Integrating safety in science - how to get scientists to buy-in
(Building safety as culture rather than a program!!)

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Outline

• Introduction to Duke-NUS

• Safety Management System (SMS)

• Roll out of the lab certification scheme at the University

• Implementation of the safety management system at Duke-NUS

• Conclusion
Introduction to Duke-NUS

• Collaborative initiative between Duke University and National University of Singapore (NUS)

• Medical School and Research Center with Signature Research Programs in cancer, neuroscience, infectious diseases, metabolic disorders and health systems

• Need for a thorough and an efficient safety program!!
What is Safety Management System (SMS)

- Integrated approach to managing safety in an organization

- Systematic, explicit and comprehensive process for managing risks.

- Successful SMS should become part of the culture, the way people do their jobs.
Why Safety Management System (SMS)?
Examples of accidents in academia

Yale senior dies in machine shop accident

(CNN) — A Yale University senior was killed in an accident in a chemistry laboratory's machine shop late Tuesday or early Wednesday, officials at the Connecticut school said.

Michele Duflaut of Massachusetts was working on a project in the Sterling Chemistry Laboratory's machine shop when her hair got caught in a lathe, a machine that shapes material by rotating it against a tool, Yale President Richard C. Levin said in an emailed statement. Her body was found by other students who were working in the building, Levin said.

The cause of death was asphyxia due to neck compression, and the manner was accidental, said Kathy Wilson, an investigator with Connecticut's Office of the Chief Medical Examiner.

The machine shop at the Yale lab is a place where students can construct or modify research instrumentation, according to the chemistry department's website. Wilson.

"The university has programs to train students before they use power equipment. Nonetheless, I have initiated a thorough review of the safety policies and practices of laboratories, machine shops and other facilities with power equipment that is accessed and operated by undergraduates," Levin said.

Levin's statement didn't say whether Duflaut was alone in the machine shop when the accident happened. A call seeking additional comment Wednesday from Yale spokesman Tom Conroy was not returned.
Something to emphasize…

- **Major Accidents**
- **Fatalities**
- **Near Misses**
- **Injuries**
- **Unsafe behavior/practices**
Emphasis for SMS

• Holistic approach of safety management

• Address unsafe practices & capture near misses

• Safety awareness

• Bringing in the right culture
Programs at NUS Office of Safety, Health & Environment (OSHE)

- Safety and Health Policy
- Chemical Policy
- BioSafety Policy
- Radiation Policy
- FireSafety Policy
- BSL3 Policy
- Tenant Policy

- Risk Assessment
- Legal Register
- OH Programme
- Chemical, Radiation, Biosafety
- Diving Programme
- Lab Design Standard
- PI Licensing Team
- PFM Compliance Programme
- Objective

- Lab Design Review Committee (JSRC)
- SOPs & Guidelines
- Crisis Plan
- Structure Safety Training System
- Lab Sign Generator
- Chemical Inventory
- Communication / Consultation

Regulatory Compliance
- Audit/Inspection
- Accident / Incident Reporting
- Investigation
- Reporting of Unsafe Acts & Conditions
- Safety Management Meeting
- EHS Bulletin

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NUS Occupational Health & Safety Management System Standard for Laboratories

- NUS Occupational health and safety (OH&S) management system standard for laboratories - Part A: Requirements
- NUS Occupational health and safety (OH&S) management system standard for laboratories - Part B: Guidance Notes

http://www.nus.edu.sg/osh/programmes/ohscert.htm
Common among all SMS Standards

(Plan-Do-Check-Act cycle)
Requirements of SMS elements

Planning
- Risk Assessment
- Legal & other requirement
- Objectives & programs

Implementation
- Roles, Responsibilities, Authorities and Accountabilities
- Competence, Training and Awareness
- Communication, participation and consultation
- Documentation and document control
- Operational controls
- Emergency preparedness and response

Checking
- Performance measurement and monitoring
- Incident investigation, corrective and preventive action
- Internal audit

Management Review
Comparison of SMS and OHSAS 18001 elements

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<tr>
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<th>SMS Elements</th>
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<td>Communication</td>
<td>Communication, participation and consultation</td>
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<td>8</td>
<td>4.4.3.2</td>
<td>Participation and consultation</td>
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<td>9</td>
<td>4.4.4</td>
<td>Documentation</td>
<td>Documentation, control of documents and control of records</td>
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<td>10</td>
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<td>Control of document</td>
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<td>4.4.6</td>
<td>Operational control</td>
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<td>4.4.7</td>
<td>Emergency preparedness &amp; response</td>
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<tr>
<td>13</td>
<td>4.5.1</td>
<td>Performance, measurement &amp; monitoring</td>
<td>Performance, measurement &amp; monitoring, evaluation of compliance</td>
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<tr>
<td>14</td>
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<td>Evaluation of compliance</td>
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<td>Incident investigation</td>
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<td>Non-conformance, corrective and preventive action</td>
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<td>17</td>
<td>4.5.4</td>
<td>Control of records</td>
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<td>19</td>
<td>4.6</td>
<td>Management review</td>
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Roll out of the Scheme by NUS

- NUS scheme titled “Laboratory Occupational Safety & Health Management System Certification Scheme”, supported by the NUS President’s office.

- In line with Singapore’s Workplace Health and Safety Act.

- Principal Investigators (PIs) required to develop and implement a Lab SMS for their laboratory activities, including those undertaken at collaborator’s laboratories.
Roll out of the scheme by NUS

• Participation of PIs was made mandatory

• PIs were required undergo internal and external audits.

• Upon successful demonstration of safety awareness & practices, the PI is issued a certificate valid for three years
  - Self regulation & maintenance of the SMS
  - No IBC approval required for new grants if risks remain the same
Roll out of the scheme by NUS

- Annual surveillance audits

- Duke-NUS embarked on this Scheme in 2010

- Pilot batch of 7 PIs taking part in the Scheme

- Pilot run used as a learning process for subsequent enrolment of the remaining 27 PIs.
Lab SMS implementation @ Duke-NUS

• 3-member Safety Team

• Works with OSHE, regulatory bodies and the staff of the School to ensure high standards of safety

• To help the PIs and their team to develop the Lab SMS, the safety team conducted several briefing and training sessions
Lab SMS implementation @ Duke-NUS

- Formed key users group to
  - Create a framework
  - Create the subheadings for lab registry

Staff & students list, applicable legislations, roles & responsibilities, training records, occupational health records, protocols/SOPs, risk assessments, accident/incident reporting, inventories
Roll out of the scheme at Duke-NUS

Session to address PIs
- Crucial in getting the buy-in

Preparation of lab register
- Templates provided where applicable
- Two way communication

Identification of lab representative/safety lead
- Contact point for the safety team to plan and execute the lab certification

Customization of risk assessments
- Involvement of all members of the lab, coordination by the lab representative

Briefing & risk assessment training for lab representative
- Detailed session to discuss about SMS elements and training on risk assessments

Preparation for Internal audit by Safety team
- Checklist (elements & practical aspects)
- Training of internal auditors
Roll out of the scheme at **Duke-NUS**

**Internal audit**
- Thorough and systematic process
- All lab members should be present
- Document review, interviews and lab inspections

**Corrective actions**
- Put in place before external audit
- Trainings, operational controls, attitude, documentation etc

**EXTERNAL AUDIT**
- Successful understanding & demonstration of safety practices
- Certificate issued
<table>
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<tr>
<th>No</th>
<th>Legislations/ guidelines</th>
<th>Applicable to lab</th>
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<tbody>
<tr>
<td>1</td>
<td>Workplace Safety and Health Act</td>
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<td>Petroleum And Flammable Materials (PFM) Regulations</td>
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<td>3</td>
<td>Chemical Weapons Convention (NACWC)</td>
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<tr>
<td>4</td>
<td>Poisons Act</td>
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<td>Environmental Protection &amp; Management Act</td>
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<tr>
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<td>Environmental Public Health Act</td>
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</tr>
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<td>7</td>
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<td>Misuse of Drug Act</td>
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<td>Arms and Explosives (Amendment) Act</td>
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<td>Biological Agents and Toxin Act</td>
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<td>13</td>
<td>WHO guidelines for biosafety</td>
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<td>Singapore Biosafety Guidelines for Research on Genetically Modified Organisms (GMOs)</td>
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<td>Singapore Guidelines on the Release of Agriculture-Related Genetically Modified Organisms (GMOs)</td>
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<td>16</td>
<td>Any other Acts or Guidelines (if yes, please provide details)</td>
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Break down of processes for risk assessments

**INPUT**
1. Hazardous materials
2. Equipment
3. Sample collection/transportation
4. Sample & chemical storage
5. Personnel

**Laboratory activities and operations**

1. Extraction/isolation/Purification
2. Manipulation/Reaction/Analysis
3. Nature of work (field work etc)

**OUTPUT**
1. Waste storage
2. Handling
3. Waste Treatment/Disposal
## Example for Risk Assessment

<table>
<thead>
<tr>
<th>No</th>
<th>Description / Details of Steps in Activity</th>
<th>Hazards</th>
<th>Possible Accident/III Health &amp; Persons-at-Risk</th>
<th>Existing Risk Control</th>
<th>Severity</th>
<th>Likelihood</th>
<th>Risk Level</th>
<th>Additional Control</th>
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<tbody>
<tr>
<td>1</td>
<td>Handling of influenza viruses</td>
<td>Possible exposure to virus due to spillage</td>
<td>Lab-acquired infection</td>
<td>Wear gloves, lab coat and covered shoes and work in BSL2 facilities. Flu vaccination (done annually) N95 mask fit testing for all involved in the project</td>
<td>3</td>
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<td>Storage of influenza viruses</td>
<td>Possible exposure to virus due to spillage</td>
<td>Lab-acquired infection</td>
<td>Wear gloves, lab coat and covered shoes and work in BSL2 facilities. Flu vaccination (done annually)</td>
<td>3</td>
<td>1</td>
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<tr>
<td>3</td>
<td>Disposal of influenza viruses</td>
<td>Possible exposure to surfaces at extreme low</td>
<td>Burns to the skin</td>
<td>Wear cryo gloves, lab coat and covered shoes</td>
<td>2</td>
<td>1</td>
<td>2</td>
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Key Challenges in establishing SMS

- Right attitude of staff
- Involvement of all stake holders
- Support from Senior Management
- Resources to roll out program
- Time required from all parties
Benefits of laboratory certification/SMS

- Standardize practices
- Identify gaps and tighten up procedures
- Clearer understanding of roles & responsibilities
- Researchers are trained and empowered to identify and address the safety issues in their laboratory activities
- Evaluating safety has become an integral part of science and every team devotes 5-10 minutes of every lab meeting to discuss safety issues that arise.
Causes of failure of SMS

• Not customizing system to the organization’s needs

• Impose without consultation

• Poor commitment from senior management

• Poor employee involvement /buy-in
Conclusion

34 PIs have successfully enrolled in this Scheme at Duke-NUS.

• Stakeholder confidence for multi- & cross institutional research is addressed
• Regulatory inspections simplified
• Sharing of safety and health best practices & paves way for continual improvement
• Greater level of Organization’s Safety & Health performance

“If we sweat the small stuff we may never have to sweat the big stuff”
- G. Dupont
THANK YOU!