - "C" - core suppliers & contract manufacturers


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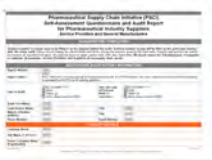
## PSCI Self Assessment Questionnaires & Audit Report Protocols



Abbreviated PSCI Self Assessment Questionnaire (SAQ) & Audit Report Template for Service Providers & General Manufacturers

https://pscinitiative.org/resource?resource=31

Full PSCI Self Assessment Questionnaire (SAQ) & Audit Report Template for Core Suppliers, External Manufacturers, Component and Material Suppliers

https://pscinitiative.org/resource?resource=32

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## Light Refresh of PSCI Protocols in 2016
### Main Changes

- **Change of title** to reflect that the document contains both the SAQ and the Audit Report
- Some **additional requests on facility background** information added
- Around **65 questions were updated with regard to wording and/or slightly extended** (including addition of "Not Applicable" boxes where necessary)
- Overall number of questions of full SAQ/Report: **127**
- 3 Questions deleted (1 Management Systems, 3 Health Safety)
- 16 New Questions added (1 Ethics, 7 Labor, 2 Environment, 6 Health & Safety)
- Questions were distinguished into **Audit questions and "For Information Gathering"** (marked by asterisks)
- Finding tables and points of excellence tables after each section were deleted – **summary tables of detailed findings resp. points of excellence only at the end of the document**
- Statement added regarding the **limitations of an audit**
- **CAPR documents transferred to excel** (easier use for follow up documentation)

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## How to complete the PSCI Audit Protocol (1)

- Sections marked in **orange** need to be filled in by the **supplier** before the audit
- Sections marked in **grey** will be filled by the **audit team** during / after the onsite audit
- Please **do not change** the **report format** and **do not change** the **answers** given by the supplier in the SAQ section.
- Auditors are asked to complete **all questions** that apply. If a question does not apply, please mark it **NA** (Not Applicable)
- Comments of the auditors **should not be a simple copy and paste of the SAQ** answer provided by the supplier or **should not be a turn around of the audit question to an answer**. Comments should reflect auditors actual observation during onsite.
- Please insert **photographs** when applicable and feasible, following the instructions as mentioned in the audit protocol.

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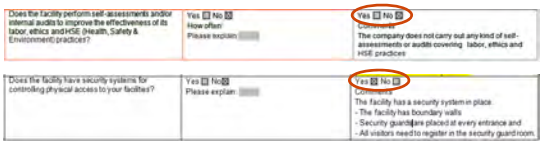
## How to complete the PSCI Audit Protocol (2)

- Comments section should not be left blank.
- The Yes/No/NA tick box in the auditor section also should not be left blank.
- The Yes/No in the auditor section refers to the related PSCI question, but not as a confirmation to the information provided by the supplier.
- Examples:

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## New Excel Version currently piloted


## PSCI Audit Process


## PSCI Audit Process

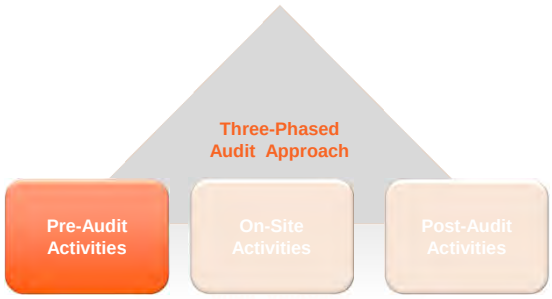
**Audit Approach**

**Three-Phased Audit Approach**

- **Pre-Audit Activities**
- **On-Site Activities**
- **Post-Audit Activities**

## PSCI Audit Process

**Audit Approach**

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## Pre Audit Activities

**Pre-Audit Activities**

**Administrative**

- Schedule audit
- Contact & coordinate with the facility
- Distribute audit materials (SAQ, list of documents, audit plan)
- Arrange for travel

**Planning**

- Assemble & review background information & applicable regulations
- Develop audit assignments & areas to focus on
- Review & discuss audit team responsibilities

**Goal**
**Hit the ground running**

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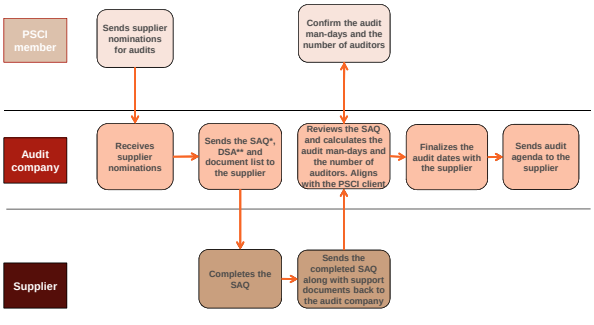
## Pre Audit Activities




*SAQ – Self assessment questionnaire
**DSA – Data sharing agreement

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## Pre-Audit Activities

- Contact the supplier, provide information about the **audit team** and agree on the **audit date**
- Provide the **applicable PSCI Audit Report Template** to the supplier, so that they can fill out the **embedded Self-Assessment Questionnaire (SAQ)**; it is recommended to send the SAQ **at least four weeks prior to the audit date**.
- Provide the **PSCI Data Sharing Agreement** along with a short explanation.
- If requested by the supplier: sign a confidentiality / data protection agreement between the audit firm and supplier before any exchange of information takes place;
- Check the **completed PSCI Self-Assessment Questionnaire** at least two weeks in advance to the audit;
- Prior to the audit, provide the supplier with **an Agenda** and a tailored **PSCI Pre-Audit Document checklist** which comprises documents/information which should be available during the audit
- Check the **website** of the auditee
- Carry out a **background research** about the auditee, e.g. media reports about environmental issues, reports about fatalities, accidents, incidents, loss of primary containments, news about legal issues etc.

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## Best Practice Examples

- Audit Announcement Letter – sample
- Audit Agenda – sample
- PSCI Pre-Audit Document Checklist - sample
- Audit preparation tips
  - Study the SAQ carefully and prepare a plan on the topics that need more attention
  - Ask for any additional information if needed from the supplier
  - Check with the client if there are any special topics that need to be considered
- Other hints for auditors
  - Dress up appropriately for the audit (e.g. business/casual attire, no high heels for ladies)
  - Bring your own safety shoes
  - Respect company's opening and closing time/shift timings
  - Most important: arrive on time!

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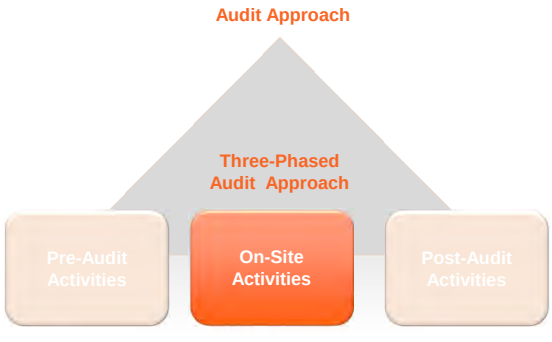
## PSCI Audit Process

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## PSCI On-Site Audit Process (HSE Part)

**Opening meeting** by the auditor which would include the introduction of the auditor and the scope of the audit.

Involved parties: site/plant management, HSE(Q), engineering, production and others (as required)

**Internal discussion** among the auditors and **preparation of the CAP** (Corrective Action Plan)


Covers **production and other relevant infrastructure areas** e.g. waste, waste water, technical areas, utilities.

**Exchange/discussions** with employees and management

**Document review** e.g. as listed in the in the PSCI document list and **discussions** with technical experts and management (e.g. HSE(Q), engineering, production)

**Presentation of best practices and points for improvement**

Summary of the CAP and as a sign of agreement signing by both parties

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## Opening Meeting

- Be **on time**!
- **Thank** the management for hosting the audit
- **Introduce** yourself and audit team and ask the others participants to introduce themselves (business cards; list of attendees)
- Provide a brief **background** about PSCI in case the company is unaware
- Explain the **purpose** and the benefits of the PSCI Audit
- Explain the **audit plan** (including areas to be inspected) and be flexible if needed
- Ask the auditee to provide an **overview of their facility and processes**
- Ask if you **may take photographs** of selected areas (do not insist taking photographs if the auditee denies it)
- Ask for **safety instructions** and **evacuation plan** if not provided by the company.

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## Physical inspection of the facility – points to consider (1)

- **Good time management** is key, especially during site tours
- Allow for **sufficient time for the site tour**, do not spend the majority of time with document review in the office
- Ask for a **site map** for the tour to help you with the site orientation
- Keep in mind that **gowning procedures** in pharmaceutical finishing plant may require a significant amount of time
- Inspect **main production areas**, but be careful not to spend too much time there (other areas like warehouses, waste storage/treatment or waste water treatment units are also important to visit)

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## Physical inspection of the facility – points to consider (2)

- Try to inspect **critical activities** e.g.
  - construction activities
  - drills,
  - inspection & sampling,
  - loading/unloading
  - Material handling and transfer
  - Waste packing and pick-up
  - Confined space entry
- Also inspect **remote areas, trailers, buildings** etc.
  - Are they truly free from hazardous materials?
  - Do employees work in this building?
  - Is there a ventilation system?
  - Are there items like fire extinguishers, emergency showers etc which need to be inspected?
  - What about asbestos?
- Observe the facility also from the **outside**

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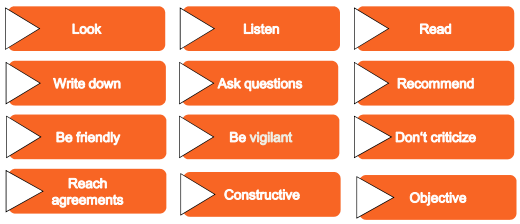
## Behaviour During an Audit

- What an auditor should do:




- How an auditor should behave: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## Closing Meeting (1)

- **Thank** the management for their time, patience and openness and indicate how this contributes to fostering the mutual relationship and building trust;
- **Re-confirm** the purpose of the audit;
- Mention **good working practices** that have been observed during the audit;
- Explain that the audit was based on a **sample examination** of their site and that it is the site's responsibility to conduct a deeper investigation into their programs;
- Explain which **findings and improvement potentials** have been observed during the audit, and discuss possible corrective actions;
- Remind the supplier that they may **challenge/discuss findings** (or provide factual evidence that a finding was incorrect) in this meeting, but any issues they have agreed to will not be changed later;
- Besides listing the findings, ensure that any **agreements or disagreements** are clearly **recorded** on the Preliminary Corrective Action Plan;

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## Closing Meeting (2)

- **Obtain the signature** of the site management on this Preliminary Corrective Action Plan Report;
- **Explain the next steps**; Drafting of PSCI Audit Report and PSCI Corrective Action Plan, Quality control of the audit report, finalization of the PSCI Audit Report and Corrective Action Plan Report and distribution to supplier and to the respective PSCI member;
- Encourage the management of the site to **allow for PSCI Audit Report and Corrective Action Plan Report Sharing** with other PSCI member companies ( either by signing the PSCI Data Sharing Agreement or by **sharing online via the PSCI audit sharing platform**)

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## Closing Meeting – Don´ts

- Never start with **negative observations**
- No **blame game**
- **Do not point out or name an employee** concerning a finding in the presence of management or his/her superior
- Never use **names or ID numbers** or any other identification of employees while presenting findings
- Avoid lengthy discussions with the management/other representatives in case of **disagreement on findings**, rather **document** the disagreement in the audit report/CAPR

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## Encouraging Suppliers to share Audits

Two ways of sharing PSCI Audit reports:

**PSCI Data Sharing Agreement**

- Available in the PSCI website under `Resources´
- To be physically siged by the supplier at the end of the audit or at a later stage
- A scanned copy to be provided to the PSCI Secretariat along with the audit documents

**PSCI Audit Sharing Online Platform**

- Suppliers can directly share the audit documents/SAQ by registring and loging into the platform
- A Supplier User Guide available on how to share audit report on the PSCI audit sharing platform on the PSCI website under `Resources´

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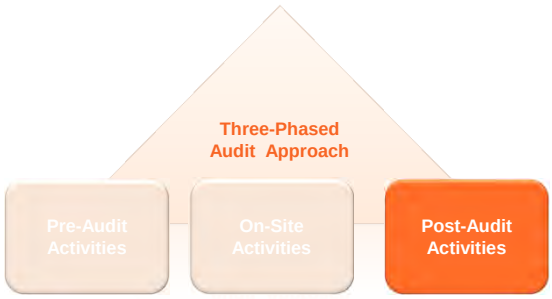
## PSCI Audit Process

**Audit Approach**

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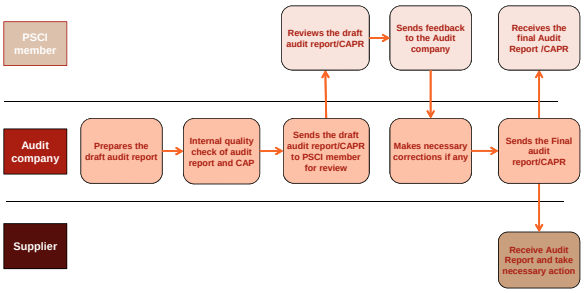
## Post Audit Activities




** In general, the auditor should not send the draft audit report directly to the supplier without prior internal quality review and approval by the PSCI member

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## Audit Report Writing

## Writing Audit Findings (1)

**Audit findings** are a particularly challenging form of writing. They

- usually involve **technical points** written in the context of a **discrepancy from requirements**
- must accurately communicate **factual information**
- must be in an **unambiguous language** to state - as **simply as possible** - what was found.
- should be **understandable to any reader**. Specifically, they must **be clearly understood by the supplier** responsible for corrective actions.

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## Writing Audit Findings (2)

Following basic questions should be considered while writing a finding:

- **Who?** defines who is involved in the finding
- **What?** defines subject of the finding
- **When?** defines the timeframe for the finding
- **Where?** describes where the finding took place
- **How?** describes the nature of the discrepancy including examples
- **How often?** describes whether the finding is a single event/case or a systematic error

And: Challenge each observation by **asking ``So what?´´** (regarding significance)

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## Audit Report Writing (1)

**Write facts**

Base your audit report entirely on the **evidence** you have gathered. **Avoid** any statement of **opinion**.

Examples

| ***Opinionated statement*** | ***Replaced with factual statement*** |
|---|---|
| The facility's contingency plan is inadequate. | The facility's contingency plan lacks the following elements: agreement with local authorities, types and locations of fire protection equipment and up-to-date listing of emergency telephone numbers |

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## Audit Report Writing (2)

**Use evidence**

Be specific in the evidence that you present. Consider whether you have answered key questions such as when, where, how many, by whom and how and, if you have not, add further detail.

Examples:

| ***Too general*** | ***Improved by adding precise details*** |
|---|---|
| • Emergency exit signs are missing. | • Two emergency exit signs were missing in the following areas:<br>o in an unused warehouse and<br>o in the meeting room on the ground floor |
| • Three fire extinguishers at the site did not have the required inspection tags. | • The team inspected 10 of 80 fire extinguishers at the site. Three fire extinguishers in the QC laboratory did not have inspection tags. |
| • Employees have not received safety training. | • Based on a review of the training records, four of 30 maintenance employees have not received safety training. |

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## Audit Report Writing (3)

**Avoid extreme language and speculations**

Refrain from using words like dangerous, severe, terrible etc. as they are not helpful in communicating of the exact nature of the problem.

Examples:

***Extreme language***

- The lack of documented confined space entry procedures for the manufacturing operations may lead to dangerous situations.

***Speculation***

- The site does not have a secondary containment for Nitric acid. Any releases would spill onto soil and enter the groundwater.

***Better wording***

- The manufacturing operations do not have written confined space entry procedures.

***Just the fact***

- The site stores two 100 liter drums of Nitric acid without secondary containment.

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## Audit Report Writing (4)

**Provide statement of requirements (e.g. legal reference) where possible but do not draw legal conclusions**

***Legal conclusion***

- The company does not have a Fire safety authorization in place (No-Objection Certificate), this is not in compliance with the Telengana State Fire Services Act 1999.

***Factual conclusion***

- The company does not have a Fire safety authorization in place. As per the Telengana State Fire Services Act 1999 a Fire safety authorization (No-Objection Certificate) is required.

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## Audit Report Writing (5)

**Clearly state the nature of the problem; do not overstate conclusions**

***Too general***

- Instruments are not being calibrated.

***Overstated conclusion***

- The facility has no respiratory protection program.

***More detailed and exact information***

- The sampling and analytical instruments in the wastewater treatment plant are not part of the calibration program.

***Exact observation***

- The facility's respiratory protection program does not include fit testing, routine inspection and maintenance of respirators.

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## Audit Report Writing (6)

**Avoid relying on hearsay evidence alone**

| *Statement based on Hearsay* | *Statement based on evidence* |
|---|---|
| An operator mentioned that 2 fatalities occurred in H Block during 2016. | The Incident investigation report no. xxx dated xx.xx.2016 indicated that 2 fatalities occurred due to a fire in H Block. |

**Avoid indirect expressions**

| *Statement using the word 'Appear'* | *Statement mentioning what was observed* |
|---|---|
| It appears that the air monitoring equipment is not calibrated. | The facility does not calibrate air monitoring equipment annually. |

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## Audit Report Writing (7)

**Do not focus criticism on individuals or their mistakes**

Do not criticize individuals or highlight their mistakes in an audit report. Ensure privacy of individuals is maintained. Never use unique identifiers in audit reports e.g. names, Company ID numbers.

| *Pinpointing individuals* | *Improved by removing the names of individuals* |
|---|---|
| Ravi and Suresh were observed …… | The team observed two maintenance personnel…… |

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## Audit Report Writing (8)

**Avoid Abbreviations**

Not all recipients of the report will be involved in health, safety and environmental activities on a daily basis and, thus, they may not be as familiar with the health, safety and environmental acronyms, abbreviations, and regulatory jargon as the auditors are.

| ***Using abbreviations*** | ***Improved by including full forms*** |
|---|---|
| There is no evidence showing that the facility measures TSS, BOD, and oil and grease in its discharges to the CETP. | There is no evidence showing that the facility measures total suspended solids (TSS), biochemical oxygen demand (BOD), and oil and grease in its discharges to the common effluent treatment plant (CETP). |

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## Audit Report Writing (9)

- In general be careful with / avoid using the following wording:
  - Is inadequate…not adequate
  - Is inappropriate…not appropriate
  - Is unclear …not clearly defined
  - Seems to…
  - Is likely /probably
  - There is a risk…
  - This is a violation of…
  - Is not in compliance with….
- Improved wording:
  - Is incomplete /missing as e.g. …..
  - Lacks the following details as e.g.
  - Is deficient in that e.g….

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## Writing Observations- Develop your Thoughts (1)

- During the plant tour, your thought is: „This warehouse is unorganized and unsuitable for storage of hazardous materials." (Maybe a very true statement, but not a good audit observation. Convince the reader this is true with observed facts!)
  - Insufficient detail („warehouse") (Get specific with locations of evidence)
  - Opinion („unorganized") (Why do you think this? Use specific evidence.)
  - Subjective conclusion („unsuitable") (Better to link to HSE requirements or site procedures: „...does not assure safe evacuation in case of an alarm".)
  - Why do you have the impression it is unorganized? Describe what you see.
- HSE does not prohibit „unorganized", „inconsistent", „inefficient", „complex", „old", or „ugly"! Always ask, „Are there requirements for what I think this is inadequate?" You must build your case if you use these words. Just because you don't like it does not make it an audit observation!

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## Writing Observations- Develop your Thoughts (2)

- Check to see if any site requirements (SOPs) exist which can be referenced in a finding.
- Check if there is a real HSE violation (e.g. warehouse is overfilled: evacuation routes/emergency doors are blocked, smoke detectors are impaired, racks are overloaded, incompatible materials are stored together….)
- Be careful in GMP areas – HSE corrective actions should not violate GMP requirements. Both HSE and GMP requirements need to be fulfilled when agreeing on corrective actions.

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## Points to Consider:

**Collect all necessary information:**

- **All necessary facts** for a finding **must be collected during** the audit process (pre-audit preparation phase (SAQ and internet search on company /region/location) and on-site audit) – if required documents are not available during the audit, state this in the report (finding!)
- Remember: findings will only be as strong as the information gathered.
- When symptoms of a problem are identified, immediately try to determine the problem scope (**systematic problem vs. isolated incident**).
- During the audit, watch for examples with **common root causes**. This is strong evidence a systematic weakness may be involved.
- **Findings are the basis for corrective actions to be accomplished.**
- Write the finding with the **desired corrective action** in mind.
- **Wording and scope** of the finding will influence the corrections.
- If the observation identifies the **root cause**, it is most valuable

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## Summary

- Writing of findings is an **integral part of the audit process**.
- **Do not wait until the audit is over to start thinking about writing the report!**
- **Gather all details** and investigate links when possible.
- Answer basic questions: **Who ? What?, When?, Where?, How?, How many** and **So what?**
- Build on findings by asking **"Why?"** for possible root causes.
- Ask yourself "**What corrective actions will result from the observation?**" "Will the actions improve one document/record or will the entire process/system be improved?" What is the goal? Write accordingly.
- Keep the written observations **simple, clear, objective, and factual.**

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## Some Examples…

### Incomplete Information

Example 1

| | | |
|---|---|---|
| Has the facility developed and implemented a waste and wastewater management practices? | Yes ☐No ☐N/A ☒<br>Do the practices cover:<br>Characterization of all wastes generated at the facility, including returned products, with regard to regulatory classification (e.g. hazardous waste, special waste, infectious waste, non-regulated solid waste, low-level radioactive waste) and hazardous properties (e.g. flammability, corrosiveness, toxicity)?<br>Yes ☐No ☒<br>Are wastes that contain Active Pharmaceutical Ingredients (APIs) managed in such a way that the API is destroyed via that waste management method?<br>Yes ☐No ☒<br>Are there measures in place to ensure that API, drug product, and branded materials are not diverted from the intended waste treatment/disposal method/facility?<br>Yes ☐No ☒<br>Does the facility evaluate the discharge of wastewater to surface waters, onsite treatment works or offsite treatment to determine potential Active Pharmaceutical Ingredient (API) impact? Yes ☐ No ☒<br>*(considerations include: treatability, bioaccumulation potential, bio-toxicity potential, and the capacity and capability of on-site treatment works, off-site treatment works, or Publicly Owned Treatment Works (POTWs) receiving the wastewater discharges to effectively perform treatment)*<br>Are potential APIs in wastewater subject to treatment, capture, and containment practices to reduce API levels to no effect levels when practical?<br>Yes ☐No ☒Comments: | Yes ☒No ☐<br>Comments<br>Only domestic waste is treated whereas process waste is transported to authorized treatment facility |



## Some Examples…

### Incomplete Information Continued…

Example 2

| | | |
|---|---|---|
| Does the facility provide sufficient portable fire extinguishing equipment for the hazards present? | Yes ☒No ☐<br>Please explain: 175 fire extinguishers provised at designated locations | Yes ☒No ☐<br>Comments<br>Total present as on date 158 |

Example 3

| | | |
|---|---|---|
| Are regular emergency evacuation drills conducted, and what is the frequency?<br>Are employees trained in the use of the Emergency Response equipment? | Yes ☒No ☐<br>Please explain: Once in 6 months | Yes ☒No ☐<br>Comments<br>Verified during interview with security guard and ERT team memebers |

Example 4

| | | |
|---|---|---|
| Does the facility rely primarily on respiratory protective devices and/or engineering controls to protect employees who handle chemicals to achieve exposure levels below the exposure limit? | Respiratory protective devices Yes ☒No ☐<br>Engineering controls Yes ☒No ☐<br>Both Yes ☒No ☐Please explain: PPE, LEV's | Yes ☒No ☐<br>Comments<br>Verified at process area and found satisfactory |



## Some Examples…

### Unclear/Unspecific Information

**Example 1**

| | | |
|---|---|---|
| Does the facility provide a means for handling compressed gases safely that includes: | Yes ☐No ☒<br>Inspection and approval before acceptance of delivery? Yes ☐No ☐<br>Storage in a segregated area designed for compressed gases? Yes ☐No ☒<br>Separation or barriers to manage compatibility issues? Yes ☐No ☒<br>Gas classification labeling? Yes ☐ No☒<br>Regulator, hose and flexible connection inspections? Yes ☐No ☒<br>Please explain: | Yes ☐No ☒<br>Comments<br>Only Compressed gas used in process and no storage |

**Example 2**

| | | |
|---|---|---|
| Is there a site procedure to inform employees of the results of exposure evaluations and monitoring results? | Yes ☒No ☐Not applicable ☐<br>Comments | Yes ☒No ☐<br>Comments<br>Medical check up |

**Example 3**

| | | |
|---|---|---|
| Is the facility emergency response equipment visually inspected monthly, comprehensively inspected annually, and documentation maintained for all inspections? | Yes ☒No ☐<br>Please explain: Inspecting Internally and by external agency | Yes ☒No ☐<br>Comments<br>Maintenance records |

## Some Examples…

### Frequently Misunderstood Questions

**Example 1**

| | | |
|---|---|---|
| Has the facility developed and implemented a plan to protect First Aid Responders and Medical Professionals from exposure to body fluids? | Yes ☒No ☐Please explain<br>Does the program include<br>Training? Yes ☒No ☐<br>Exposure response kits? Yes ☒No ☐<br>The offer of Hepatitis B inoculations?<br>Yes ☐No ☒ | Yes ☒No ☐<br>Comments<br>They have Occupational health center with a permeant Dr (both male and female and nurses all shifts |

**Example 2**

| | | |
|---|---|---|
| Does the facility ensure the provision of safe and potable drinking water and hygienic facilities to its employees? | Yes ☒ No ☐<br>Please explain: The factory provided to employees of the drinking water is purified water, provide matching and number of personnel toilet and shower facilities, and maintain facilities in good condition and clean | Yes ☒ No ☐<br>Comments<br>Drinking water was provided through site tour. The canteen was provided by company, and the meal is free. |

**Example 3**

| | | |
|---|---|---|
| Does the facility have tools or processes to support fair competition? | Yes ☒No ☐<br>Please explain<br>We have defined criteria for appraising the employees and also selecting the suppliers/ vendors..<br><br>As per the protocols, audit compliance is given focus, regular meetings with vendors are conducted to share their performance. | Yes ☒No ☐<br>Comments Verified the employee's appraisal system, the same appraisal criteria is followed for all the employees. Verified the same during individual interviews as well. Criteria for the selection of the suppliers/ contractors are defined and is same for all.<br>See the inserted records on employee's appraisal and vendor selection. |

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## Some Examples with Improved Wording

| | | | |
|---|---|---|---|
| The hardware warehouse and office building are used, but have not obtained fire protection permit from local government.<br><br>1st Follow-up Audit on 3 August 2016: Closed<br>The facility obtained the Fire protection permit form local government for hardware warehouse and office building (Permit No.: 仙公消验备字[2016]第0007 号, Issued date: 21 March 2016). | Fire Protection Law Article 13 | Discussion with concerned personnel and review of related records | Obtain permit from local fire protection bureau in time<br><br>Finding closed |

| | | |
|---|---|---|
| Does the facility ensure that an adequate amount of fire water is maintained for fire protection? | Yes ☒ No ☐<br>Please explain and include the source of water.<br>The source of water is through adequate number of bore wells and as well as near by river. The site was provided with 10 million liter and 28 million liter sumps with FM approved diesel driven and Electrical driven pumps. | Yes ☒ No ☐<br>Comments<br>There are two fire water tanks with storage capacity of 10 million Liters & 28 million Liters.<br>Line pressure: 7.8 bar, verified during plant tour<br>Jockey pump set limit is 7 bar<br>The fire water tank are fitted with FM approved diesel driven and Electrical driven pumps with AUTO'ON' |

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## Classification of Findings (1)

**Critical Findings:**

- Are **very** high risk findings that require immediate action to protect human life, the health of employees or the environment;
- May result in loss of license to operate or serious damage to reputation;
- Require immediate corrective action by the supplier;
- Need to be communicated to PSCI member or PSCI secretariat prior to audit report finalization.

**Examples for Critical Findings:**

- Operation of a solvent storage facility without legally required permit
- Intentional shut-down or bypassing of important safety installations

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## Classification of Findings (2)

**Other findings:**

- Are all other major or minor audit findings*, which need to be corrected by the supplier in an appropriate period of time

**Examples of Other findings:**

- Inspection of portable fire extinguishers not carried out monthly
- Not all safety data sheets are available in local language
- Hazard communication labeling missing on some bottles and drums
- Facilities respirator protection program lacks fit testing
- Inspection intervals of respirators exceeded in some cases
- Safety training missing in a some cases and for some topics

All findings need to be summarized in the PSCI Corrective Action Plan

*Please align with the client regarding further sub classification of the `other´ findings

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## Proposing Recommendations for Corrective Actions (1)

Ensure that recommendations are written in a way to convey ***what* should be done**, without dictating to the auditee ***how* it is to be done**.

Don´t tell them **"How"** tell them **"What"**

Example 1:

| | Description of finding | Local law (give regulatory citation) or PSCI Principles | Objective evidence observed: | Possible corrective action |
|---|---|---|---|---|
| How | The company does not have sufficient resources to carry out personnel dust exposure assessment and process hazards analysis | PSCI | Review of documents, discussion with concerned personnel | The facility should hire an industrial hygienist and two additional process safety engineers. |
| What | The company does not have sufficient resources to carry out personnel dust exposure assessment and process hazards analysis | PSCI | Review of documents, discussion with concerned personnel | The facility should assess the need for additional industrial hygiene and process safety resources to perform personnel dust exposure assessment and process hazards analysis in units A, B, and C. |

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## Proposing Recommendations for Corrective Actions (1)

Don´t tell them **"How"** tell them **"What"**

Example 2:

| | Description of finding | Local law (give regulatory citation) or PSCI Principles | Objective evidence observed: | Possible corrective action |
|---|---|---|---|---|
| How | The Company has only installed 2 portable fire extinguishers in the flamable goods warehouse | PSCI & Local law | Review of documents, discussion with concerned personnel & facility visit | The company shall install 10 more fire estinguishers in the flamable goods warehouse. |
| What | The Company has only installed 2 portable fire extinguishers in the flammable goods warehouse | PSCI & Local law | Review of documents, discussion with concerned personnel & facility visit | The company should review its fire protection plan in the flammable goods warehouse to ensure an adequate number of fire extinguishers. |

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PSCI
PHARMACEUTICAL SUPPLY CHAIN INITIATIVE

# Questions

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## Group Exercise

PSCI
PHARMACEUTICAL SUPPLY CHAIN INITIATIVE

## Exercise: What´s wrong with the wording of following audit findings?

| | |
|---|---|
| There is minimal on-site compliance with Corporate or department contractor safety policy and procedures. | |
| Some of the air sources are being operated without proper permits and some are not adequately maintained. | |
| The facility's central MSDS file is very neat and accessible to those employees who should see it. Not all materials used or stored by the facility have MSDSs in the central file. Those MSDSs reviewed appeared complete and contained the appropriate information. | |
| Bob Miller was neither familiar with the company's SOP on Hazardous materials nor could he identify where MSDSs were located. | |
| The audit team was told that there have been a number of spills of hazardous materials by the maintenance staff. The audit team recommends that these individuals be disciplined and retrained. | |
| It seems that the emergency routes in the warehouse are too narrow. | |
| An operator reported that work permits were not always issued when staff enters into confined spaces. This violates the site´s confined space entry program. | |
| The chemical hygiene plan was found deficient and should be improved. This is a serious concern. | |

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## Exercise: Classification of Audit Findings (1)

- The Streba 30 Fluid Bed Granulator used for substances (containing micronized APIs) with dust explosion properties was run without any pressure relief device (pressure relief flaps had been set out of function). During the audit, the pressure relief flaps were set into operation again, but the proper function in case of dust explosion is not ensured. The pressure relief is directed into the working room.
- The natural gas pipe from the gas transfer station to the boiler house is not identified / labeled.
- Eight 100 l drums containing used organic solvents – waiting for distillation – are stored in the outside distillation area without any retention basin and next to the rainwater drainage which runs to the river.

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## Exercise: Classification of Audit Findings (2)

- The safety data sheets for the cleaning agents 1273 and 1322 used in the production area are only available in English and not in the local language.
- 4 out of 5 emergency exit doors in the raw material warehouse and 4 out of 7 emergency exit doors in the canteen were found locked by padlocks.
- Eye showers and/or eye wash bottles are not available in the following areas where corrosive liquids are handled:
  - Cleaning room of Quality Control Laboratories and Microbiological Laboratory (corrosive cleaning liquids)
  - Cleaning room of non-hormonal production building A100 (corrosive cleaning liquid)
  - Battery charging rooms in warehouse A, B and C (acids)
  - Water treatment plant in technical area for QC laboratory (sodium hydroxide)

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## Exercise: Classification of Audit Findings (3)

- Ear protection is worn in the areas for which protection is required, but there are no signs posted on wearing ear protection in 2 areas (packaging area in ground floor, mill room in waste area).
- No documented risk assessment on handling biological substances in the Microbiological laboratory has been performed and the handled biological substances have not been classified into biological risk groups or to safety levels.
- Two 2 containers of liquid/solvent waste (1 and 5 liters) were stored in the paint shop without a retention basin, and they were not labeled with regard to waste type and hazard symbol.

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## Exercise: Classification of Audit Findings (4)

- In the finished goods warehouse there are three fire resisting compartments. Ten openings for cables to pass through the walls were seen which were not fire-stopped /sealed.
- 23 out of 25 hoods in the research & development (R&D) and 12 out of 15 hoods in the Quality control (QC) laboratories of an API site have measured air flow rates below 0,25 m/s. Standard NFX XXX requires a minimum air flow rate of 0,5 m/s.
- In the warehouse for flammable liquids (stored in closed containers) two LP (liquid propane) – certified trucks are used which are not approved for this service.

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## Group Exercise 1

Writing an audit finding

Gathered information:

- During the site tour, these 4 gas cylinders were seen in a small unidentified room.
- Last inspection date was either not visible on the cylinder or more than 10 years ago.
- Windows in the room were closed.
- Besides these gas cylinders 4 other types of gases were also stored in a similar manner in this room e.g. flammable gases (acetylene) and oxygen.

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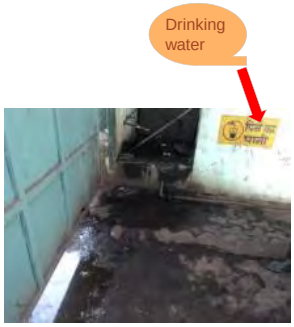
## Group Exercise 2




Writing an audit finding

Gathered information:

- Company manufactures API intermediates in an industrial zone
- No other source of drinking water is provided by the company e.g. bottled water, water purifier/cooler

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## Group Exercise 3

Writing an audit finding

Gathered information:

- This grinder was seen in the workshop at a site.
- The audit team was told that this equipment was still in use.

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## Group Exercise 4

Writing an audit finding

Gathered information:

- Site manufactures intermediates and active ingredients
- The water seen in the picture is the outcome from the washings of the empty reaction vessels and reaction room
- This is the general practice at the facility
- This was repeatedly observed also in follow-up audit

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## Group Exercise 5

Writing an audit finding

Gathered information:

- This picture was taken at a manufacturing block where about 30 employees are working on each floor
- The building had 4 floors in total
- This picture is from the second floor
- The stair case is also supposed to be part of the emergency exit route.

90

## Group Exercise 6

Writing an audit finding

Gathered information:

- These drums were stored at the backyard of a site that manufactures API intermediates
- 3 out of 5 drums were empty, 2 were half-full (content unknown, strong odor of organic solvents noticed)
- The site also handles hazardous materials

91

## Group Exercise 7

Writing an audit finding

Gathered information:

- This emergency body and eye wash shower was seen when touring an API manufacturing site (close to an area where corrosives were handled)
- This type of emergency shower was observed in similar conditions at various locations during the site tour

92

## Group Exercise 8

Writing an audit finding

Gathered information:

- These situations were observed during a follow-up audit at a chemical production site
- One of the findings from the initial audit were missing secondary containments, which were reported to be closed in the corrective action plan submitted by the site
- The drum in the first picture was found to be filled with aqueous hydrochloric acid.

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PHARMACEUTICAL SUPPLY CHAIN INITIATIVE

**PSCI Auditors Training**
**Hyderabad Marriott**
**Feb 28 – Mar 1, 2017**

# PROCESS SAFETY

Steve Meszaros – Senior Director, Pfizer
& Past Chair – PSCI
Ron Sethi – Sethi Consulting Company

## PSCI Audit Questionnaire "Process Safety Section"

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This presentation on Process Safety will give the Auditors the background and training to obtain the right information for the following questions in the PSCI Audit Questionnaire.

- Questions 80 to 95 – Process Safety

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## Topics covered in this presentation

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1. Process Safety Elements & Regulations
2. Storage & Handling of Hazardous & Flammable Chemicals
3. Reaction Thermal Hazards & Emergency Vent Sizing
4. Centrifuge Safety
5. Dust Hazards & Explosion Protection

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## Why is Process Safety Important?

- Gaps in Process Safety have been been identified as the major cause of accidents in the Chemical & Pharma Industry.
- These accidents have caused major fires, catastrophic explosions, fatalities and serious injuries.
- The next few slides show examples of some catastrophic events in the last 30 years.

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## Historical Data

- UK reported 134 incidents caused from Reaction Hazards.
- USA: Chemical Safety Board investigated 90 incidents in the last 20 years in which fatalities or serious injuries were involved
- Similar incidents related to Process Safety occur in other countries every year.

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## Partial List of Accidents in Pharma Industry

| Date | Location | Incident | Casualties |
|---|---|---|---|
| 1999-Feb | USA | Feed Mill Dust Explosion | 7 killed, 1 serious burn |
| 2006-Dec | Japan | Centrifuge Explosion | 1 killed, 7 injured |
| 2009-Mar | China | Accident in HBr Recovery System | |
| 2010-Jan | USA | Phosgene Leak | 62 hospitalized |
| 2010-Mar | Japan | Cellulose Plant FBD Explosion | |
| 2010-April | China | Centrifuge Fire | None |
| 2010-Sep | Italy | Gas Poisoning | |
| 2010-Dec | India | Asphyxiation | 2 killed |
| 2011-Jan | China | Solvent Fire | None |
| 2011-Jan | China | Phosgene Leak | 62 hospitalized |
| 2011-Mar | India | Bromine Leak | 120 hospitalized |
| 2011-Mar | Singapore | Asphyxiation | 1 killed, 1 hospitalized |
| 2011-May | China | Dust Explosion | 2 killed |
| 2012 | USA | Dust Explosion | 7 suffered severe burns |
| 2013-Jan | India | Reactor Explosion | 2 killed |
| 2016-Feb | USA | Feed Mill Dust Explosion | 7 killed, 1 severe burns |
| 2016-Oct | China | Explosion in WW Recovery System | None |

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## Cyclohexane spill and flash fire

**28 dead**
**36 injured**


100

## Confined Vapor Cloud Explosion

101

## Runaway Reaction in Blocked-In Pipe

102

## Storage tank overfilled

103

## Chemical Reactivity Incident From Improper Storage

104

## Managing Process Safety Is Good Business!

**(1) Loss avoidance**

to save lives, reduce injuries, limit property damage

**(2) Protect**

and maintain the business; to enable growth and success


**(3) Creating Value**

For employees, customers, shareholders, the community and the industry

**(4) Corporate responsibility**

to employees, shareholders, the community, and the public

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## Process Safety Management (What Does it Cover?)

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- Personnel safety
- Safety of the manufacturing process
- Management systems
- Technology
- Loss prevention
- Risk management
- Risk communication

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## Key Elements of Process Safety Program

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- Process Safety Information
- Employee Participation
- Training
- Operating Procedures
- Contractors Safety
- Process Hazard Analysis
- Mechanical Integrity
- Hot Work Permit
- Management of Change
- Incident Investigations
- Pre-Startup Safety Reviews
- Emergency Planning and Response

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## Process Safety Management Program in India

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**Background of EH&S Legislation in India**

After the Bhopal gas disaster in 1984, the Indian Government introduced the following regulations.

- Factories Act was amended to assign the responsibility for the safety of the workplace and workers to the highest level of management in a organization
- The Environmental legislation underwent changes, with the Environment Protection Act in 1986
- Manufacture, Storage and Import of Hazardous Chemical rules, 1989 was introduced to prevent another Bhopal type of disaster.
- Chemical Accidents (Emergency Planning, Preparedness and Response) Rules, 1996 was introduced.
- Public Liability Insurance Act, 1991 was introduced which mandates compulsory insurance for the immediate relief to persons affected by accidents.

**Process Safety Management Program in India**

- Per KPMG, though the Process Safety Management system is not mandated by Indian law, a number of chemical industries in India are voluntarily adopting the PSM system developed by OSHA in USA.
-

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## National Regulations – India

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**List of Indian National Regulations (Source- Enhesa)**

| | |
|---|---|
| Air Emissions | 30 |
| Emergency Preparedness | 25 |
| Facilities & Technical Safety | 29 |
| Chemicals Management | 44 |
| Hazardous Materials Transport | 47 |
| Occupational Health | 34 |
| Safety Management | 28 |
| Waste Management | 37 |
| | |
| Indian Factories Act | 59 |


INDIAN
TIONAL REGULATIC


INDIAN
FACTORIES ACT

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## Key Data To Be Included in Process Safety Information

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- Toxicity Data
- Permissible Exposure Limits (PELs)
- Physical Data
- Reactivity Data
- Corrosivity Data
- Thermal and Chemical Stability Data
- Hazardous Effects of Inadvertent Mixing
- Process Flow Diagram
- Process Chemistry
- Maximum Inventory of hazardous chemicals
- Operating Procedures
- Safe Upper and Lower Control Limits
  - Temperatures, pressures, flow rates, compositions
- Consequences of Deviations or Effect of Variables
- Dust Hazards & Explosivity Data
- Health Hazards

Note to Auditors: It is not enough to verify that the facility has the Safety Data Sheet (SDS) for each chemical. The information about some components on the above list may not be in the SDS sheets. Therefore, you should verify that the above information is available for each hazardous chemical and is organized in a central file.

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## Design Data Required for Process Safety Management

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- Equipment Design Specifications
- As Built Engineering (P&I) Drawings (See Note Below)
- Plot Plan and Equipment Arrangement Drawings
- Electrical Classification
- Safety Interlocks
- Electrical Classification
- Thermal Hazards Test Data
- Relief Vent Sizing
- Safety Interlocks
- Environmental Controls
- Ventilation Systems
- List of Design Codes
- Underground systems

Note for the Auditors: Accurate P& I drawings are very critical for conducting the Haz-Op reviews, preparing operating instructions and to provide training. These drawings also allow the Auditors to verify the design of the key process safety elements.

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## Key Elements to Look for in P&I Drawings – 1 of 2

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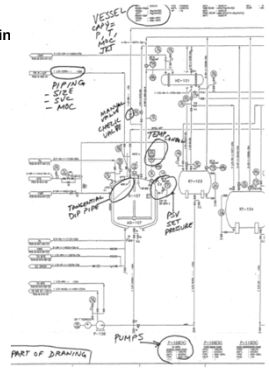
The quality and completeness of the P& I drawings is very important for minimizin the process safety risks

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## Key Elements to Look for in P&I Drawings – 2 of 2

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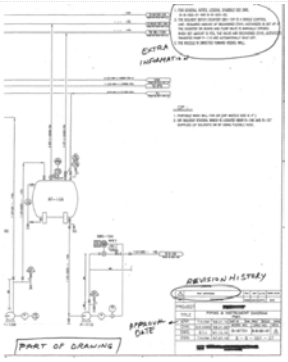


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## Guidelines for Storage of Hazardous Chemicals in Bulk Storage Tanks – 1 of 2

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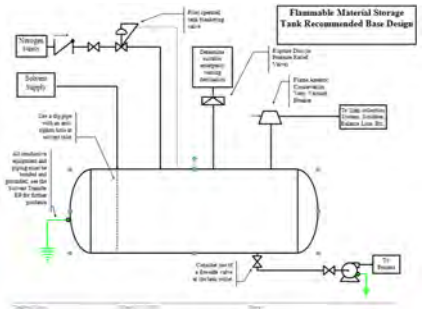
- Tanks should have labels indicating name of chemical and hazmat risks. Labels are critical for:
  - Information for employees
  - Loading/Unloading Operations
  - Emergency Responders
  - Community Right to Know
  - Regulatory Compliance
- Safety Data Sheets (SDS) of each chemical should be available to personnel involved in the operation
- Containment dike for spill control. Minimum volume of dike = 110% of largest tank. Material - impervious
- Incompatible materials should not be in a common dike
- Instruments to monitor level, pressure and temperature (it should preferably be remote and have alarms in control room/process area)
- Vents/relief device sized for heating from external fire
- Conservation vents are recommended for minimizing emissions

## Guidelines for Storage of Hazardous Chemicals in Bulk Storage Tanks – 2 of 2

- Suitable fire protection/fire fighting at tanks
- Designed to prevent ignition (dip pipes, tangential splash legs, N2 blanketing)
- Dedicated hoses for transfer of each chemical
- Use of appropriate PPE and Respiratory Equipment
- Leak detectors and alarms for gases
- Written procedure for unloading from tankers including inspection of tankers for leak, quality and identity check and transfer to process before unloading
- Written procedure for grounding and bonding of tankers and hoses prior to unloading
- Written procedure for transfer from bulk tanks to process
- Written hazards communication program for each chemical to provide required information to employees and to provide training and education
- Current list of chemicals and inventories should be reviewed with local authorities, fire department and emergency responders.

## Best Practice Example - Design of Bulk Stg Tank




## Storage of Hazardous Chemicals - 1 of 2 [Drums & Gas Cylinders]

- All drums, containers and cylinders should have labels indicating name of chemical and warnings of hazmat risks
- SDS for each chemical should be available to personnel involved in the operation
- Materials should be stored as per instructions in Safety Data Sheets
- Storage area should be curbed for spill control. Material of floor and curb should be impervious
- Storage should be in an area not likely to flood and should be down slope from wells
- Storage occupancies should comply with local, state & country codes
- Drums/containers/cylinders should not be stored in stairways or hallways
- Adequate lighting and ventilation should be provided in storage buildings.
- Building should be well ventilated to keep contaminant in air below PEL and 25% below LEL.

## Storage of Hazardous Chemicals - 2 of 2 [Drums & Gas Cylinders]

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- Storage areas should be segregated and partitioned based on compatibility of materials.
- Water reactive materials should not be stored in areas where water flooding from pipe leaks or roofs can occur
- Leak detectors and alarms for toxic gas cylinders (Cl2, H2, HCl, NH3, etc)
- Dispensing of flammable chemicals should not be done in the storage area
- Periodic inspection of stored drums and gas cylinders
- The site should have a written emergency evacuation plan based on dispersion modeling for highly toxic vapors and gases such as Cl2, NH3, Phosgene, etc.
- Current list of chemicals and inventories should be reviewed with local fire department and emergency responders.
- Suitable fire protection/fire fighting of building/area

## Electrostatic Hazards in Storage & Handling of Flammable Solvents

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- **Risk of Electrostatic Hazards**
  - Numerous fire and explosion incidents in the Pharma industry have occurred from electrostatic charges.
  - Static cgarge is created when two objects that are in contact are separated.
  - If static charge is not eliminated rapidly, arc charge is built up
  - It will build enough energy to jump as a spark to nearby ground or a less charged object.
- **Examples of Sources of Static**
  - Liquid flowing through a hose
  - Spraying or coating
  - Blending or mixing
  - Filling tanks, drums, cans or pails
  - Dry powders through chutes or pneumatic conveying
  - Belts that are moving.
  - Human body (can pass on 75-100 mJ of energy)
  - Lightning is a good example of static electricity

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## Prevention of Static Hazards in Storage & Handling of Flammable Solvents

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### Grounding, Bonding & Inerting

- All equipment handling flammable liquids and powders must be grounded & bonded.
- In addition, proper measures should be taken to eliminate all sources of ignition, including electro-static.

Bonding: Process of connecting 2 or more conductive objects together with a conductor to equalize their electrical potential.

Grounding: Process of bonding 1 or more conductive objects to the ground, so that all objects achieve zero potential

Inerting: Protection method based on reduction of O2 concentration of a flammable mixture by the addition of an inert gas, such as N2, CO2.

Inert gas: A non-flammable, non reactive gas that renders the combustible material in a system incapable of supporting combustion

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## Verification of Static Grounding System


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## Reaction Hazards – 1 of 6
### Historical Data of Incidents

**Following data was collected for 189 industrial incidents in UK involving thermal runaway reactions:**

- **134 incidents were classified by processes, key ones are:**
  - **Polymerizarion (condensation): 64**
  - **Nitration: 15**
  - **Sulphonation: 13**
  - **Hydrolysis: 10**
- **34 incidents were caused by little or no study for reaction hazards**
- **15 incidents were caused by raw material quality**

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## Reaction Hazards – 2 of 6
### Incidents by Causes

- **32 incidents were caused by temperature control**
- **17 incidents were caused by agitation**
- **35 incidents were caused by mischarging of reactants or catalysts**
- **25 incidents were caused by Maintenance**
- **11 incidents were caused by human error**

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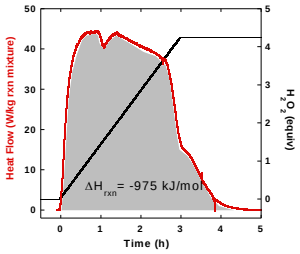
## Reaction Hazards – 3 of 6

Thermal Hazards Testing – Heat of Reaction

- **RC1 Calorimeter is used to measure heat of reaction.**
- **If RC-1 data is not available and if the chemistry is known, the heat of reaction can also be estimated from heats of formation.**

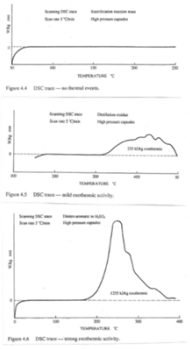



Typical Graph of RC1 Experiment

## Reaction Hazards – 4 of 6

Thermal Hazards Testing – Thermal Stability (DSC)

- **Differential Scanning Calorimeter (DSC)**
- **is used to give an indication of thermal**
- **stability of a reaction. Detects**
- **exothermic/endothermic activity.**
  - **Small sample size (5 -10 mg)**
  - ***Rapid testing time (can be done in 2 hours)***
  - **Disadvantages:**
  - **No information about pressure**



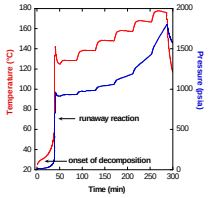
## Reaction Hazards – 5 of 6

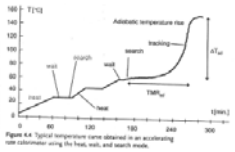
Thermal Hazards Testing for Runaway Reactions (ARC)

**Accelerated Rate Calorimeter (ARC) is used to study the characteristics of a runaway reaction. Rate of pressure & temperature rise from this test can be used for vent sizing for runaway reactions.**

**Advantages:**
- **Larger sample size (2-5 g)**
- **More accurate onset temperature**
- **Pressure information**

**Disadvantages:**
- **1-3 days per sample**



## Reaction Hazards – 6 of 6

Thermal Hazards Testing – Vent Sizing (VSP)

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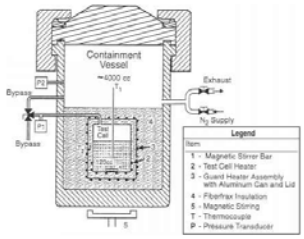
**Vent Sizing Package (VSP):**

**This test uses a 120 ml heated test cell with pressure control system. The test yield data on vapor behavior and the information is used for the sizing of emergency relief vents on the reactors.**

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## Reference Book for Understanding Reaction Hazards

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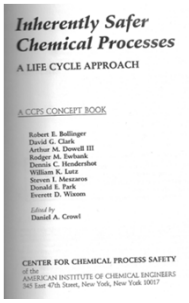
- **This book provides very good material for the design & understanding of inherently safer processes**

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## Best Practice Example

**Nitrogen Inerting of Automatic Reactor**

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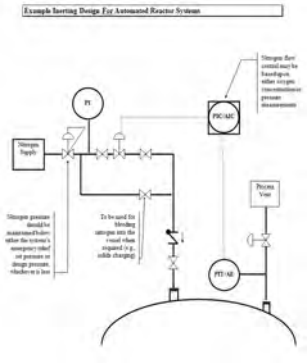


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## Best Practice Example
## Nitrogen Inerting of Manual Reactor

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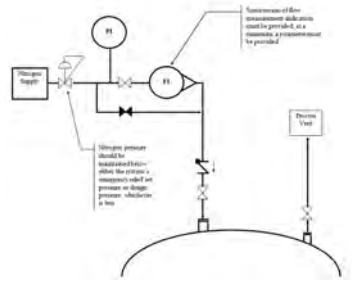
Figure 2 - Example Inerting Design For Manually Controlled Reactor Systems



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## Centrifuge Safety – 1 of 4
### Risk Analysis

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- Risk of fire & explosion in centrifuges using flammable solvents is much greater than other equipment.
- Reasons:
  - Ignition sources are frequently present.
  - Centrifuges operate like a fan and draw air into the equipment
  - They have inherent sources of ignition such as:
    - ✓ Electrostatic charge from flow of slurry & wash liquor through the pipes
    - ✓ High spinning speeds (up to 1,500 rpm) can generate charge
    - ✓ Mechanical friction due to misalignment, worn out seals, failure of bearings can cause sparks
- Risk Levels:
- High: Centrifuges containing liquids at or above flash point
- Medium: Liquids below flash point that are opened frequently
- Low: Liquids below flash point that are opened infrequently

Centrifuge Guidelines

- Guidelines for Safe Operation of Centrifuges:
  - The attached paper published by the Journal of American Institute of Chemical Engineers provides excellent guidance for the design of three types the design of inerting systems and safe operation of centrifuges.

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## Centrifuge Safety – 2 of 4
### Inerting System – Option-1

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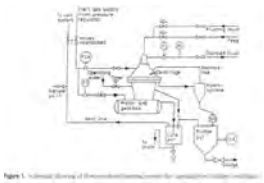
- Flow Monitored System:
  - Recommended for low risk operation
- Advantages:
  Simple, inexpensive
- Disadvantages:
  - Least reliable.
  - Unexpected leaks of air will not detect unsafe condition
- Methodology:
  - Two N2 supply lines (1 for high purge rate and 1 for continuous purge)
  - Regular O2 monitoring, min. one per shift



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## Centrifuge Safety – 3 of 4
### Inerting System – Option – 2

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- **Pressure Monitored System:** Recommended for medium risk operation
- **Benefits:** Moderately expensive, more reliable, uses less N2
- **Requirements:**
  - Design of equipment should be able to withstand 6"wc (0.22 psig) pressure
  - Interlocks for lid, valves, N2 pressure and vent line
  - Pressure relief in case pressure exceeds 6"wc or goes below 1" with automatic shutdown of centrifuge and closure of feed line, wash line and introduction of high N2 flow.

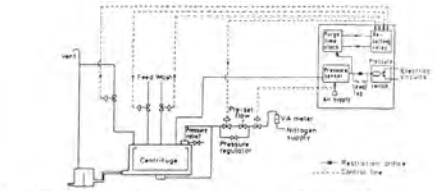


Figure 2. Schematic drawing of pressure-monitored inerting system (for batch centrifuge).

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## Centrifuge Safety – 4 of 4
### Inerting System – Option – 3

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- **O2 Monitored System:**
  - Recommended for high risk operation
- **Advantages:**
  - Most reliable and fail safe
- **Disadvantages:**
  - Most expensive
  - O2 analyzer needs to be checked daily
- **Methodology:**
  - O2 is measured continuously
  - Automatic N2 feed
  - N2 feed stops when safe O2 level is reached

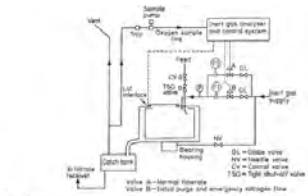


Figure 3. Schematic drawing of oxygen-monitored inerting system (for batch centrifuge).

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## Dust Explosion Hazards

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## Major Combustible Dust Accidents Investigated by USA Chemical Safety Board in Last 15 Years

| Date | Company | Casualties |
|---|---|---|
| Jan, 2003 | West Pharmaceutical | 6 killed, dozens injured |
| Feb, 2003 | CTA Acoustics | 7 killed |
| Oct, 2003 | Hayes Lammerz | 2 severely burned, 1 injured |
| Feb, 2008 | Imperial Sugar | 14 killed, 38 injured |
| Dec, 2010 | A.L. Solutions | 3 killed |
| Jan, 2011 | Hoeganaes Corp | Multiple accidents over 6 months – 5 killed |
| Oct, 2012 | U. S. Ink | 7 injured |
| | | |

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## *Dust Explosion by Equipment Type 127 Incidents*

| *Equipment Type* | *% of Incidents* |
|---|---|
| *Dust Collector* | 52 |
| *Impact Equipment* | 17 |
| *Silos & Bins* | 13 |
| *Dryers & Ovens* | 9 |
| *Processing Equipment* | 6 |
| *Conveyor* | 3 |

## Data for Dust Hazards Evaluation – 1 of 2

**Note to Auditors: It is very important for you to verify that the facility has the dust hazards data for the powders and conducted the risk assessment (raw materials, intermediates, finished product)**

**Minimum Expectation of Data (Key Parmeters)**

- **Minimum Ignition Energy (MIE):**
  - **Lowest energy capable of igniting a sample when dispersed in the form of a dust cloud.**
- **Minimum Ignition Temperature (MIT)**
  - **Lowest surface temperature capable of igniting a powder or dispersed dust dispersed. This is relevant for defining the maximum operating temperature for electrical and mechanical equipment.**
- **Explosion Severity Test or Dust Deflagration Index (Kst)**
  - **Measure of the maximum burning rate of a dust cloud. Data used for designing dust explosion protection equipment.**

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## Dust Hazards Evaluation – 2 of 2

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### Other Data for Dust Hazards

**(Requirement is based on the type of equipment used in the process)**

- **Thermal Stability Test**
- **Minimum Explosive Concentration Test**
- **Limiting Oxygen Concentration (LOC) Test**
- **Volume Resistivity – Powder**
- **Charge Relaxation Time – Powder**
- **Powder Chargeability**
- **Impact Sensitivity Test (BAM Fall Hammer Test)**

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## Dust Explosion Incident

**(West Pharmaceutical, Jan, 2003)**

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- West Pharmaceuticals Plant, North Carolina
- Manufacturing plant for rubber stoppers for pharma industry
- Powder in a mixing step created a cloud which ignited
- The fire spread into other areas and propagated in the ceiling above the equipment where a dust layer ignited and caused a major secondary explosion.
- Explosion destroyed 50% of the plant.
- 6 persons killed, 38 injured
- Damage: $150 million
  Fire raged for 2 days
- Shock wave from explosion broke windows 1,000 feet away
- Propelled debris was found about 2 miles away

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## Photos of Damage from West Pharma Explosion

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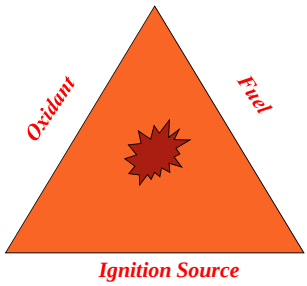
## Dust Explosion at Imperial Sugar Refinery, Georgia (USA) 17 February 2008 - 13 Persons Killed

## Fire Triangle




**Note: If the powder is in confined space, the ignition will lead to an explosion**

## Preventive/ Mitigation Strategies for Dust Explosions

- **Preventive :**
  - **Remove the fuel or oxidant leg of the fire triangle to prevent combustion, i.e. to operate below Min. Explosive Concentration.**
  - **If this is not possible, then mitigation steps are needed.**
- **Mitigative:**
  - **Accept that an explosion may occur and institute measures that will eliminate the potential for injury to personnel or damage to equipment.. This can be by the following methods:**
    - **Option - 1: Venting**
    - **Option - 2: Containment**
    - **Option – 3: Suppression**
    - **Option – 4: Isolation**

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## Option – 1 - Explosion Venting

- This is the most commonly used method
- Use intentionally 'weak' elements to relieve the pressure & vent combustion event to a safe location to prevent catastrophic equipment damage or personnel injury
- Use value of $K_{st}$ along with appropriate nomographs and/or equations to size vent of proper area (in USA, NFPA-68 provides the guidance tools for calculating the vent sizes)

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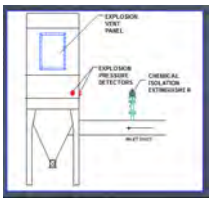
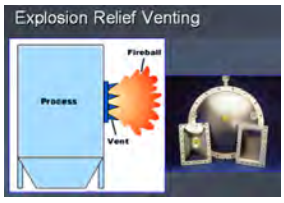
## Explosion Venting






$K_{st}$ or $K_g$ value
Pmax
Length to diameter ratio
Max. and Min.
Operating Conditions
Vessel Strength
Vessel Volume
Vent Duct Length

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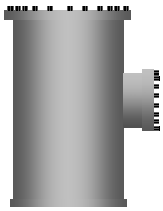
## Option -2: Containment

- Design the equipment to withstand internal explosion without catastrophic failure. Maximum pressure from a dust explosion can be up to 12 bars.
- The maximum pressure is determined from the Explosion Severity Test (Kst)
- Generally limited to smaller volume equipment due to cost



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## Option-3: Explosion Suppression – 1 of 2

- This system uses fast-responding system to detect incipient explosion and releases extinguishing agent to terminate the combustion (typically detection in <10 msec, suppression in <100 msec)
- Either presence of flame and/or pressure rise can be detected
- Extinguishing agent may be extinguishing powder (e.g., sodium bicarbonate), water or inert gas
- Design of the system is generally vendor-specific but the value of $K_{st}$ is needed
- Suppression systems must be periodically inspected to ensure operational integrity
- Suppression systems only operate once; process must be interlocked to shut down upon activation

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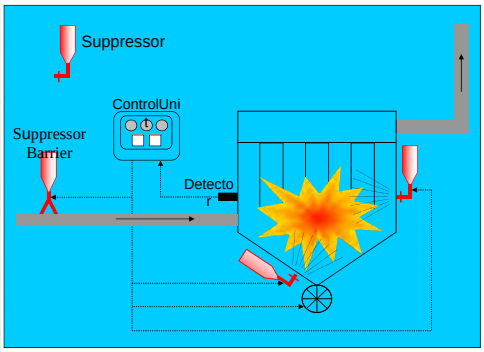
## Explosion Suppression System – 2 of 2




## Option - 4: Isolation

- This is required to prevent propagation of an event in one vessel to other attached pieces of equipment
- Quick acting isolation valves on the inlet and/or the outlet of the equipment are used when explosion is vented
- Either passive or active methods may be used to prevent an explosion from propagating from its point of origin to other pieces of equipment
- Process elements or dedicated special devices can also be used to isolate the event

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## Examples of Process Equipment Used for Isolation

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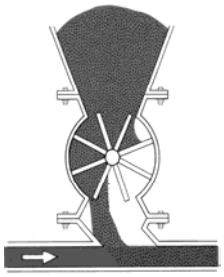
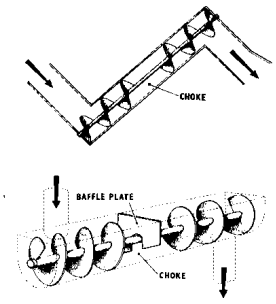
Rotary Valve



Screw Feeder




## Dust Hazards Assessment Guide

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**This paper was presented by Steve Meszaros and Ron Sethi at the NFPA Symposium in Baltimore in May, 2009. It offers guidance for the following topics:**

- **Assessment of dust explosivity hazards**
- **Testing of powders**
- **Layers of protection based on MIE for different types of equipment**
- **Special considerations for aqueous formulations and those containing flammable solvents**
- **Design of explosion protection equipment**

Dust Hazards Assessment Guide

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## Montage of Incidents

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**Following slides will show some accidents which happened in different companies in the last 20 years**

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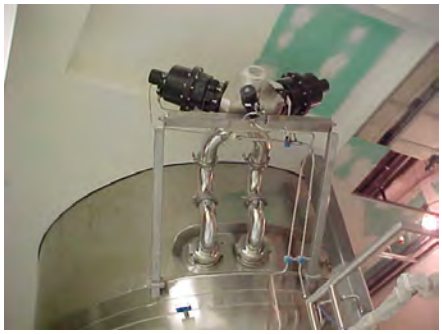

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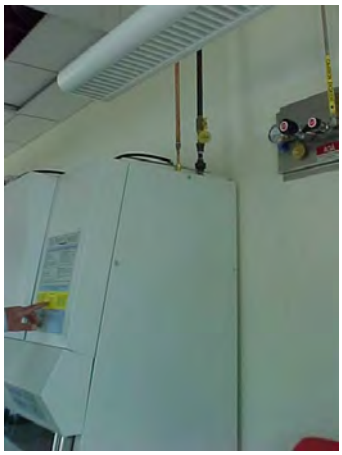

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## Environmental Protection

Presented by
**Rachel Rae**
Global HSE Associate
**Eli Lilly and Company Limited**

**Dr. Daniel Rehm**
HSE Associate - Elanco EEM-API
**Elanco Animal Health**

**Richard. Davis**
Director, Environment
**Pfizer, Inc**

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## Pharmaceuticals in the Environment (PIE)

Presented by
Rachel Rae
Global HSE Associate

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PHARMACEUTICAL SUPPLY CHAIN INITIATIVE

## Agenda

1. Global Perspective
2. PSCI Principles-PIE
3. Technical Requirements
4. PEC/PNEC

## Bio

PSCI Role: Audit Committee Co Chair

Current Role: Global HSE Associate-Eli Lilly and Company Ltd

Tasks: HSE assessments at third party manufacturing and critical suppliers for the human pharmaceutical network. Management of the PIE program for Europe.

Career History:

2013-2015 Six Sigma Black Belt, Production Associate and Environmental Capability program owner-Eli Lilly

2008-2013 Environmental Advisor-Eli Lilly

2006-2008 Senior Environmental Consultant-Jacobs Engineering

2000-2006 Process Industry Inspector-Environment Agency (UK)

**Rachel Rae**
Global HSE Associate
**Eli Lilly and Company Limited**
Rachel.rae@Lilly.com

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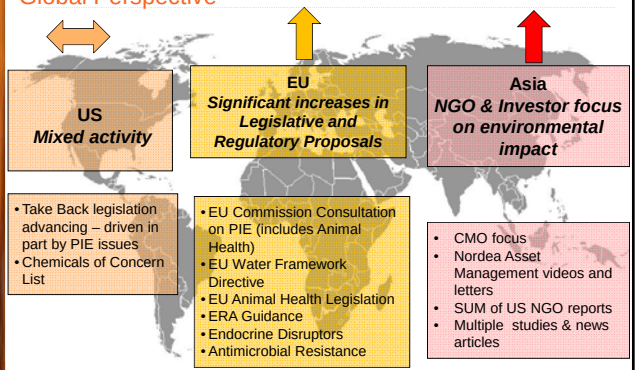
## Global Perspective



**US**
***Mixed activity***

- Take Back legislation advancing – driven in part by PIE issues
- Chemicals of Concern List

**EU**
***Significant increases in Legislative and Regulatory Proposals***

- EU Commission Consultation on PIE (includes Animal Health)
- EU Water Framework Directive
- EU Animal Health Legislation
- ERA Guidance
- Endocrine Disruptors
- Antimicrobial Resistance

**Asia**
***NGO & Investor focus on environmental impact***

- CMO focus
- Nordea Asset Management videos and letters
- SUM of US NGO reports
- Multiple studies & news articles

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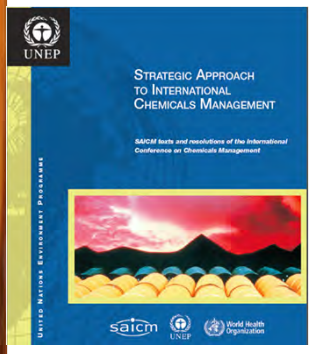
## Stakeholders voicing their concerns




At its first session, held in Dubai, United Arab Emirates, from 4 to 6 February 2006, the International Conference on Chemicals Management adopted the Dubai Declaration on International Chemicals Management and the Overarching Policy Strategy. The Conference also recommended the use and further development of the Global Plan of Action as a working tool and guidance document. Together these three documents constitute the Strategic Approach to International Chemicals Management.

Emerging Policy Issues:

- Lead in Paint
- Chemicals in Products
- Endocrine Disrupting Chemicals
- Hazardous substances in electrical and electronic products
- Nanotechnology and manufactured nanomaterials
- Environmentally Persistent Pharmaceutical Products*

*Added

October, 2015

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## Calls for Action to Reduce Environmental Antibiotic Residues & Set Standards

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Develop standards (under the tripartite collaboration with FAO and OIE), based on best available evidence of harms, for the presence of antimicrobials and antimicrobial residues in the environment, water supply and food (including aquatic and terrestrial animal feed).

WHO Draft Action Plan on AMR - 2014

**Reduce Environmental pollution**

ESTABLISH MINIMUM STANDARDS TARGETING THE EMISSION OF MANUFACTURING WASTE CONTAINING APIs

ENCOURAGE THE PHARMACEUTICAL INDUSTRY TO DRIVE HIGHER STANDARDS THROUGHOUT THEIR SUPPLY CHAINS

Review on Antimicrobial Resistance

O'Neill Final Report - 2016

**Work to reduce the development of antimicrobial resistance**

- We support measures to reduce environmental pollution from antibiotics, along with a 'one health' approach towards prudent and responsible use, including a global reduction of unnecessary antibiotic use in livestock, and we applaud moves from major food groups to work towards this goal.

**Declaration by the Pharmaceutical, Biotechnology and Diagnostics Industries on Combating Antimicrobial Resistance** 2016

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## Global Response on AMR

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- **World Health Assembly 2015 – Geneva (WHO)**
  - "Global Action Plan on Antimicrobial Resistance"
  - Improve awareness of AMR, strengthen knowledge through surveillance and research, reduce the incidence of infection, optimize the use of antimicrobial agents, develop the economic case for sustainable investment
- **UN General Assembly 2016**
  - Countries reaffirm commitment to develop national action plans on AMR based on a *"Global Action Plan on Antimicrobial Resistance"*
- **International Federation of Pharmaceutical Manufacturer's and Associations 2016**
  - "Industry Roadmap and Combating Antimicrobial Resistance" (13 companies) – Davos Declaration

World Health Organization

GLOBAL ACTION PLAN

SIGNATORY COMPANIES

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## Drug Resistance Research

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- Harvard Medical School and Technion Institute of Technology demonstrate how bacteria move as they become immune to antibiotics, supported by grants from the NIH and European Health Council*


- Cinematic Approach to Drug Resistance
- https://www.youtube.com/watch?feature=player_embedded&v=plVk4NVIUh8

*A Cinematic Approach to Drug Resistance", Harvard Gazette, September 8, 2016

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## Reporting on Pharmaceutical Manufacturing

Nordea Asset Management-The largest Nordic financial services firm expresses concerns with water pollution in India from pharmaceutical suppliers (2015)


The Sum of Us Report (2015)


https://www.youtube.com/watch?v=EBU-upZOLgs

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## The News on India….


Reuters 2016 Hyderabad
"Resistant bacteria are breeding here and will affect the whole world,"

The Guardian-UK 2016
"In India and China, where a large proportion of antibiotics are produced, the poorly regulated discharge of untreated wastewater into soils and rivers is causing the spread of antibiotic ingredients which cause bacteria to develop immunity to antibiotics, creating superbugs"

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## How we are using PSCI to Address the Issues

| | | |
|---|---|---|
| 55 | Has the facility developed and implemented waste and wastewater management practices? | Yes No<br>Do the practices cover:<br>Characterization of all wastes generated at the facility, including returned products, with regard to regulatory classification (e.g. hazardous waste, special waste, infectious waste, non-regulated solid waste, low-level radioactive waste) and hazardous properties (e.g. flammability, corrosivity, toxicity)?<br>Yes No<br>Are wastes that contain Active Pharmaceutical Ingredients (APIs) managed in such a way that the API is destroyed via that waste management method? Yes No<br>Are there procedures in place to ensure that API, drug product, and branded materials are not diverted from the appropriate/authorized waste treatment/disposal method/facility? Yes No<br>Does the facility have a system for collecting water from fire fighting? Yes No<br>1 Does the facility evaluate the discharge of wastewater to surface waters, onsite treatment works or offsite treatment to determine potential Active Pharmaceutical Ingredient (API) / environmental impact? Yes No<br>2 (Evaluation may include: treatability, bioaccumulation potential, bio-toxicity potential, and the capacity of on-site treatment works, off-site treatment works, or Publicly Owned Treatment Works (POTWs) receiving the wastewater discharges to effectively perform treatment)<br>3 Are APIs in wastewater subject to treatment, capture, and containment practices to reduce API concentrations to predicted no effect concentration (PNEC) levels?<br>Yes No Comments: |

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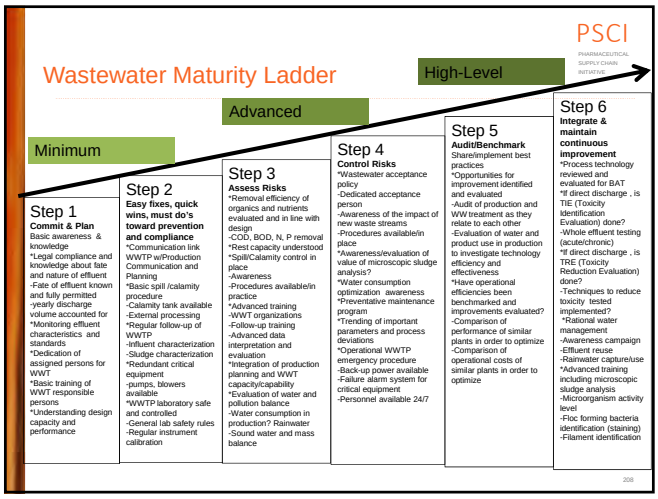
## Wastewater Maturity Ladder




## Pre Assessment Information

- What information can you gather in advance:
  - What APIs do they handle
  - MSDS
  - Is there any guidance available for the limit to water (PNEC)
  - Where is the nearest water body-receiving water
  - Flow rates of receiving water bodies

| Default Concentration Values | |
|---|---|
| Hormones | 0.0001ug/l |
| Parasiticides and Synthetic Opiods | 0.001ug/l |
| Active ingredients and isolated intermediates at are carcinogenic, mutagenic or reproductive development hazards | 0.01ug/l |
| All other active ingredients | 0.1ug/l |

## Permits

We are complying with our Permit

- Most discharge permits will address established parameters, e.g., control of pH, biological oxygen demand, chemical oxygen demand, etc.
- Some discharge permits include periodic general toxicity testing, i.e., whole effluent toxicity
- Most discharge permits will NOT directly address active pharmaceutical ingredients (APIs) but DO include a 'general duty' clause, i.e., "No toxics in toxic amounts".

2

## Technical Assessment-Reduce at Source

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- Volume-Sources of effluent
  - Process effluent
  - CIP
  - General area cleaning

High volume/high concentration

Low volume/low or high concentration

- Capture

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1 2

## Technical Assessment-Onsite Treatment Technologies

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| Category of API | Manufacturing | Fill/Form/Finish | Secondary Packaging |
|---|---|---|---|
| Hormone Substances i.e Estradiol, Testosterone | Process wastewater collected and incinerated | Process wastewater collected and incinerated | Building floor drains should be plugged when packaging is running unless a spill diversion tank/pit is provided. Management practices, such as collecting/removing unused tablets, capsules or liquids from the work area should be in place to insure that residual active ingredient is not flushed to sewers. |
| Oncolytic and Mutagenic | Process wastewater collected and incinerated | Collection of concentrated wastewater from milling, granulation, dryer and filling etc. Secondary treatment for further wash ie activated sludge, bioreatctor etc | Building floor drains should be plugged when packaging is running unless a spill diversion tank/pit is provided. Management practices, such as collecting/removing unused tablets, capsules or liquids from the work area should be in place to insure that residual active ingredient is not flushed to sewers |

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| Category of API | Manufacturing | Fill/Form/Finish | Secondary Packaging |
|---|---|---|---|
| Pesticide, Fungicide and Insecticide Products and Synthetic Opioids | Process wastewater collected and incinerated Aqueous cleaning of empty equipment should be incinerated or treated using pollutant removal technologies, such as hydrolysis, chemical oxidation, or activated carbon adsorption. These treatment technologies must be demonstrated effective for each specific application and may need to be used in conjunction with one another to provide treatment for all active ingredients used at a facility over a period of time. Active ingredient specific treatment residuals must be incinerated. | | Building floor drains should be plugged when packaging is running unless a spill diversion tank/pit is provided. Management practices, such as collecting/removing unused tablets, capsules or liquids from the work area should be in place to insure that residual active ingredient is not flushed to sewers. |
| Non-Hormone/Non-Synthetic Opioid Small Molecule Active Ingredients Examples: Fluoxetine, Duloxetine, Olanzapine, Ractopamine | At the source collection of concentrated wastewaters (mother liquors, first washes of process equipment, etc.) for incineration. Other process wastewaters are typically managed in wastewater treatment systems that provide at least secondary treatment (activated sludge, membrane bioreactor). | Collection of concentrated wastewater from milling, granulation, dryer and filling etc. Secondary treatment for further wash ie activated sludge, bioreatctor etc | Building floor drains should be plugged when packaging is running unless a spill diversion tank/pit is provided. Management practices, such as collecting/removing unused tablets, capsules or liquids from the work area should be in place to insure that residual active ingredient is not flushed to sewers |

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| Category of API | Manufacturing | Fill/Form/Finish | Secondary Packaging |
|---|---|---|---|
| Large Molecule/Protein Examples: Insulin, Monoclonal Antibodies | Procedures/Processes should be in place for inactivation of protein before discharge (heat or acid/alkaline denaturing). Process wastewaters after inactivation are typically managed in wastewater treatment systems that provide at least secondary treatment (activated sludge, membrane bioreactor). Process wastewater collected and incinerated | | Building floor drains should be plugged when packaging is running unless a spill diversion tank/pit is provided. Management practices, such as collecting/removing unused tablets, capsules or liquids from the work area should be in place to insure that residual active ingredient is not flushed to sewers. |
| Large Molecule/Antibiotics | Procedures/Processes should be in place for destruction/inactivation of antibiotics before discharge. High temperature, acid/alkaline hydrolysis and ozonation have been demonstrated as in-plant pre-treatment technologies. However, these technologies are active ingredient specific and may need to be used in conjunction with one another to provide treatment for all active ingredients used at a facility over a period of time.After control of high strength waste streams, process wastewaters are typically managed in wastewater treatment systems that provide at least secondary treatment plant performance (activated sludge, membrane bioreactor). | | |

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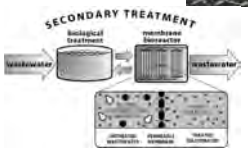
## Secondary Treatment Technologies

Activated Sludge

UV Disinfection




Membrane Bioreactor

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1 2

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## Technical Assessment-Onsite Treatment

- Treatment volume-Evidence of overspill
- Inspect Final Discharge Point
  - Where does it discharge too-standing waterbody, sewer, river, sea
  - Can you go to see the discharge point
  - What does the effluent look/smell like
    - Strong solvent odour
    - Visible contamination

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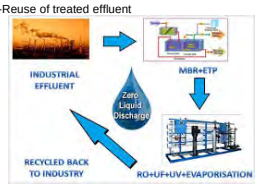
1 2

## Technical Assessment-Onsite Treatment

- Zero Discharge-Reuse of treated effluent




- Check the mass balance volumes-

e.g. is the daily amount of effluent the same as the input to the cooling towers
is the volume far greater then irrigation use

- Doesn't always equal 'zero risk'
  - Ground dispersion may result in:
    - Dermal/inhalation exposure to applicator and/or recreational users
    - Edible vegetation and/or groundwater users
    - Terrestrial organisms
    - Mist inhalation from opened cooling uses.

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1 2

## Technical Assessment-Administration Controls






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1 2

## Technical Assessment-Offsite Treatment

- Permitted Volumes vs Daily Flows
  - What are they limited to
  - Compliance history
  - Specific parameters
- Treatment Capability
  - Do the know what the treatment type is
- Where is the final discharge point

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3

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## What is an Environmental Risk Assessment?

- Good management practices may not eliminate all API released to water
- Your responsibility is to know whether the amount released could have a potential impact on the environment
- Environmental Risk Assessment requires data and professional judgment

Predicted Environmental Concentration **(PEC) (Concentration in Effluent)**

Predicted No Effect Concentration **(PNEC) (Concentration Limit)**

**Risk Quotient (RQ)**
PEC /PNEC <1, Low risk
PEC /PNEC >1, Potential risk:
Reassess/take appropriate action

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3

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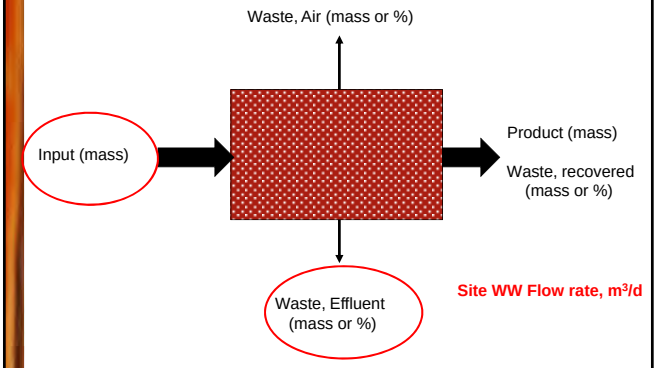
## Mass Balance: Approach




**Site WW Flow rate, $m^3/d$**

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3

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## PEC Data Collection & Analysis

- Review batch records to determine API losses
- Estimate API losses (account for batch and cleaning cycles)
- Estimate treatment plant removal efficiency using the API chemical and physical properties, literature, or assume 0%
- Get wastewater and receiving water flows

***Examples***

**On-Site**

| | |
|---|---|
| batch records | wastewater POG[1] |
| product yield | wastewater flows |
| batch/year | WWTP unit ops |
| cleaning cycles | API analyses[2] |

**Off-Site**

POTW flow
POTW unit ops
receiving water flow

1 POG = Point of Generation
2 API analysis of wastewater, solvent waste, solid waste, etc.

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## Mass Balance Loss -Example

**Using mass balance values**

1. Must be representative of the process
2. Consider control chart for calculated losses

| Date of Manufacture | Item Code | # of vials filled | Amount of API in vials (kg), (calculated) | Amount of API not in vials (kg), (calculated) | Daily sum of amount not in vials |
|---|---|---|---|---|---|
| 04-JAN-2011 14:13:03 | 0000000000001 | 15767 | 18.037448 | 0.095552 | 0.216272 |
| 04-JAN-2011 14:18:08 | 0000000000001 | 15745 | 18.01228 | 0.12072 | |
| 11-JAN-2011 14:12:12 | 0000000000001 | 15740 | 18.00656 | 0.12644 | 0.332416 |
| 11-JAN-2011 14:09:54 | 0000000000001 | 15765 | 18.03516 | 0.09784 | |
| 11-JAN-2011 14:24:55 | 0000000000001 | 15756 | 18.024864 | 0.108136 | |
| 18-JAN-2011 10:52:49 | 0000000000001 | 15723 | 17.987112 | 0.145888 | 0.283768 |
| 18-JAN-2011 10:46:36 | 0000000000001 | 15730 | 17.99512 | 0.13788 | |
| 25-JAN-2011 16:24:28 | 0000000000001 | 15534 | 17.770896 | 0.362104 | 0.491976 |
| 25-JAN-2011 16:22:15 | 0000000000001 | 15737 | 18.003128 | 0.129872 | |
| | Avg Number of vials filled | Avg Amount of API in vials (kg) | Avg Amount of API not in vials (kg) | Worst Case API in Wastewater (kg) | Limit API in Wastewater (kg/day) |
| | 15721.89 | 17.99 | 0.15 | 0.29 | 0.65 |
| | | | | Cumulative Daily Worst Case (kg) | |
| | | | | 0.49 | |

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## Sources of PNEC Information

Published data – Journals such as: Environmental Toxicology and Chemistry, Environmental Science and Technology, Aquatic Toxicology, others

- Vestel, J. et al. Use of acute and chronic ecotoxicity data in environmental risk assessment of pharmaceuticals, Environmental Toxicology and Chemistry, Accepted Article DOI: 10.1002/etc.3260
- Company specific values
- Default values

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## Calculating the Risk Quotient

$$\text{Risk Quotient (RQ)} = \frac{\text{PEC}}{\text{PNEC}} = \text{<1 or >1?}$$

| Risk Quotient | | |
|---|---|---|
| Less than (<) 1 | Indicates that the expected concentration is lower than the concentration indicating low/no potential environmental risk | |
| Greater than (>) 1 | Indicates that the expected concentration exceeds the no-effect concentration indicating the potential for risk | |

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## Guidance


SETAC PRESS

Hazard/Risk Assessment

A RISK-BASED APPROACH TO MANAGING ACTIVE PHARMACEUTICAL INGREDIENTS IN MANUFACTURING EFFLUENT

https://pscinitiative.org/resource?resource=292

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## Stormwater: Issues and best practice

Presented by
Dr. Daniel Rehm
HSE Associate EEM API

## Bio

- Daniel is HSE Associate in the Elanco External Manufacturing API Hub Basel, Switzerland
- PhD in Chemistry from Humboldt University in Berlin, Germany with 16 years of experience in Chemical Industry, Insurance and Pharmaceutical Industry. Functional experience in R&D, HSE, Engineering and Manufacturing
- Working in Elanco for 1 year.
- Additional qualification as Fire Protection Manager

**Dr. Daniel Rehm**
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**Elanco Animal Health**
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## Agenda

1. Stormwater: what issued can be found
2. Potential pollution sources of stormwater
3. Stormwater pollution prevention

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## Stormwater: personal experience

- November 1st, 1986: Schweizerhalle fire, contaminated fire water
- 2006 to 2009: Singapore: strict management of stormwater
- June 15th, 2015: tropical storm Bill in Houston, USA

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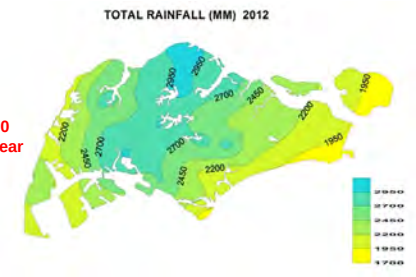
## Rain in Singapore

**Up to 3000 mm per year**




Source: National Environment Agency Singapore

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## Stormwater management In Singapore

- Water is seen as a valuable resource in Singapore
- Very strong regulation on stormwater management
- Chemical and pharmaceutical industry has to implement strict control of stormwater release

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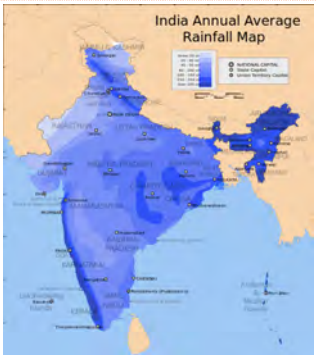
## Rain in India

**Up to 2500 mm per year**




Source: Wikipedia

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## What Is Stormwater Runoff?

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Stormwater runoff is water from rain or snowmelt that does not immediately infiltrate into the ground and flows over or through natural or man-made storage or conveyance systems.

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## What Are Its Impacts?

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Runoff from areas where industrial activities occur can contain toxic pollutants (e.g., heavy metals and organic chemicals) and other pollutants such as trash, debris, and oil and grease, when facility practices allow exposure of industrial materials to stormwater. This increased flow and pollutant load can impair waterbodies, degrade biological habitats, pollute drinking water sources, and cause flooding and hydrologic changes to the receiving water, such as channel erosion.

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## Types of activities at industrial facilities with potential of pollution in stormwater

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- Loading/unloading operations
- Outdoor storage
- Outdoor process activities
- Dust or particulate generating processes
- Illicit connections and non-stormwater discharges
- Waste management

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## Examples

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## Stormwater pollution
## Loading/unloading operations

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- Incomplete bunding
- No spill retention capacity

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## Stormwater pollution
## Outdoor storage

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- No secondary containment for outdoor storage of material


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## Stormwater pollution
## Outdoor process activities

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- Open structure building without sufficient retention capabilities

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## Stormwater pollution
## Dust or particulate generating processes

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- Insufficient capacity or no dust filters
- Ashes from coal fed boilers and/or stacks

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## Stormwater pollution
## Illicit connections and non-stormwater discharges

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- Overflow of waste water tanks
- Leakage from cooling towers with contaminated water (recycled from waste water treatment plant

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## Stormwater pollution
## Waste management

- Storage of hazardous waste without bunding or secondary containment

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## Stormwater pollution prevention
## 4 steps

- Step 1: Form a team of qualified personnel
- Step 2: Assess potential stormwater pollution sources
- Step 3: Select appropriate control measures
- Step 4: Inspection and monitoring of controls


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## Form a team of qualified personnel

- The team should consist of those people on-site who are most familiar with the facility and its operations
- Team should consists ideally of members from the following departments:
  - HSE
  - Engineering
  - Effluent treatment operators

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## Assess potential stormwater pollution sources

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- Assess the different pathways how storm water can be contaminated
  - Mass balance of API process
  - Fate of water from equipment washing
- Site tours to identify gaps

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## Select appropriate control measures

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- Hierarchy of control measures
  - Eliminate
  - Reduce
  - Mitigate
- Engineering controls preferable over administrative controls
- Analysis of all stormwater before release

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## Inspection and monitoring of controls

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- Regular site tours to control controls and identify new issues
- Regular training of personnel about stormwater control
- Continuous improvement mind set needed to guarantee future success

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# Environmental Protection Programs
# Air, Waste, Material Storage, and Authorizations

Presented by
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Director, Environment
**Pfizer, Inc**

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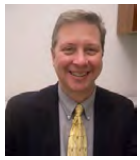
## Bio

- Richard is Director, Environment for Pfizer Global Environment, Health and Safety and is located in Groton, CT USA
- Bachelors Degree in Chemical Engineering and Materials Management from the University of Connecticut. Masters Degrees in Business Administration (Production Management) and Environmental Management from Rensselaer Polytechnic Institute
- 35 years experience with Pfizer in Pharmaceutical Production, EHS, Operational Excellence, and Global Real Estate



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## Agenda

1. **Auditor Insights**
2. Air Emissions
3. Material Storage
4. Waste Management
5. Authorizations and Permits
6. Management Systems

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## Auditor Insights
## Preparation for the Site Visit

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- Review supplier website for general information on the company, structure, products, locations
- Review internet for any information on environmental performance related to the site
- Review Google satellite imagery for the location. Check for:
  - Property boundaries
  - Nearby water bodies
  - Nearby residential and commercial structures
  - Stormwater flow direction
  - Excavations
  - Apparent material storage and disposal areas inside and exterior to the facility
  - Evidence of soil and surface water contamination (e.g., staining or discolored surfaces)

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## Auditor Insights
## Background Information Review

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## Auditor Insights
## Background Information Review

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## Auditor Insights
## Background Information Review

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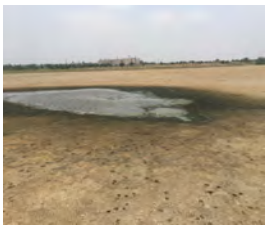
Groundwater collection and runoff

Potentially impacted lake



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## Auditor Insights
## Opening Meeting

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- Supplier should provide an overview presentation on the location as part of the opening meeting
- Review what you would like to see on your site tour including external to facility boundary
- Ask for a copy of the site plot plan if available
- Provide list of documents you would like available to review on the day of the visit
- Review intent to take photographs and agree to process. You should be able to take photos outside the facility. The supplier may wish to take photos for you internal to the site and provide after the assessment
- Ask for copies of important documents and presentation (paper copy or electronic) and agree to method of sharing documents

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## Auditor Insights
## Tour of the Facility Exterior

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- **Initial impressions are important**!
- Be prepared to take photographs
- Mobile devices are usually satisfactory for this purpose
- You can also use your mobile device for access to Google maps while you tour the facility exterior
- Make a full perimeter tour unless unsafe or time prohibitive
- Be prepared for uneven terrain, wet conditions, livestock, residential structures, heavy traffic, etc. on the tour. Your safety is a priority, so use your best judgment on conducting the tour
- Local residents may be interested in what you are doing. If possible you should confirm who they are if they engage while ensuring your own safety

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## Auditor Insights
## Tour of the Facility Exterior

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- **Particularly look for the following on your tour:**
  - Discolored soil or surface water
  - Surface water runoff from storm drains or sheet flow
  - Quality of stormwater
  - General housekeeping outside the facility
  - Excavations for construction. Look for discoloration of soil in excavations; sheen, color or odor in any groundwater in the excavation
  - Storage or placement of waste materials exterior to the facility.
    - Construction and demolition debris is common outside manufacturing facilities
    - Look for any manufacturing or laboratory wastes that may be exterior to the facility (e.g., paperwork, labels, sample bottles, piping, containers (bottles, drums, etc.)
  - Evidence of releases
  - Visible emissions from air emission sources
  - Significant dead vegetation

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## Auditor Insights
## Tour of the Facility Exterior

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- Review the "Environmental Performance Board" at the entrance to the facility. The State Pollution Control Boards (PCBs) usually require posting of permit limits and most recent performance.
- Photograph the Board and compare with documents provided by the supplier
- Identify all neighbors of the supplier facility by name and type of activity.
- Identify any potential concerns with neighbors (e.g., potential impacts to the supplier facility or risk of impact from the supplier facility)


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## Auditor Insights
## Tour of the Facility Interior

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- Photographs of the facility interior are desirable if the facility will allow
- However, they should be limited to a small number and agreed on with the supplier
- The facility interior tour should include a full tour of the facility interior perimeter if time permits
- Look for water discharges at the site perimeter
- You can ask the site contact to arrange the tour so that you can see the entire interior perimeter while touring the specific locations on the interior tour list

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## Auditor Insights
## Tour of the Facility Interior

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- **Interior Tour should include the following areas**:
  - Boilers and Diesel Generators
  - Boiler ash collection, storage, and disposal
  - Fuel storage areas
  - Process wastewater collection and treatment systems
  - Domestic wastewater collection and treatment systems
  - Utilities wastewater collection and treatment systems
  - Stormwater collection and discharge systems
  - Waste storage areas including hazardous, biomedical, non-hazardous, recycling, and scrap materials

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## Auditor Insights
## Tour of the Facility Interior

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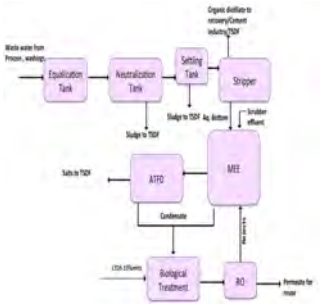


- Many pharmaceutical suppliers have made significant investments in on-site wastewater treatment facilities
- Zero-Liquid discharge (ZLD) facilities may be required by permit or have been installed due to limitations at the Common Effluent Treatment Plants (CETPs)
- CETPs may also have installed ZLD technologies. If the supplier is using a CETP, ask if the CETP is ZLD
- Confirm if final use of treated water is for boiler feed, cooling tower makeup, and/or irrigation
- Review water balance. Do the volumes make sense?

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## Auditor Insights
## Tour of the Facility Interior

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- **Interior Tour should also include the following areas (if applicable):**
  - Process areas with a focus on modules or units producing the material for the client
  - Water extraction wells
  - Potable water delivery and storage systems
  - Deep wells or borings for waste or wastewater disposal
  - Underground storage tanks
  - Air pollution control equipment for boilers and process emissions
  - Solvent storage and recovery
  - Land application areas
  - Incinerators

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## Agenda

1. Auditor Insights
2. **Air Emissions**
3. Material Storage
4. Waste Management
5. Authorizations and Permits
6. Management Systems

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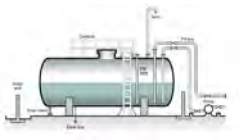
## Air Emissions
## Storage Tanks Controls

- Review management and control of emissions from storage tanks
- Determine what controls are in place including conservation vents, vent condensers, or other control devices
- Look for controls (and emergency plans) in place for storage of bulk quantities of volatile toxic or highly flammable compounds including chlorine, bromine, and anhydrous ammonia
- Review the Authorization for specific requirements for vent controls on storage tanks.



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## Air Emissions
## Process Emission Controls

- Determine what controls are in place on process equipment including vent condensers, wet scrubbers, carbon adsorption, thermal oxidizers or other control devices
- Determine if the operating parameters and maintenance of the air pollution control equipment is understood and in place including
  - Scrubber flow rates and pH
  - Frequency of carbon regeneration
  - Operating temperatures for thermal control devices
- Review the Authorization for any specific requirements for vent controls on process equipment

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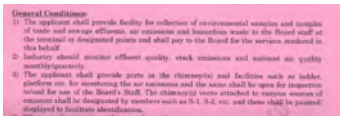
## Air Emissions
## Process Emission Authorizations

- Requirements may be include:
  - Specific Limits on emissions
  - Ambient air quality sampling and limits
  - General conditions
  - No specific limits other than APCE must be in place



General Conditions:

1) The applicant shall provide facility for collection of environmental samples and samples of trade and sewage effluents, air emissions and hazardous waste to the Board staff at the terminal or designated points and shall pay to the Board for the services rendered in this behalf.
2) Industry should monitor effluent quality, stack emissions and ambient air quality monthly/quarterly.
3) The applicant shall provide ports in the chimney(s) and facilities such as ladder, platform etc. for monitoring the air emissions and the same shall be open for inspection to/and for use of the Board's Staff. The chimney(s) vents attached to various sources of emission shall be designated by numbers such as S-1, S-2, etc. and these shall be painted/ displayed to facilitate identification.

| Sr. No. | Stack Attached To | APC System | Height in Mtrs. | Type of Fuel | Quantity & Unit | S % | SO2 Kg/Hr. |
|---|---|---|---|---|---|---|---|
| 11 | Process Stack | Bromine Scrubber | 10 | --- | --- | --- | --- |
| 12 | Process Stack | HCL Scrubber | 10 | --- | --- | --- | --- |
| 13 | Process Stack | RM Scrubber | 06 | --- | --- | --- | --- |
| 14 | Process Stack | 6APA Scrubber | 06 | --- | --- | --- | --- |
| 15 | Process Stack | AHU Bleading Vent Scrubber | 06 | --- | --- | --- | --- |
| 16 | Process Stack | Gen Vent Scrubber | 10 | --- | --- | --- | --- |
| 17 | Process Stack | Bromine Scrubber | 10 | --- | --- | --- | --- |

| | | |
|---|---|---|
| Particulate matter | Not to exceed | 150 mg/Nm³. |
| $SO_2$ Process | Not to exceed | 2070 Kg/D |
| HCL | Not to exceed | 35 mg/Nm³ |
| Bromine | Not to exceed | 9 ppm |



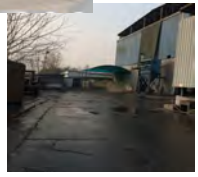
## Air Emissions
## Fuel Burning Equipment Emission Controls

- Confirm the number of boilers on-site and size (TPH) and the fuel used (e.g., coal, oil, natural gas)
- Identify control equipment in place (e.g., baghouse for particulates, SOx control, NOx control) and emission monitoring equipment (e.g., CEMS)
- Look for visible opacity at the stack



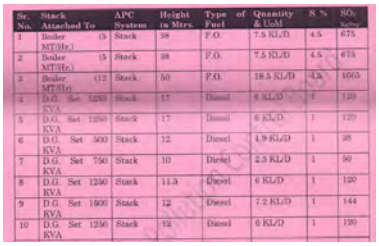
## Air Emissions
## Fuel Burning Equipment Particulate and Dust Control

- Tour the coal handling facilities (if applicable) and boiler ash handling
- Review storage practices to minimize dust and potential runoff to stormwater from coal and ash
- Determine disposal location for boiler ash (e.g., sold, landfill)



## Air Emissions
## Fuel Burning Equipment Authorizations

- Review authorization for any specific requirements for emissions, fuel rates, and/or ambient air standards
- Be sure to review any general conditions for requirements as well (e.g., malfunction requirements)



| Sr. No. | Stack Attached To | APC System | Height in Mtrs. | Type of Fuel | Quantity & UoM | S % | $SO_2$ kg/hr |
|---|---|---|---|---|---|---|---|
| 1 | Boiler MT/Hr.) (5 | Stack | 38 | F.O. | 7.5 KL/D | 4.5 | 675 |
| 2 | Boiler MT/Hr.) (5 | Stack | 38 | F.O. | 7.5 KL/D | 4.5 | 675 |
| 3 | Boiler MT/Hr) (12 | Stack | 50 | F.O. | 18.5 KL/D | 4.5 | 1065 |
| 4 | D.G. Set 1250 KVA | Stack | 17 | Diesel | 6 KL/D | 1 | 120 |
| 5 | D.G. Set 1250 KVA | Stack | 17 | Diesel | 6 KL/D | 1 | 120 |
| 6 | D.G. Set 500 KVA | Stack | 12 | Diesel | 1.9 KL/D | 1 | 38 |
| 7 | D.G. Set 750 KVA | Stack | 10 | Diesel | 2.5 KL/D | 1 | 50 |
| 8 | D.G. Set 1250 KVA | Stack | 11.5 | Diesel | 6 KL/D | 1 | 120 |
| 9 | D.G. Set 1600 KVA | Stack | 12 | Diesel | 7.2 KL/D | 1 | 144 |
| 10 | D.G. Set 1250 KVA | Stack | 12 | Diesel | 6 KL/D | 1 | 120 |

5) The applicant shall provide an alternate electric power source sufficient to operate all pollution control facilities installed to maintain compliance with the terms and conditions of the consent. In the absence, the applicant shall stop, reduce or otherwise, control production to abide by terms and conditions of this consent.

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## Air Emissions
## Odor Controls

- Note any odors on your interior and exterior tour
- Review odor control systems in place with facility staff
- Confirm operation and maintenance are adequate to prevent nuisance odors
- Confirm operation is in compliance with the Authorization

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## Air Emissions
## Noise

- Noise limitations fall under ambient air quality requirements
- Be sure to review noise monitoring records when you complete the assessment of other ambient air quality monitoring
- While many of the facilities are located in industrial or commercial zones with higher noise allowances, be sure to compare to the Authorization limits

| Category of Area/Zone | Limits in dB (A) Leq | |
|---|---|---|
| | Day Time | Night Time |
| Industrial Area | 75 | 70 |
| Commercial Area | 65 | 55 |
| Residential Area | 55 | 45 |
| Silent Zone | 50 | 40 |

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## Agenda

1. Auditor Insights
2. Air Emissions
3. **Material Storage**
4. Waste Management
5. Authorizations and Permits
6. Management Systems

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## Material Storage Containers

- Review storage of drummed and bagged materials at the facility
- Assess if warehouses are properly managed and have containment for potential releases
- Look for poor material storage practices particularly in contactor, scrap, and used equipment areas
- Review the requirements of the Authorization as most require covered storage

## Material Storage Tanks

- Look for appropriate maintenance on tanks including evidence of corrosion
- Do the tanks have overflow and overfill protection?
- Check for appropriate containment including:
  - Adequate material of construction
  - Adequate containment volume
  - No damage to the containment floor or walls
  - Open drain valves
- Review tank truck loading and unloading practices
  - Is the tank truck unloading pad contained?
  - Are the pumps and connection points contained?

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## Material Storage
## Underground Storage Tanks

- Be sure to identify any underground storage tanks at the facility
- Review UST construction and containment methods (e.g., single walled, double walled, single wall in concrete vault)
- Review methods used to determine leaks (e.g., inventory reconciliation, groundwater monitoring, leak detection in vault or interstitial space)
- Review tank truck loading and unloading practices
  - Is the tank truck unloading pad contained?
  - Are the pumps and connection points contained?


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## Agenda

1. Auditor Insights
2. Air Emissions
3. Material Storage
4. **Waste Management**
5. Authorizations and Permits
6. Management Systems

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## Waste Management
## Regulatory Framework

- Environmental Protection Act
- Hazardous Wastes (Management, Handling and Trans-boundary Movement) Rules
- Bio-Medical Wastes (Management and Handling) Rules
- Battery (Management and Handling) Rules
- e-Waste (Management and Handling) Rules

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## Waste Management
## Identification, Characterization, and Inventory

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- The site should have a documented process to identify and properly characterize all of its waste streams
- An inventory of wastes generated should be available on site
- The inventory should include at a minimum:
  - Point of Generation (process generating the waste)
  - Hazardous characteristics and classification (corrosive, flammable, radioactive, etc.)
  - Annual Generation Rate

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## Waste Management
## Storage and Handling

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- Waste storage areas should be secured and managed to prevent releases to the environment
- Located indoors or in covered structures to prevent direct contact with stormwater
- Impervious floors with secondary containment that completely surrounds the storage area(s) and capable of containing 110% of the largest container
- Storage areas clean and free of debris and accumulated liquids
- Sufficient aisle space for inspection of container condition and labelling and to allow access during an emergency

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## Waste Management
## Storage and Handling

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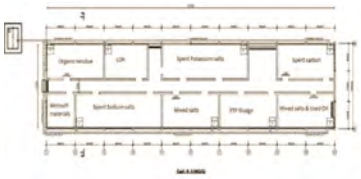
- **Review the following:**
  - Inspection program in place for waste storage areas
  - Separate storage for incompatible wastes
  - Suitable emergency response equipment in place including safety showers and eyewash, communication systems, and spill control equipment
  - Suitable PPE available for personnel managing waste
  - Proper security and signage



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## Waste Management
## Bio-Medical Waste

- Confirm with the site if they generate biohazardous wastes (e.g., microbiological testing wastes)
- Review storage and handling methods
- Must be managed appropriately while on site
- Segregated from other hazardous wastes
- Confirm disposal method and location
- Incinerated at a PCB approved location

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## Waste Management
## Disposal

- Wastes must be disposed at the location specified in the Authorization
- Confirm locations of disposal against the Authorization with the site
- A multipart manifest is used to track waste shipments
- Confirm the site has a system for tracking waste shipments and retaining shipment records
- Review hazardous waste manifests to confirm that each waste stream is being disposed at the correct and authorized location
- Review Form 4 – Waste Disposal Report to PCB to determine if wastes are being properly accounted for and waste disposal volumes do not exceed the Authorization limits

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## Agenda

1. Auditor Insights
2. Air Emissions
3. Material Storage
4. Waste Management
5. **Authorizations and Permits**
6. Management Systems

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## Authorizations and Permits Document Review

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3. The Consent is valid for the manufacture of -

| Sr. No. | Product Name | Maximum Quantity in MT/A |
|---|---|---|
| 1 | Alendronate Sodium Trihydrate | 0.500 |
| 2 | Almotriptan Malate | 0.010 |
| 3 | Alosetron HCl | 0.002 |
| 4 | Aripiprazole | 1.200 |
| 5 | Armodafinil | 0.200 |
| 6 | Atorvastatin Calcium | 0.100 |
| 7 | Azithromycin | 0.100 |
| 8 | Biapenem | 0.500 |
| 9 | Cetrizine HCL | 1.200 |
| 10 | Cilastatin Sodium Sterile | 5.000 |

- You should identify the documents you plan to review in the initial agenda and again at the opening meeting so that the facility staff can have the documents, and colleagues familiar with the documents, available for the review
- You may ask for copies of documents. However, it is not necessary or critical to obtain copies of all documents reviewed
- Focus should be on permit compliance
- Review a sample of performance reports from at least the last year
- If time permits, you can review previous years

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## Authorizations and Permits Document Review

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- The following documents should be reviewed during the assessment if applicable:
  - Environmental Clearance (EC)
  - Consent for Establishment (CFE)
  - Consent for Operation (CFO)
  - Excise Register (ER1) – Production records with focus on Pfizer products
  - Form 5 - Report to PCB on emissions and compliance
  - Form 1 - Water Cess Records (Water use records and fees)
  - Form 4 – Waste Disposal Report to PCB
  - Manifests for wastewater shipments to the CETP
  - Manifests for hazardous waste shipments to the TSDF
  - Ambient Air Quality test reports
  - Stack Emission test reports
  - Wastewater Analysis
  - Agreements with the CETP
  - Agreements with the TSDF
  - Agreements with Cement Kilns
  - Records of waste disposal facility audits

Government of Maharashtra

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## Authorizations and Permits General Permitting Structure

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- Environmental permits are built on production types and quantities
- Limits are set using mass balance approach
- Ministry of Environment and Forest (MofEF) (India Government level) issues EC
- Indian States issue CFE and CFO


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## Authorizations and Permits
## General Permitting Structure - EC

- The EC is the first permit step for a new facility or proposed expansion
- Ensure facility has an EC for their current operations
- The CFO and EC limits generally are the same unless there was a contested permit at the State level and tighter limits were applied

Government of Maharashtra

SEAC-2512/CR-20/TC-2
Environment department
Room No. 217, 2nd floor,
Mantralaya Annex,
Mumbai- 400 032
Dated: 29th September, 2014

To,
M/s. Orchid Chemicals & Pharmaceuticals Limited
Gat No.38, CIDCO, village Vitava,
Waluj MIDC, Aurangabad

**Subject: Environment clearance for proposed expansion of manufacturing capacity from 166.01 TPA to 430.00 TPA at Plot No.L 9 & L-8(part), MIDC, Gat No.38, CIDCO, village Vitava, Waluj, Aurangabad by M/s.Orchid Chemicals & Pharmaceuticals Limited**

Sir,

This has reference to your communication on the above mentioned subject. The proposal was considered as per the EIA Notification, 2006, by the State Level Expert Appraisal Committee-I, Maharashtra in its 77th meeting and decided to recommend the project for prior environmental clearance to SEIAA. Information submitted by you has been considered by State Level Environment Impact Assessment Authority in its 73rd meeting.

2. It is noted that the proposal is for grant of Environment Clearance for proposed expansion of manufacturing capacity from 166.01 TPA to 430.00 TPA at Plot No.L 9 & L-8(part), MIDC, Gat No.38, CIDCO, village Vitava, Waluj, Aurangabad. SEAC-I considered the project under screening category 5(f) B1 of EIA Notification 2006.

Brief Information of the project submitted by Project Proponent is as:

| Name of the Project | Proposed Expension from existing 166.01 TPA to 430.00 TPA in existing manufacturing unit of Orchid Chemicals & Pharmaceuticals Ltd. |
|---|---|
| Project Proponent | Orchid Chemicals & Pharmaceuticals Ltd., L-9 & L-8 (part), M.I.D.C., Gat No.38, CIDCO, Village Vitawa, Waluj, Dist. Aurangabad |



## Authorizations and Permits
## General Permitting Structure – CFE and CFO

- Consent for Establishment (CFE) is issued by the State pollution control board (PCB)
- Subsequent to CFE, a Consent for Operation (CFO) is issued by the PCB with limitations based on mass balances and other specific and general conditions:
  - Provides for limits on what can be produced and how much
  - Limits water consumption
  - Limits wastewater volume and characteristics including, typically COD and TDS
  - Sets specific limits on solid waste volumes, usually by waste stream, and location and/or method of disposal
  - Sets emission limits on boilers and fuel burning equipment (PM, SO2, NOX)
  - Sets ambient air quality limitations (PM10, PM2.5, SO2, NOX)
  - Noise Limitations (day and night time limits at fence line)
  - Specific conditions may include installation of control equipment and monitoring equipment
  - General conditions may include items such as “no outside storage of hazardous materials”



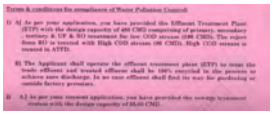
## Authorizations and Permits
## General Permitting Structure – CFE and CFO

- Be sure to review limits on:
  - Permit expiry date
  - Valid / Permitted Products
  - Quantity of each product allowed to be manufactured
  - Volume of hazardous waste and disposal location
  - Wastewater discharge limitations and any ZLD requirements
  - Stack emission limitations
  - General conditions required by the permit

MAHARASHTRA POLLUTION CONTROL BOARD

3. The Consent is valid for the manufacture of :-

| Sr. No. | Product Name | Maximum Quantity in MTPA |
|---|---|---|
| 1 | Alkalihalide Sodium Trihydrate | 5.000 |
| 2 | Atorvastatin Malate | 0.100 |
| 3 | Alosetron HCl | 1.000 |
| 4 | Aripiprazole | 0.200 |
| 5 | Armodafinil | 0.100 |
| 6 | Atorvastatin Calcium | 0.100 |
| 7 | Artesunate | 0.101 |
| 8 | Bupropion | 0.500 |
| 9 | Cetirizine HCL | 1.000 |
| 10 | Glatiramer Acetate Depot | 5.000 |



Terms & conditions for consolidation of Water Pollution Consent

1) a) As per your application, you have provided the Effluent Treatment Plant (ETP) with the design capacity of 460 CMD comprising of primary, secondary, tertiary & UF & RO treatment for low COD stream (400 CMD). The reject from RO is treated with High COD stream (90 CMD). High COD stream is treated in ATFD.

b) The Applicant shall operate the effluent treatment plant (ETP) to treat the trade effluent and treated effluent shall be 100% recycled in the process to achieve zero discharge. In no case effluent shall find its way for disposal in/ outside factory premises.

ii) a) As per your consent application, you have provided the sewage treatment system with the design capacity of 50.00 CMD.

## Authorizations and Permits
## Production Records

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- A review of actual production quantities compared to CFO limits is a key part of the document review
- As the CFO limits are based on production quantities and mass balances, if the facility is exceeding its permitted volumes, it may well be exceeding its waste and wastewater volume limits and potable water volume use limits
- You should also review what products are being made to determine if they are all permitted
- In particular, you should confirm the limits on individual products are not being exceeded and that the facility has permission to manufacture the material

| Sr. No. | Name of Product | MPCB Consented manufacturing quantity in KG/A (Apr 15-Mar 16) | Production Quantity | | | | | | | | | | | | | Balance Quantities can be manufactured upto Mar-16 (Kgs) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Apr-15 | May-15 | Jun-15 | Jul-15 | Aug-15 | Sep-15 | Oct-15 | Nov-15 | Dec-15 | Jan-16 | Feb-16 | Mar-16 | Total | |
| 1 | Alendronate Sodium Trihydrate | 500.00 | | | | | | | | | | | | | - | 500.00 |
| 2 | Almotriptan Malate | 10.00 | | | | | | | | | | | | | - | 10.00 |
| 3 | Alosetron HCl | 2.00 | | | | | | | | | | | | | - | 2.00 |
| 4 | Aripiprazole | 1,200.00 | | | | | | | | | | | | | - | 1,200.00 |
| 5 | Armodafinil | 600.00 | | | | | | | | | | | | | - | 600.00 |
| 6 | Atorvastatin Calcium | 950.00 | | | | | | | | | | | | | - | 950.00 |
| 7 | Azithromycin | 1,000.00 | | | | | | | | | | | | | - | 1,000.00 |
| 8 | Bisoprolol | 500.00 | | | | | | | | | | | | | - | 500.00 |
| 9 | Cetirizine HCL | 800.00 | | | | | | | | | | | | | - | 800.00 |
| 10 | Cilastatin Sodium Sterile | 5,300.00 | | | | | | | | | | | | | - | 5,300.00 |

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## Agenda

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1. Auditor Insights
2. Air Emissions
3. Material Storage
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6. **Management Systems**

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## Management Systems
## Organization and Staffing

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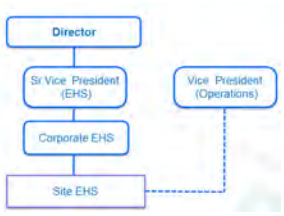
- Review the site organization chart with a focus on EHS
- Review reporting relationships
- Does the EHS lead report to the site lead or in another part of the organization?
- Does the EHS staff and environmental staffing appear adequate for the site size and complexity
- If there is an on-site wastewater treatment facility, is it adequately staffed and managed?
- Is there a Corporate EHS organization?
- What is the reporting relationship of site EHS to the Corporate EHS organization?
- What support does the Corporate EHS organization provide?




**Total Employees : 1452**
**Working days : 24 x 7**
**Schedule : 4 Shifts**
**EHS Staff: : 10**
**Environmental : 7**

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## Management Systems
## Policies and Procedures

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[redacted]
Environment, Health and Safety Policy
[redacted]

- Ask for the sites environmental, health and safety policy
- Is the policy current?
- Is there evidence that employees are aware of the policy (e.g., is it posted, is there a clear culture at the site that is supportive of the policy)
- Are procedures in place for environmental activities?
- Do the operating procedures include environmental aspects?
- Is there clear evidence that the procedures are followed?

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## Management Systems
## Certifications

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- Is the site ISO 14001 registered?
- If so, when was first registration?
- When is the next re-certification?
- ISO registration is helpful but not always a clear indicator of a robust and compliant program


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## Management Systems
## Goals and Environmental Impact Reduction

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- Does the facility have clear environmental goals?
- Are they set locally or at the corporate level?
- Is there clear support for achieving the goals?
- Doe the facility or company report the progress against goals publicly?
- Review the methods that facility has in place to measure key environmental impacts including:
  - Energy consumption
  - Water consumption
  - Hazardous and non- hazardous waste generation and disposal

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## Management Systems
## Compliance and Event History

APPCB issues closure notices to 195 bulk drug and other polluting industries in AP

Karnataka Pollution Control Board issues closure notice to bulk drug cos in Bidar & Kalburgi for flouting norms

API facility at Chennai issued notice by TNPCB

- Before conducting the assessment, review compliance history via web search
- Review compliance history with the site during the visit including:
  - Status of Authorizations (e.g., are they current, have they applied for an expansion)
  - Any notices of violation
  - Any fines or penalties for non-compliance
  - Any spills or unplanned releases to the environment
- This is a key concern raised by investors and NGOs

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## Management Systems
## Waste Vendor Management

- Does the facility audit their waste vendors?
- Determine:
  - the frequency of the audits
  - if there is an audit protocol in place
  - if the auditor is qualified to complete the assessment
- For facilities discharging wastewater to a common effluent treatment plant:
  - does the facility conduct periodic audits of the CETP?
  - do they periodically escort the trucks to the site to ensure waste delivery?

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Intentionally left blank…..

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# The Pharmaceutical Supply Chain Initiative Training for Auditors – IH Topics

Compiled by:
PSCI Audit Committee

Presented by Shelly Shope
Elanco Animal Health Division
Eli Lilly and Company



PSCI

PHARMACEUTICAL SUPPLY CHAIN INITIATIVE

## Agenda (90 minutes)

- **END IN MIND** – discovering PSCI critical & PSCI other issue
  - PSCI IH Principles
  - PSCI Critical Finding for IH
- **Key concepts** in the Industrial Hygiene program & **Red Flags**
  - Are we using the same SDS information?
  - Occupational Exposure Banding 101
  - Engineering Controls
  - Personal Protective Equipment
  - IH Monitoring
  - Medical Surveillance
  - Employee Training
  - Biosafety / Radiation Safety
- **Case Studies Examples** – using the audit protocol

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## What are the PSCI Health & Safety Principles applicable to IH?

**1. Worker Protection**
Suppliers shall protect workers from over exposure to chemical, biological, physical hazards and physically demanding tasks in the work place and in any company provided living quarters.

**3. Emergency Preparedness and Response**
Suppliers shall identify and assess emergency situations in the workplace and any company provided living quarters, and to minimize their impact by implementing emergency plans and response procedures.

**4. Hazard Information**
Safety information relating to hazardous materials - including pharmaceutical compounds and pharmaceutical intermediate materials - shall be available to educate, train, and protect workers from hazards.

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## Managing Potent and Sensitizing API Compounds
## What is in a GOOD IH PROGRAM

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- An onsite person who has had training in control of hazardous agents
- Access to expert (e.g. certified industrial hygienist, qualified consultant)
- Inventory of hazardous chemical agents, in particular potent materials, sensitizers, carcinogens and reproductive hazards.
- Information on chemical agents from customers and suppliers and use of a banding system
- Access to MSDS data and communication of risks, procedures and controls to staff using the hazardous agents.
- Chemical risk assessments – chemicals used, operations performed, assessment of control measures (including non-production tasks such as maintenance of equipment, handling of waste)
- Procedures and training on storage / use and cleaning of PPE.
- Sampling and monitoring data as appropriate
- Risk based health surveillance.
- Incident/exposure records

## Using the PSCI Questionnaire for IH

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- Don't just answer yes/no
- Identify what they do and let the PSCI company understand ANY concerns with the approach you see.
- Ultimately – find the single question to place in your conclusions about acceptable to be CAPABLE and EFFECTIVE at handling the APIs they are under contract to handle. Find one question where you will document whether OEL approach aligned between the companies.
- When it is unknown whether exposure are acceptable – write the finding to have the company secure the data to ensure their control strategy is supported.
- ALWAYS – reference what you SAW in the field, not what you read in a SOP. Be sure to document what you did or did not see on your tour! This is very important for possible sharing of future audit reports between PSCI members.

**Safety Questions – for IH**

- 62. Have any significant Health & Safety incidents occurred at this facility over the past three years?
- 63. Does the facility provide the following types of HSE (Health, Safety & Environment) training to employees (full-time, temporary, or contractor)?
  - Hazard Communication
  - Personal protective equipment & Respirator use

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## PSCI Occ Health/IH Questions

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- **81. Has the facility established practices to eliminate hazards of materials using the hierarchy of exposure control:**
- **82. Does the facility perform risk assessments for chemicals handled? Mark the technologies in use.**
- **83. Has the facility established occupational exposure levels for all Active Pharmaceutical Ingredients (API) and hazardous substances?**
- **84. Has the facility established exposure control capabilities for handling pharmaceutical compounds?**
- **85. Does the facility perform risk-based medical monitoring or employee health surveillance which includes recording, investigation and follow-up? List Methods used.**
- 86. Has the facility developed and implemented a plan to protect First Aid Responders and Medical Professionals from exposure to body fluids?
- **87. Does the facility perform exposure monitoring for the following health and safety risks? Mark per category.**
- 88. Is there a site procedure to inform employees of the results of exposure evaluations and monitoring results?
- 89. Does the site provide Personal Protective Equipment (PPE) for face, eye, foot, head, and hand protection?
- **90. Does the facility rely primarily on respiratory protective devices and/or engineering controls to protect employees who handle chemicals to achieve exposure levels below the exposure limit?**

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## Occ Health/IH Questions

- 91. Does the facility use any of the following respiratory protection equipment for worker protection against exposure to chemicals or pharmaceutical compounds. Mark those and comment on appropriateness.
- **92. Are there provisions for fit testing, training, use, cleaning, inspecting, storing, and maintenance of respirators?**
- 120. Does the facility maintain Safety Data Sheets (SDSs) for all hazardous substances?
- 121. Does the facility have a training program covering the properties and health effects of the hazardous substances, use of and access to SDSs, container labelling and safe handling procedures?

### Process Safety Management Questions

- 94. Does the facility have processes to manage chemical hazards safely in order to prevent catastrophic events involving **highly toxic, flammable, reactive and/or corrosive substances**?
- 117. Are emergency response plans in place and when was the plan updated?
- 118. Does the site have an on-site emergency response team that is trained for fire or other emergencies?
- 119. Does the site use off-site consequence modelling to evaluate to potential off-site impact of chemical releases?

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## Industrial Hygiene – What are we after?

PSCI Audit Findings

Critical Findings:

- Are very high risk findings that require immediate action to protect human life, the health of employees or the environment;
- May result in loss of license to operate or serious damage to reputation;
- Require immediate corrective action by the supplier;
- Need to be communicated to the audit sponsor prior to audit report finalization.

Examples for critical findings:

- Severe violations of human rights or labor rights (e.g. presence of child labor in a facility or forced labor, over-excessive working hours);
- Health and safety issues that can cause immediate life threatening situation or serious injuries to employees and other individuals on site;
- Environmental or safety issues that could result in serious and immediate harm to the community.

Other findings:

- Are all other major or minor audit findings, which need to be corrected by the supplier in an appropriate period of time?

Q1. Did you discover a known or highly probable situation that could cause immediate harm? If so, describe and help us understand why?

Q2. Is site CAPABLE to EFFECTIVELY manage our pharmaceutical risks in our Contract?

Q3. Is the site handling APIs correctly for themselves and others? (Brand Risk)

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## IH Red Flags – potential IMMEDIATE CONCERN

- Site handling their API as NUSIANCE DUST 10 mg/m3 because no regulatory limit. No banding approach exists for products without limits. Site is handling potent pharmaceuticals.
  - Site has never seen the API – OEL from the PSCI member company SDS. When you compare the two with them, you find major differences in classifications and OEL.
- IH monitoring (if collected) has had faulty interpretation – there are clear overexposures and no action.
- Highly potent pharmaceutical being handled (<10 mcg/m3), operation is OPEN , respirator required by SOP is NOT on the site or completely wrong for the hazard class (e.g. not a respirator or respirator protection factor too low). No segregation and unsure if nearby personnel are also overexposed.
- During tour of area with highly toxic gases and/or solvents – you smell strong odors, experience irritation, see wrong PPE, and no alarm or shut-offs. Dust masks being used on solvents/gases. Process venting is directed into the room where people work.
- The site lacks any data to justify that they know their workers are protected. This combines with poor Hazcom and PPE practices.
- No capable resource being used to manage IH issues/concerns.
- Site performs QC sampling in warehouse on the open floor for ALL chemicals.
- There is no LEV in the centrifuge unloading or dryer loading rooms where wet cakes are being handled. Limited PPE is being worn.
- There is NO IH sampling data for any process or chemical on record.

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## Immediate Harm…..

Easy

- Concept of Immediately Dangerous to Life and Health (IDLH) can be applied. Typically applies to acutely Toxic materials, gases and solvents. NIOSH – is a USA reference for IDLH values.
- IH monitoring has documented exceedances emission exceeding Respirator Protection Factors
- Protection for spill and emergency responders is insufficient for risk

Experience

- For APIs that are potent compounds – a different model is necessary to understand
  - Carcinogens
  - Sensitizers
  - Highly Potent Pharmaceuticals
  - Hormones
  - Reproductive Hazards

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## First Question - Do we agree on Hazards of API? and Controls Needed?


- API Supplier – Generic
- API Supplier – Proprietary Chemistry as Contract Manufacturer
- Drug Product Pharma Company

Differing Data Sets & Handling Expectations


*1st question – do we they agree on classification and occupational exposure limit?*

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## A few foundational basics….

- **Occupational Exposure Limit (OELs)**
  - A numerical air concentration limit expressed as PPM or mg/m3 over a stated time duration (8hr, 12hr, 15 min, Ceiling) which nearly all adult workers may be exposed to during their working lifetime without adverse effects. These may be set by a government or a company. Thousands of chemical do NOT have OELs.
  - Can be found on a MSDS.
- **Occupational Exposure Banding** – Pharmaceutical Industry Method
  - Classify the Hazard Bands and pick your Default Band: The method a company establishes to setup rules for identifying a control strategy for handling materials with limited toxicology data for safe handling. The bands may be created using rule sets, limited toxicology, and Risk Phrases from the Global Harmonization Standard. Typically found on a MSDS.
  - An established set of recommended ENGINEERING and CONTROL strategies for handling chemicals within a chemical exposure band. Companies who set OELs generally have these. NOT typically found on a MSDS.

$$OEL\ (mg/m^3) = \frac{NOEL\ (mg/kg/day) \times BW\ (kg)}{V\ (m^3/day) \times S \times UF \times \alpha}$$

- NOEL = the no-observable-effect-level (mg/kg/day)
- BW = average human body weight (50 kg)
- V = volume of air breathed in an 8-hr work day (10 $m^3$/day)
- S = time, in days, to achieve a plasma steady state
- UF = uncertainty factors
- α (alpha) = % absorbed through inhalation

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## On Line Control Banding Information and Tools

- COSHH (Control of Substances Hazardous to Health) Essentials (UK HSE, 2006)
  http://www.coshh-essentials.org.uk/
- ILO (International Labour Organization) International Chemical Control Kit (ILO, 2006)
  http://www.ilo.org/public/english/protection/safework/ctrl_banding/index.htm
- AIHA Control Banding Working Group
  http://www.aiha.org/content/insideaiha/volunteer+groups/controlbanding.htm
- NIOSH Control Banding
  http://www.cdc.gov/niosh/topics/ctrlbanding/
- ISPE Volume 7 (2010) "Risk Based Manufacture of Pharmaceutical Products"
- PSCI website – type in "IH, Banding, or Containment" on the resource link

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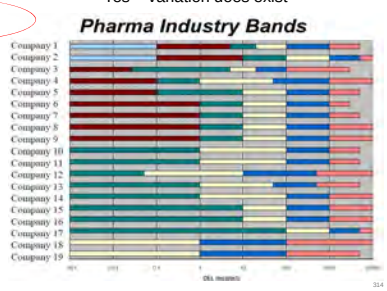
## Managing Potent and Sensitizing Compounds Exposure Control Banding

- Example of exposure control banding:
  - OEB 1 (>1000 ug/m3)
  - OEB 2 (100-1000 ug/m3)
  - OEB 3 (10-100 ug/m3)
  - **OEB 4 (1-10 ug/m3)**
  - **OEB 5 (<1 ug/m3)**

Yes – variation does exist

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## Managing Potent and Sensitizing Compounds Factors Influencing Exposure


If you are auditing a company with OEB 4/5 you really need experience with OEB control concepts.

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## WHY? Because APIs are not Nuisance Dust

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**INDUSTRIAL HYGIENE / WORKER EXPOSURE RED FLAGS**

- Look at MSDS between companies – do they agree on OEL and classifications? Differences >20X are of concern.
- We know APIs do not have regulatory exposure limits – PSCI companies DO NOT treat APIs as NUSIANCE DUST. Agree on the required exposure limit and control banding. If none exists – Red Flag.
- API /DP companies for Pharma MUST have internal processes for setting final API and intermediate control banding and implementing those practices – especially in development and for intermediates.
- Industrial hygiene workplace monitoring needs to CONFIRM their strategy is working, especially when exposure limits are low and PPE in use is very minimal. No data is a RED FLAG.
- IH Capability in some parts of the world is a challenge. We typically encourage our partners to hire consultants.

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## Be really careful of UNITS of MEASURE in your reports

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- mg/m3
- mcg/m3
- µg/m3
- ng/m3


API Manufacturer Limit : 0.1 mg/m3

PSCI Member Limit: 0.1 mcg/m3

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## Banding Exercise – What mass can your eyes no longer see?

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Average worker breathes about 17 M3 in a workday

Photo from web reference "IP Powertools – Understanding the OSHA Silica PEL"


| Band Range | Mass Inhaled over 8hr day |
|---|---|
| 10,000 µg/m3 | 4% sugar pack |
| 1,00 µg/m3 | 0.4% sugar pack |
| 100 µg/m3 | 0.04% sugar pack |
| 10 µg/m3 | 0.004% sugar pack |
| 1 µg/m3 | 0.0004% sugar pack |
| 0.1 µg/m3 | 0.00004% sugar pack |

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## High Potential Exposure Concerns

- Reactor charge/material transfer
- Drying/discharging
- Granulation/mixing
- Milling/de-lumping
- Dispensing/weighing/repackaging
- Maintenance activities
- Cleaning / Heel Removal
- Process upsets/spills

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## When doing a PSCI audit for a member company – get their banding categories and tools.

*SAMPLE: Control Banding Implementation*

| Band | PPE | Facility Design | Engineering Controls | Equipment Cleaning and Maintenance |
|---|---|---|---|---|
| Level 1 | •Gloves<br>•uniforms | •General Ventilation<br>•Shared HVAC<br>•General Filtered Exhaust<br>•Recirculate Permitted<br>•Common Gowning & De-gowning | •Passive Ventilation/Dilution<br>•Open Mat'l Conveying and/or Mat'l Transfers<br>•Open Process Equipment | •Open Process Equipment Transport to Cleaning Area<br>•Manual Cleaning |
| Level 2 | •Respirators<br>•Tyvek coveralls | •Pressure Differential To Selected Adjacencies<br>•Open Process Area<br>•Closed Building<br>•Process segregation with doors<br>•Gowning/De-gowning Room | •Standard Equipment Design (Normally Closed)<br>•Local Exhaust Ventilation<br>•Mat'l Conveying Essentially Open with Hardware Remediation<br>•Pressure Convey<br>•Laminar flow | •Open Process Equipment Cleaned In-Situ |
| Level 3 | •Maximum PF respirator | •HEPA Filtration<br>•Room Finishes & Surface MOC's and Utilities Are Designed for Ease of Cleaning<br>•Process segregation with airlocks<br>•Decon Shower | •Standard Equipment Design with Separate Mechanical Space<br>•Glovebox or Glovebag<br>•Closed Material Conveying<br>•Minimize Make/Break Connections<br>•Split butterfly valves (SBV) | •Provide CIP with Rinse Water Capture<br>•Closed equipment maintenance capability |
| Level 4 | •Seek expert assistance<br>•Respirators not adequate for "open" processing<br>•Redundant PPE with engineering controls | •Seek expert assistance<br>•Dedicated HVAC<br>•HEPA Filtration w/Safe Change<br>•No Exhaust Return<br>•Closed Process Area<br>•Closed Building<br>•Separate Gowning & De-gowning<br>•Automation | •Seek expert assistance<br>•Process Equipment iDesigned for Total Containment<br>•Closed Mat'l Transfers with Barrier Add-ons<br>•Vacuum Convey<br>•Minimize Mat'l Conveying Steps<br>•Minimize Material Transfer Connections<br>•Isolator with continuous liner<br>•Enhanced/purgable SBV | •Seek expert assistance<br>•Minimize Waste via Process and Formula Optimization<br>•Protective barriers for laptops, paperwork, documents |

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## PSCI Questionnaire – It now makes you identify the controls you observed.

*SAMPLE: Engineering Control Capabilities from PSCI website*

| Engineering Control | Capability (µg/m3)* |
|---|---|
| Walk-in fume hood | < 5000 |
| Laminar flow booth (horiz) | < 500 |
| Laminar flow w/ continuous liner | < 100 |
| Downflow booth | < 100 |
| Downflow booth w/ screen | < 25 |
| Split butterfly valve (SBV) | < 10 |
| Single chamber glovebox (GB) | < 1 |
| SBV w/ purge capability | < 0.5 |
| Glovebox isolator around continuous liner | < 0.1 |
| GB w/ RTP (rapid transfer port) | < 0.05 |
| Multi-chamber GB w/ RTP/ESBV | < 0.01 |

** operator exposure during unit operation*

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## Transfer Mechanisms

Cut & tape bag

Cone valve

Split Butterfly Valve

Containment flap

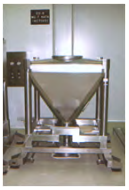
Continuous liner

Alpha/beta flange

## Material Transfers

Active- open

Active- closed



IBC

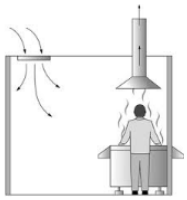
FIBC

## Isolators

**Flexible- glovebag**

**Rigid- glovebox**

## Local Exhaust – GOOD vs BAD



Dusts aren't hot vapors!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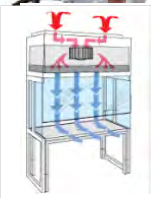
## Laboratory Controls



No worker protection

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## 2nd question – based on controls in place, are people protected?

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- If what you saw didn't use the Hierarchy of Engineering Controls, but was more heavily reliant on PPE or work procedures….ARE THEY ADEQUATELY PROTECTIVE?

- Are PPE and Containment requirements documented in the manufacturing ticket or batch record?
- Are personnel wearing the correct/required PPE?
- Does the site's Respirator Program appear to be adequately managed?
- If the site is handling highly potent API powders or drug products, have they implemented containment measures to avoid "open handling"? Is there an actual engineering improvement plan?
- If the site is handling potent API powders or drug products, have they implemented a comprehensive Industrial Hygiene Monitoring Program (i.e. more than just cursory area samples or particle counting)?

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## 3rd Question – do we have adequate Respiratory Protection?

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**The values of the APF in EU and other countries** [edit]

Studies of respirator's performance was carried out not very often, and almost all of these studies were conducted in USA (and UK). It is possible that the lack of information about the RPD efficiency in the workplaces, was the reason behind developing these assigned PF in several European countries, whose values differ significantly from the evidence-based values of APFs in the US and UK.

**The Assigned Protection Factors for some main RPD types, developed in several EU countries**[2] [hide]

| RPD type | APF in several EU countries | | | |
|---|---|---|---|---|
| | Finland | Germany | Italy | Sweden |
| FFP2 filtering facepices | 10 | 10 | 10 | 10 |
| Elastomeric half masks with P2 filters | 10 | 10 | 10 | 10 |
| FFP3 filtering facepices | 20 | 30 | 30 | 20 |
| Elastomeric half masks with P3 filters | - | 30 | 30 | - |
| Negative pressure air-purifying respirators with full face mask and P2 filters | 15 | 15 | 15 | 15 |
| Negative pressure air-purifying respirators with full face mask and P3 filters | 500 | 400 | 400 | 500 |
| Powered Air-Purifying Respirators (PAPRs) with loose-fitting hood or helmet, and THP3 filters | 200 | 100 | 200 | 200 |
| PAPRs with full face mask, and TMP3 filters | 1000 | 500 | 400 | 1000 |
| SARs with full facepiece and negative pressure demand air supply | 500 | 1000 | 400 | 500 |
| Supplied Air Respirators (SARs) with full facepiece and positive pressure demand air supply | 1000 | 1000 | 400 | 1000 |
| SCBAs with full facepiece and positive pressure demand air supply | - | ≥ 1000 | 1000 | - |

Source - Wikipedia

Am I a respirator?

**PPE Use/Re-use?**

**Training?**

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## PPE Program

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Storage / Clean

Solvents + Dusts?

Right Gloves?

Shoes?

Fit-testing

CPC Coveralls



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## Do the controls protect nearby workers and products?

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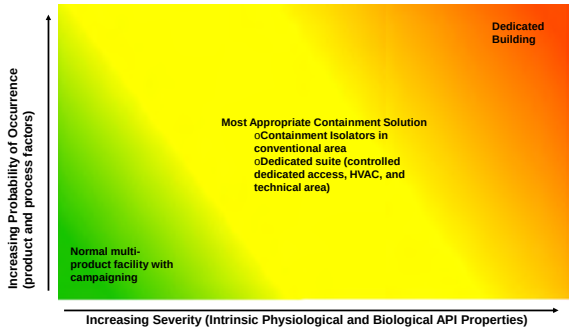


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## Case Study….potent steroid

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- API manufacturer of Generic material did not set their own limits but found a limit on the web from another company and used it.
- Elanco limit was 500X times lower. Data exchange revealed similar thought process on setting limits but different toxicology data was being used. Elanco process allows for updating when new data available. End Result – companies aligned within 5X on OEL accounting for different safety margin practices.
- Company had no workplace monitoring data to verify they were meeting their previous limit or the new limit. They were in a dedicated suite. API company asked to immediately upgrade from dust masks and install better controls. API manufacturer collected IH data to verify that their final PPE/engineering was protective. Engineering controls were implemented in a very focused way reducing costs. Company applying approach to all their chemical manufacturing.
- DATA IS YOUR FRIEND. In absence – default to more protective PPE & SOPs

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## Do you see why this is the first question?


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- API Supplier – Generic
- API Supplier – Proprietary Chemistry as Contract Manufacturer
- Drug Product Pharma Company

Differing Data Sets & Handling Expectations


*1st question – do we they agree on classification and occupational exposure limit?*

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## IH Monitoring Basics

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- Personal Breathing Zone Samples vs Area Samples
- Total Dust vs API dusts at Drug Product Sites
- Training of sampler and report writer?
- # of samples, # of days sampled
- Verify the Math on protection factors
- Short tasks data versus full shift data
- No data – use company's commissioning data on their web site
- Focus is ONLY on API and not on solvent/gases – BIG issue for wetcakes.

Is it well managed?

Does it seem appropriate?

Most important, is to qualify the scope of the data you did see.

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## Medical Surveillance




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- Regulations can vary on formality of program and scope – know your local countries requirements
- Generally – programs globally exist for respirator protection, noise, some vaccines.
- Is there an occupational physician for the site who understands and sees the workers IH profiles and establishes the medical surveillance program?
- For highly potent compounds – does the site have any special medical surveillance programs, including biological monitoring?
- Has the site experienced high blood results / occupational health events – what is their response action?
- If the material is a sensitizer, has the site established processes to protect people with known allergies?
- How is the site managing reproductive hazards with men and women?
- What is the frequency of IH Health type events at the site?
- How does the site investigate workplace exposure events?

Is it well managed?

Does it seem appropriate?

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## Company has limited IH data…what to do?

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- Situation: API company hired IH consultant and measured total dust of one unit operation. Data for that one chemical on that one day showed the Respirator being worn was sufficient. Some containment in place and PPE and work practices generally seem to align to what you have seen of control bandings?
- Your PSCI member company has a different API of varying particle size/density and uses different unit operations.
- Your PSCI member company requires data to support the control strategy but does not have an analytical limit to give the company.


Company X lacks IH data to establish the effectiveness of their control strategy. Unit Operations Y should be assessed with priority as a minimal protection factor of 50X is currently in use with a relatively open process.

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## Other MSDS Classification Issues

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- Material is a Dangerous Good for Shipping and API company is not aware of the toxicology data driving this decision
- Packaging, Shipping, and handling practices need awareness
- If shipped to EU, CLP product labeling for some products (e.g. feed) may be impacted.
- Combustible Dust Classification
- Process Safety Data may not may not be on the SDS depending on the company philosophy.
- Labeling for receiving customer country and shipping country



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## Let's test our rating alignment
## BLINDED ELANCO CONCLUSION DATASET

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Site is currently handling compounds with the highest hazard category of Containment (<1 ug/m3). As outlined in the IH (Industrial Hygiene) section of this report Elanco has critical concerns over the open handling of API.

- Exposure Control Program Improvements*
  - Improve Periodic Monitoring for High Potency API & Low OEL Solvents (e.g., Methylene Chloride & API (Drying/Milling) to confirm PPE (Primary control) provides adequate protection.
  - Apply statistical methods for data collected when determining acceptability of sampling results (task based).
  - Respiratory Protection Improvements: Confirm suitability of current respirator(s) for Methylene Chloride (consider airline for this contaminant) and develop cartridge change out schedule for filters and adsorbent cartridges (for other contaminants).
  - Implement improved Lab Safety / Lab Hygiene practices:
    - Fume Cabinet Use: Certify Performance of Hoods,
    - Train employees on proper hood use
    - Improve housekeeping
  - Containment capabilities – Site High potency lab and Facility X are capable for OEL <1 ug/m3.

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## Let's test our rating alignment
## BLINDED ELANCO CONCLUSION DATASET

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Report Findings:

Voluntary respirator program in place

Employee exposure monitoring conducted in late 2012 for nuisance dust. However, business was unable to produce air sampling results to quantify exposures.

General dust control was minimal, with dry sweeping of product and dust buildup at many of the work stations.

Random respiratory compliance check made with filling operation for Sulfuric Acid. Exposures had not been quantified and employees were not utilizing respiratory protection during open filling of this product that is severely irritating to the respiratory system.

Report Findings

- Adopted SafeBridge banding system and refined to align with their business needs.
- Exposure assessment extends upstream into business development to assure exposure control elements are considered during bidding process.
- Visual Management Systems used to highlight level & risk of materials (Potent Compounds), proper PPE and gowning & chemical specific HazCom.
- Commitment to engineering controls was evident in both manufacturing & laboratory (isolators & ventilated balance enclosures rated for nanogram containment).
- Established exposure monitoring program that is growing & adopting AIHA assessment model.

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## Let's test our rating alignment
## BLINDED ELANCO CONCLUSION DATASET

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Drug Product site – no potent compound handling

- Fume cupboard used in QC laboratory, but no testing carried out on face velocity (66);
- No exposure monitoring has been carried out at the site (74, 75);
- Site has not provided fit testing, cleaning program or maintenance of cartridge respirators. Cartridges changed every 6 months (79);

Example API Site

| | | | | |
|---|---|---|---|---|
| **Q68** | **Not all SDSs of hazardous chemical are available.And there was no OEL data for the API and intermediate. No exposure control hierarchy at facility.**<br>**No LEV was provided to the powder and solvent handling tasks.** | **PSCI principle** | **Site Visit** | **Collect SDSs for all hazardous chemical. Consider the effective engineering control for the chemical and dust exposure.** |
| **Q69** | **Very limited engineering control was used for the chemical exposure risk control. Site rely on the PPE for the risk control.** | PSCI principle | Site Visit | **Consider the effective engineering control for the chemical and dust exposure. Establish occupational exposure banding.** |
| **Q72** | **On-the-job occupational health medical monitoring for employee were conducted. However, pre hire job employee occupational health surveillance was not conducted. And the QC team members were not in the on job occupational health medical monitoring scope.** | PSCI principle | Document Review | **Develop the pre job occupational health medical check plan** |
| **Q74** | **And from the 2015 monitoring record, the total dust in the packaging area of plant X and Y are 21mg/m3 and 32.3mg/m3. But there was no effective remediation plan conducted after the monitoring.** | PSCI principle | Document Review | **Develop effective remediation plan for the dust control.** |
| **Q76** | **Gauze respirators were used for the dust and solvent exposure control at some jobs in the site.** | **PSCI principle** | **Site Visit** | **Stop use gauze respirator on facility.And conduct the effectiveness assessment for the current PPE matrix.** |

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## IH Red Flags – PSCI "Other" type of examples

- IH Program in place but some minor differences between OELs and Protection factors between companies.
- PPE and IH Programs written centrally by API company – instructions on posters, SOPs, etc., do not match what is available at the site. Need confirmation of all SOPs and PPE actual requirements so workers can be protected. No evidence of immediate overexposure concerns.
- Site not doing respirator fit testing
- Site has not linked occupational workplace exposure to their health surveillance program fully
- Combination of all controls appear to be protecting workers but process is HIGHLY dependent on PPE and administrative controls. Engineering improvements to improve control are strongly recommended.
- Site has not assessed exposure risk and potential in lab areas.
- IH data collected is very limited, all area samples (no personal results)
- LEV exists, but designs and photos show it is most likely highly ineffective to control risks and no (or very minimal) PPE is being used. The site needs a review of its engineering control strategy and data collected on LEV/exposure performance…no potent compounds.

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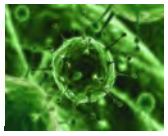
## Biosafety & Radiation Safety

- Just as there are Control Bands for Chemicals, there are Risk Groups for Biosafety Hazards and the establishment of Biosafety Control Bands (1-4) for Biologicals. Do the companies agree?
- If sites have products with ionizing radiation and/or BSL 3 or 4 operations be sure the correct expert is part of the evaluation. Generally special government licenses may be required.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## Questions & Resources?

- Thank you for the opportunity.

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# Safety Auditing – Red Flag Issues

Presented by
**Shelly Shope**
HSE Advisor
**Elanco Animal Health, Eli Lilly and Company**

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## Agenda

1. **Auditor Insights**
2. Flammables
3. Dangerous Work Programs
4. Life Safety
5. Management Systems



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## Auditor Insights
## Preparation for the Site Visit

- Generally, consultants KNOW the local regulations very well and what to expect – so this is typically the easier part of auditing as not so "PSCI specific"
- Based on company information and questionnaire, decide what to secure more information on during opening meeting:
  - Missing "expected" programs
  - Discuss last 3 most significant events and review incident investigation
  - Understand how the site ensures safety practices meet their SOPs/Programs
  - Look to media to determine if any recent events that you need to discuss
  - How does the reported injury rate compare to best in class businesses
- Review key information but TOUR is where you see if practice matches procedures and if they have compliance gaps in key missing programs

## Key areas of Concern by PSCI

- Flammable Handling – done in right area, using right equipment, right procedures
  - Open flammable work done in non-approved classified areas
  - Classified area has equipment that s not up to spec for classified area (bonding/grounding/classified lights, inerting)
  - Significant open solvent work and no LEL monitors in building
  - Flammable disposal creates safety concern going to area not sufficient to handle risk
  - Open flammable without any Local Exhaust Ventilation
  - Condition of flammable cabinets
  - Loading of flammables in storage areas exceeds posted capacity
  - Significant storage of incompatibles – do they have schemes to prevent this
  - obvious equipment that was in a fire and still present. Seek out their investigation thoroughness

  - A task I like to witness is tanker truck unloading – lots of hazards
  - Second favorite task – centrifuge unloading or tray dryer loading.

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## Example Photos/Stories

Vaccume pump fire residue from Toluene vapors


Same plant – need to see everything.

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## #2: Examples for Dangerous Work


Do they have these?

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## Key areas of Concern by PSCI

- Dangerous Work Programs – Serious Injury or Fatality Risks:
  - Confined Space Entry – tank cleaning and inspection, manholes, waste pits – etc.
  - Control of Hazardous Energy / LOTO – electrical and other forms of energy
  - Free Fall Hazard (Fall from Heights)
  - Contractor Safety
  - Hot Work / Open Flame
  - Machine Safety – guards in place, interlocks or shutdown used
  - Material Handling – people trained to use lifts, cranes, fork trucks

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  - How doe the site approach dangerous work and **permitting**? Are risk assessments part of the process? Who signs off and approves work? IS there self auditing of these programs?
  - Does training for these programs exist?
  - Is what you see out there matching what you KNOW to be the requirement?
  - The absence of a required regulatory program can be a "critical" finding; improvements to an existing program is typically an "other" finding

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## Key areas of Concern by PSCI


- Life Safety / Emergency
  - Are exit doors or dorm areas locked so in an emergency life safety systems won't work
  - Note the systems used by the site and confirm they are present (e.g. smoke detectors, fire sprinklers, blowdown, LEL sensors – does it meet local code? Are they being maintained?
  - Does the site understand it's worst case scenarios?
  - Does the site train and drill for those scenarios – is it extensive enough to be prepared?
  - Are the systems being maintained?
  - What orientation did you receive as a visitor to the site?
- Minor areas of gaps are not what we are looking for
  - e.g. missing extinguishers list
  - For minor discrepancies you find – ask why? List a management system gap rather than a detailed list.

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## Management Systems – Culture

- **Ultimately:**
  - **Do they KNOW their risks and regulatory obligations?**
  - **Have their sufficiently RESOURCED their HSE Program?**
  - **Are they generally a COMPLIANT organization?**
  - **Are they capable to address their programs – technically?**
  - **Do they have their own self-auditing program to KNOW their programs are being followed?**
  - **Is line management accountable for safety? or the safety department in a central off-site facility?**
  - **Always ask – why are you finding the gaps?**
  - **Are they willing to improve?**
- **Closing Meeting – how did they respond to the critical issues identified? What will PSCI member company who hired you need to understand about their response? What might you need to escalate?**

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## You Made It!

Questions for any of the technical auditing topics before taking the quiz?

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## The Pharmaceutical Supply Chain Initiative

Need more information?

Visit: www.pscinitiative.org

Email: the PSCI Secretariat at info@pscinitiative.org