RISK ASSESSMENT APPLICATION TRAINING

By

Faculty of Engineering, Safety Office
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What is Risk Assessment?

Risk Assessment is a systematic approach to identify hazards, evaluate risk and incorporate appropriate measures to manage and mitigate risk for any work process or activity.
What is Risk Assessment?

Risk Assessment is not a product of perception or experience but an evaluation base on facts.
Definition for some Basic Words

**Safety** – Freedom from harm

**Hazard** – Potential to cause harm such as death, injury, ill health or damage to property

**Risk** – Likelihood of the hazard resulting in harm and the severity of the effects from the hazard.

Risk = Severity x Probability (likelihood of Occurrence)
Why Risk Assessment?

Key to Prevention of Accidents and Adverse Consequences

Assurance on a Safe Workplace

Legal Compliance - Workplace Safety & Health Act
- Those who creates risk will need to manage the risk
- Implementation of Risk Assessment
Accidents do happen, even in universities.

Your role is to manage the risk and incorporate adequate measures to prevent it.

Chemical drum explodes at NUS

A CHEMICAL drum containing waste acids exploded in a store room at the science faculty of the National University of Singapore yesterday, at around 6.40 pm.

No one was injured but because of a gas leak, police officers cordoned off the area around the science faculty at Kent Ridge. Workers in the area, mainly cleaning staff, were asked to keep away.

The force of the explosion blasted open the store room door, said a Singapore Civil Defence Force spokesman.

When SCDF officers arrived at the scene, they found the remnants of a 200-litre plastic drum which used to contain waste acids.

SCDF officers covered the pieces and sealed them in a special container before spreading soda ash over the entire store room to prevent any further chemical reaction.

No one was in the vicinity at the time but, just after the explosion, there were reports of black fumes being seen around the building.

Near the science faculty are the halls of residence for undergraduates living on campus. They were not affected by the explosion and the SCDF completed its clean-up operations and declared the area free of gas by 9.15 pm.

SCDF deployed 30 officers with one fire engine, four support vehicles, and two other specialised vehicles designed to handle incidents involving hazardous materials.

An NUS safety officer, who declined to be named, said that the store room contained waste acids and used organic solvents.

The waste chemicals from experiments carried out by students from the science faculty are stored at the room before they are removed by a contractor on a regular basis.

“In my 10 years here, I think this is the first time something like this has happened,” he said.
Risk Concepts

How Serious??

Consequences

How Often??

Likelihood

Acceptability Criteria
Risk Concepts

What can go Wrong

How likely is it?

What are the Impacts

Understand Risk

MANAGE RISK
Legal Requirement
Legal Requirement

Workplace Safety & Health Act

Effective from 1st March 2006.

The WSH Act is an essential part of the new OSH framework to cultivate good safety habits in all individuals at the workplace.

It requires every person at the workplace to take “reasonable practicable” steps to ensure the safety and health of every workplace and worker.
Legal Requirement

Reasonable Practicable

Action is considered to be practicable when it is capable of being done.
Legal Requirement

Reasonable Practicable

Reasonable usually takes into account:
• The **severity** of harm & degree of risk (or likelihood) of that injury or harm occurring. Greater risk, reasonable to go to very considerable expense & effort to reduce it

• How much is **known** about the hazard & the ways of eliminating, reducing or controlling it. What are others practicing & what the standards recommend?

• The availability, suitability and cost of the safeguards. **Cost** of safeguards to measure against consequence of failure to do so.
Legal Requirement

Workplace Safety And Health (Risk Management) Regulations 2006

Enforced from 1st September 2006.

The WSH (Risk Management) Regulations require employers, the self-employed and principal (including contractor and sub-contractor) to conduct risk assessments for the purpose of identifying workplace safety and health risks and implementing measures to control the hazards and reducing the risks.

Whoever generates the risk shall manage the risk.
Legal Requirement

Workplace Safety And Health (Risk Management) Regulations 2006

Penalties
Any person who fails to comply may be fined up to $10,000 for the first offence.

For a second or subsequent offence, the person may be fined up to $20,000 or jailed up to 6 months or both.

R 3(1) - Conduct Risk Assessment
R 4(1) - Eliminate, Minimise & Control Risk, Specify Responsibilities
R 5 - Maintain Risk Assessment Record
R 6 - Inform Those At Risk of Risks & Measures, SWP
R 7 - Review of Risk Assessment.
Roles & Responsibilities

Risk Assessor

1. Identify Workplace Potential hazards
2. Evaluate Workplace Risks
3. Propose control measures to mitigate risks
4. Submit assessment report to Management/PI for implementation of control measures
5. Submit a copy of completed RA to Safety Officer for record
Roles & Responsibilities

PI & Management

1. Resource provider
2. Owner of process/experiment
3. Ensure risk assessment has been conducted for all work activity & experiment under him/her
4. Endorse & implement control measures to mitigate risk
5. Communication of hazards & controls to affected parties
6. Ensure all risk assessment has been timely reviewed and a record of all risk assessment have been kept.
Risk Management Overview
Components of Risk Mgt

1. Information Preparation
2. Hazard Identification
3. Risk Evaluation
4. Risk Control
5. Record keeping
6. Implementation & review

Risk Assessment
Risk Management Process Overview

1. Preparation
   - All information necessary for risk assessment should be obtained as far as possible.

2. Hazard Identification
   - Identify workplace hazards associated with each work activity or trade, and potential accidents or incidents.

3. Risk Evaluation
   - Estimate the risk levels of the workplace hazards identified.
   - Prioritise measures to control the hazards and minimise the safety and health risks.

4. Risk Control
   - Keep the written description of the risk assessment for at least 3 years.
   - All risk assessment records should be concise and kept in a register.
   - Control hazards and reduce risks by following the Hierarchy of Control measures:
     - Elimination
     - Substitution
     - Engineering Controls
     - Administrative Controls
     - Personal Protective Equip.

5. Record Keeping
   - All risk assessment records should be concise and kept in a register.

6. Implementation & Review
   - Risk assessment plans should be reviewed:
     - Once every 3 years (making reference to the previous risk assessment).
     - Whenever new information on safety and health risks surfaces.
     - There are changes to the area of work and / or
     - After any accident or serious accident.

   - Keep the written description of the risk assessment for at least 3 years.
   - All risk assessment records should be concise and kept in a register.
   - Control hazards and reduce risks by following the Hierarchy of Control measures:
     - Elimination
     - Substitution
     - Engineering Controls
     - Administrative Controls
     - Personal Protective Equip.
Information Preparation

1. Information needed for risk assessment
   - Material Safety Data Sheets
   - Chemical inventory
   - Photos, drawings, design, operation manual
   - Process flow charts
   - Accident records
   - Relevant Legislation & CPs

2. List of work activities / process

3. Sequence of work activity / process
How to do a risk assessment?

1. **List & prioritise lab activity/teaching experiment**
   e.g. Use, handling, storage and disposal of the agent

2. **Hazard Identification**

3. **Study the hazards of each activity / procedure / process**

4. **State the potential adverse effects (Consequence)**

5. **Consider current/existing controls**

6. **Evaluate the Severity (S) and Likelihood (L) of accidents/incidents arising from these hazards**

7. **Establish the risk rating by multiplying S & L**

8. **If risk is unacceptable, incorporate additional controls**

9. **Implement control measures to bring risk to ALARP.**
## Activity or Experiment-Based Risk Assessment Form

<table>
<thead>
<tr>
<th>Department:</th>
<th>Name of Experiment/Activity:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Location:</td>
<td>Name of Person in-charge: Name of PI:</td>
</tr>
<tr>
<td>Last Review Date:</td>
<td>Next Review Date:</td>
</tr>
</tbody>
</table>

### 1. Hazard Identification

<table>
<thead>
<tr>
<th>SN</th>
<th>Task</th>
<th>Hazards</th>
<th>Possible Consequences</th>
<th>Existing Risk Control (if any)</th>
<th>S</th>
<th>L</th>
<th>R</th>
<th>Additional / New Risk Control</th>
<th>S</th>
<th>L</th>
<th>R</th>
<th>Action By</th>
<th>Deadline</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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</tr>
</tbody>
</table>

### 2. Risk Evaluation & Control

- **Conducted by:** (Name, designation)
- **Approved by:** (Name, designation)

- **Signature:**
- **Date:**
## Activity or Experiment-Based Risk Assessment Form

<table>
<thead>
<tr>
<th>Department:</th>
<th>Chemical Dept</th>
<th>Name of Experiment/Activity:</th>
<th>Use of hot-plate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Location:</td>
<td>E5-06-07</td>
<td>Name of Person in-charge:</td>
<td>Ivy Ong</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Name of PI:</td>
<td>Prof Lim See In</td>
</tr>
<tr>
<td>Last Review Date:</td>
<td></td>
<td>Next Review Date:</td>
<td>19 Feb 2010</td>
</tr>
</tbody>
</table>

### 1. Hazard Identification

<table>
<thead>
<tr>
<th>SN</th>
<th>Task</th>
<th>Hazards</th>
<th>Possible Consequences</th>
<th>Existing Risk Control (if any)</th>
<th>S</th>
<th>L</th>
<th>R</th>
<th>Additional / New Risk Control</th>
<th>S</th>
<th>L</th>
<th>R</th>
<th>Action By</th>
<th>Deadline</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>Place Sample on hot plate</td>
<td>Glass beaker</td>
<td>Breakage causing cuts</td>
<td>Gloves</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Ivy Ong</td>
<td>21 Feb 08</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Electricity</td>
<td>Electrical shorts/fire</td>
<td>Distance</td>
<td>3</td>
<td>1</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Ivy Ong</td>
<td>21 Feb 08</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Toxic sample</td>
<td>Toxic effects</td>
<td>Fumehood</td>
<td>3</td>
<td>1</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Ivy Ong</td>
<td>21 Feb 08</td>
</tr>
<tr>
<td>02</td>
<td>Turn on hot plate</td>
<td>Over temp</td>
<td>Glass breakage</td>
<td>Signs &amp; SOP</td>
<td>2</td>
<td>2</td>
<td>4</td>
<td>Regular monitoring</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>Ivy Ong</td>
<td>21 Feb 08</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Reactive sample</td>
<td>Explosion</td>
<td>Supervision</td>
<td>3</td>
<td>2</td>
<td>6</td>
<td>Utilise water bath</td>
<td>3</td>
<td>1</td>
<td>3</td>
<td>Ivy Ong</td>
<td>21 Feb 08</td>
</tr>
</tbody>
</table>

Conducted by: (Name, designation) Ivy Ong, Kee Wah & David Ng  
Approved by: (Name, designation) Prof Lim See In (Project Supervisor)

Signature: Ivy Ong  
Date: 20 Feb 2008
Prioritise Activity/Experiments

Ultimately all tasks in laboratory
- Jobs does not have a written procedure
- First jobs with highest rates of accidents or greatest potential for injuries
- New Experiments
- Changes in process and procedures

Involve all students and researchers
Prioritise Activity/Experiments

- Practical constraints on time and resources
- Some experiments are more hazardous than others and some have worse incident history than others
- Factors that can be considered to prioritize
  - Frequency of past incidents
  - Severity of potential activities
  - Infrequently performed jobs: students may be greater risk when undertaking non-routine tasks
A task is a single, separate, specific component of the employee’s overall duties.

A TASK is a *single* activity that clearly advances a work assignment and is a logical portion of that assignment.
Break down into Successive Tasks

- Task is a segment of an overall job
- Completion of each operational task in proper sequence leads to the completion of the job
- Break down into basic steps or task
  - Important to keep the tasks in their correct sequence
- Dividing a job into tasks requires a thorough knowledge of the job

If the tasks are made too general, specific operations and related hazards may be missed

Too many tasks may make the Risk Assessment impractical

Rule of Thumb: Most experiments can be described in less than ten tasks – normally 6 – 8 tasks
Team Practical Activity

Activity 1: Listing & Prioritise of Lab Activity/Teaching Experiment (10 mins)

1. Form into a team of 3-4 people
2. List down the lab activities and prioritise the activity by estimating their risk level and rank them in order of most hazardous to the least hazardous using P1, P2 & P3.
3. Select one top priority activity/experiment and break down into successive steps
4. One representative to present and use flip chart for the presentation.

<table>
<thead>
<tr>
<th>Lab Activity/Teaching Experiment</th>
<th>Priority List (P1/P2/P3)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
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<td></td>
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</tr>
</tbody>
</table>
Hazards Identification
IDENTIFY POTENTIAL HAZARDS

- The most important step preceding any Risk Assessment - hazards can only be controlled if they are identified.

- It is important when conducting a Risk Assessment, that you evaluate equipment, procedures and personnel
IDENTIFY POTENTIAL HAZARDS

- Each step is analyzed for potential inherent hazards
- Decision on the relevance of any particular hazard come later in the risk assessment processes
1. Hazardous material (Biological Agents, Chemicals and Radioactive materials)
2. Equipment
3. Collection
4. Transportation

1. Extraction/isolation
2. Purification
3. Manipulation
4. Dilution
5. Pilot plants

1. Storage
2. Handling
3. Waste Treatment
Observation Method

Discussion Method
Proactive
Team Effort

Recall & Check Method
Hazards in a laboratory

- Chemicals
- Biological
- Radiation
- Mechanical
- Physical & Environmental
- Energy
- Human factor
Chemical Hazard Factors

Chemical Properties
- Flammability
- Explosive nature
- Toxicity
  - Carcinogenic,
  - Teratogens,
  - Mutagenic,
  - Asphyxiant,
  - Irritants

Where can such information be obtained?
Biological Hazards

- Animals (poisons vs physical wounds)
- Infection (pathogenic bacteria, viruses, molds)
- Health care facilities, waste treatment operations, normal field activities
- Sharps, biological equipment
Radiation Hazards

**Ionizing**
Alpha particles, beta particles, gamma rays, x-rays (Half life, quantity, type of radiation)

**Non – Ionizing sources**
Sun lamps, arc welding, lasers (class of laser), sonicators
Mechanical Hazards

Protrusion
Sharp Edges
Moving Parts/machinery
Nipping or Pinch Points
Acceleration (Inadvertent motion)
Deceleration (Sudden stops)
Vibration
Falling weight
Physical & Environmental Hazards

Weather
Radiant heat (Furnace)
Cold environment
Noise
Ventilation
Vibration
Lighting
Poor housekeeping
Energy Hazards

**Electrical**
(Overloading, exposed wires, inadvertent activation, non-approve appliances)

**Pressure**
(Loose connection for hydraulic/pneumatic, residual energy)

**Fire**
(Non-compatible storage or activity, excessive flammable or combustible materials)
Human Factors

Fatigue

Stress

Lack of concentration

Lack of skills

Not fit for job

Attitude problem
Team Practical Activity

Activity 2: Hazard Identification (10 minutes)

1. List down the potential hazards for each step/task (At least 3 steps)

2. List down the possible consequences for each hazards

3. One representative to present and use flip chart for the presentation.
Risk Evaluation
Risk Evaluation

By Considering

1. Severity and
2. Probability

Severity
Classified into Minor, Moderate and Major

Probability
How often it can happen
Frequent - Very likely can be often incidents/accidents
Possible – chance in accidents/incidents (Once in a year)
Remote – Unlikely, never hear before ( > 5 years)
Risk Evaluation

1. Refer to classification table for Severity & Likelihood

2. Determine risk factor by multiplying S & L (Refer to Risk Matrix)

3. Refer to the risk acceptability table
# Risk Evaluation

## Severities Categories & Description

<table>
<thead>
<tr>
<th>Level</th>
<th>Human (Impact to Physical Being)</th>
<th>Biological Impact</th>
<th>Environmental Damage</th>
<th>Property Damage (S$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1) Minor</td>
<td>No Injury or light injury requiring only first aid treatment (MC &lt; 4 days MC)</td>
<td>May not cause human disease, if does, the disease is unlikely to spread to the community and there is usually effective prophylaxis or treatment available;</td>
<td>Reversible</td>
<td>Up to $5,000</td>
</tr>
<tr>
<td>(2) Moderate</td>
<td>Any injury/ill health leading to ≥ 4 days MC or ≥ 1 day hospitalisation or leads to temporary disability</td>
<td>Can cause severe human disease, not ordinarily spread by casual contact from one individual to another; it may spread to the community, but there is usually effective prophylaxis or treatment available</td>
<td>Reversible but takes years</td>
<td>$5,001 to $50,000</td>
</tr>
<tr>
<td>(3) Major</td>
<td>Fatality, permanent Disability or life threatening disease</td>
<td>Can cause lethal human disease, may be readily transmitted from one individual to another, or from animal to human or vice-versa directly or indirectly, or casual contact, it may spread to the community; usually no effective prophylaxis or treatment available</td>
<td>Irreversible</td>
<td>More than $50,000</td>
</tr>
</tbody>
</table>
## Risk Evaluation

### Likelihood Categories & Description

<table>
<thead>
<tr>
<th>Level</th>
<th>Events Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1) Remote</td>
<td>Undesired event which may occur but unlikely, once in 5 years</td>
</tr>
<tr>
<td>(2) Possible</td>
<td>Undesired event which is probable, once in a year</td>
</tr>
<tr>
<td>(3) Frequent</td>
<td>Undesired event which probably occur in most circumstances, once or more in a month</td>
</tr>
</tbody>
</table>
# Risk Evaluation

## Risk matrix to determine Risk Level

<table>
<thead>
<tr>
<th>Severity</th>
<th>Likelihood</th>
<th>Remote (1)</th>
<th>Occasional (2)</th>
<th>Frequent (3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Major</td>
<td>Medium Risk</td>
<td>High Risk</td>
<td>High Risk</td>
<td></td>
</tr>
<tr>
<td>Moderate</td>
<td>Low Risk</td>
<td>Medium Risk</td>
<td>High Risk</td>
<td></td>
</tr>
<tr>
<td>Minor</td>
<td>Low Risk</td>
<td>Low Risk</td>
<td>Medium Risk</td>
<td></td>
</tr>
</tbody>
</table>

## Risk Matrix Table

<table>
<thead>
<tr>
<th>Severity</th>
<th>Likelihood</th>
<th>Remote (1)</th>
<th>Occasional (2)</th>
<th>Frequent (3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minor (1)</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Moderate (2)</td>
<td>2</td>
<td>4</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>Major (3)</td>
<td>3</td>
<td>6</td>
<td>9</td>
<td></td>
</tr>
</tbody>
</table>
## Risk Evaluation

### Acceptability of Risk

<table>
<thead>
<tr>
<th>Risk Score</th>
<th>Risk Level</th>
<th>Acceptability of Risk</th>
<th>Recommended Actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;3</td>
<td>Low Risk</td>
<td>Acceptable</td>
<td>No additional risk control measures required. To continue to monitor to ensure risk do not escalate to higher level.</td>
</tr>
<tr>
<td>3 – 4</td>
<td>Medium Risk</td>
<td>Moderately Acceptable</td>
<td>Acceptable to carry out the work activity; however, task need to be reviewed to bring risk level to As Low As Reasonably Practicable. Interim control measures such as administrative controls can be implemented. Supervisory oversight required.</td>
</tr>
<tr>
<td>&gt;4</td>
<td>High Risk</td>
<td>Not Acceptable</td>
<td>Job must not be carried out until risk level is brought to at least medium risk level. Risk controls should not be overly dependant on personal protective equipment. Controls measures should focus on Elimination, substitution and engineering controls. Immediate Management intervention required to ensure risk being brought down to at least medium level before work can be commenced.</td>
</tr>
</tbody>
</table>
Control Measures
Selection of OH&S Risk Control Measures

- Eliminate / Substitute
- Engineering Controls
- Administrative Measures
- PPE
The control of hazards and reduction of risks can be accomplished by following the Hierarchy of Control measures.

These control measures are not usually mutually exclusive.

e.g. Engineering controls can be implemented together with administrative controls like training and safe work procedures.
Risk Controls

- Eliminate the hazard
- Substitute the hazard with less hazardous or non-hazardous options
- Minimize risk due to the hazard
  - Reduce the exposure
  - Isolate the hazard
  - Provide personal protective equipment and clothing
  - Implement administrative controls
  - Have an emergency plan in place
Eliminate Hazard

Most effective measure because the risk is eliminated

- Choose different process
- Modify an existing process by changing the energy type
- Modify or change equipment or tool
- Lock out energy source
Very effective, especially for hazardous substance

- Replace solvent by water solution
- Substitute vapor heating by electric heating
- Use electronic control instead of pneumatic one
- Use a non-sparking hammer in a flammable atmosphere instead of a steel hammer
Elimination/substitution

Use a chemical of less toxicity (higher LD50, PEL)

Use a biological agent of lower risk group

Micro-scale experiments / Computer simulation

Hydrogen generator instead of hydrogen gas cylinders

Use of plasticware instead of glassware

Use of mechanical transport aid instead of manual handling
Engineering Controls
Administrative Controls
Personal Protective Equipment
Engineering Controls

Biological Safety Cabinet, Local exhaust ventilation, Fume cupboard, etc

Centrifuges – safety cups

Interlocks

Safety Guards

Primary barrier to prevent exposure by containment
Examples of engineering controls
Local exhaust ventilation
Blade remover
Safeguarding of CO2 cylinders

Special Rack is used

Strap is used
Adequate number of overhead electrical sockets to avoid overloading

Approved electrical conduits
Administrative Controls

Standard Operating Procedures, signage, etc

Survey/Wipe tests

Occupational Health – vaccinations/immunizations

Training

Labeling

Inspections

Maintenance of Equipment
Safe Operating Procedure

SOPS are required to detail:

- Safety roles and responsibilities
- Safe use of equipment
- Maintenance of equipment
- Medical surveillance, etc

Can be incorporated into experimental procedures
Typical Format of an SOP/SWP

1. Title
   • The title of the Safe Work Procedure (e.g. Handling of HF acid)
2. Scope
   • What the procedure covers - specific
3. Objectives
   • What is set to be achieved with the SWP in place.
4. Definitions
   • Define all key terminology used in the SWP so as to prevent ambiguity.
5. Procedure & Safety Considerations
   • Listing of sequence of tasks / activities (job steps) with safe practices (control measures) indicated/specified correspondingly.
6. Flow chart
   • Inserting a flowchart of the process for clarity (overview).
7. Emergency Response & Contact Numbers
   • How to respond to emergencies related to the work scope, who to notify, what number to call, mitigation guidance, etc.
8. Appendices
   • Any other relevant information and cross-referencing.
Machine SOP

SOPs are written clearly and framed for easy reference.

Workshop demarcation zones

Areas outside the demarcation zone are out of bound.
Personal Protective Equipment (PPE)

Respirator, gloves, etc
Always the last option
Aim is to protect the worker when all other control measures are not practical
Subject to worker compliance
Needs periodic checks and maintenance for continuing suitability
Risk Control Measures
Risk Control Measures

Personal Protective Factors

Procedures and Training

The Warning System
Risk Control Measures

The Mitigation System

Maintenance & Inspection

Design and Engineering
Residual Risks

Residual risks are the remaining risks for which the planned risk controls are not able to effectively remove/control or arising from the control measures itself.

The RA Team should ensure that:

• The RA is conducted properly,
• That any residual risks are evaluated and managed,
• The residual risks of each of the controls are highlighted to persons “at-risk” – workers directly involved in the work activities.
Record Keeping

1. Risk Assessment record has to be kept for at least 3 years under the WHS (RM) Regulations requirement.

• Recommended to keep record as long as the process/activity is still valid, before end of any product life cycle or to tie in with the period other legislation requires pertaining to the particular process/activity.
Implementation & Review

1. Management staff or Principle Investigator will need to approve the implementation of control measures.

2. Monitoring of the process or activity has to be carried to ensure that there is no residual risk or additional risk arising from the control measures.

3. Risk assessors have to check or monitor the new implementation of control measures and to communicate with respective lab or operational personnel.

4. Review on Risk Assessment to be carried on the following basis:
   - At lease once every three years base on legislative requirements
   - After an accident/incident occurrence
   - Any change in process or activity
Activity 3: Risk Evaluation & Control (15 mins)

1. Continue your risk assessment work done during your 2\textsuperscript{nd} group activity with a Risk Evaluation activity and present your work to the class.

2. Risk Evaluation
   - Identify the existing controls for each of the respective job step.
   - Use the 3X3 Risk Assessment Matrix to evaluate the Risk Level by estimating the following:
     - Likelihood of the hazard occurring
     - Severity of the consequences if the hazard occurs
     - Risk = Likelihood $\times$ Severity
# Risk Assessment Sample

## Activity or Experiment-Based Risk Assessment Form

<table>
<thead>
<tr>
<th>Department:</th>
<th>Chemical Dept</th>
<th>Name of Experiment/Activity:</th>
<th>Use of hot-plate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Location:</td>
<td>E5-06-07</td>
<td>Name of Person in-charge:</td>
<td>Ivy Ong</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Name of PI:</td>
<td>Prof Lim See In</td>
</tr>
<tr>
<td>Last Review Date:</td>
<td></td>
<td>Next Review Date:</td>
<td>19 Feb 2010</td>
</tr>
</tbody>
</table>

### 1. Hazard Identification

<table>
<thead>
<tr>
<th>SN</th>
<th>Task</th>
<th>Hazards</th>
<th>Possible Consequences</th>
<th>Existing Risk Control (if any)</th>
<th>S</th>
<th>L</th>
<th>R</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>Place Sample on hot plate</td>
<td>Glass beaker</td>
<td>Breakage causing cuts</td>
<td>Gloves</td>
<td>1</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Electricity</td>
<td>Electrical shorts/fire</td>
<td>Distance</td>
<td>3</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Toxic sample</td>
<td>Toxic effects</td>
<td>Fumehood</td>
<td>3</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>02</td>
<td>Turn on hot plate</td>
<td>Over temp</td>
<td>Glass breakage</td>
<td>Signs &amp; SOP</td>
<td>2</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Reactive sample</td>
<td>Explosion</td>
<td>Supervision</td>
<td>3</td>
<td>2</td>
<td>6</td>
</tr>
</tbody>
</table>

### 2. Risk Evaluation & Control

<table>
<thead>
<tr>
<th>SN</th>
<th>Task</th>
<th>Hazards</th>
<th>Possible Consequences</th>
<th>Existing Risk Control (if any)</th>
<th>S</th>
<th>L</th>
<th>R</th>
<th>Additional / New Risk Control</th>
<th>Action By</th>
<th>Deadline</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Regular monitoring</td>
<td>Ivy Ong</td>
<td>21 Feb 08</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td>2</td>
<td>Utilise water bath</td>
<td>Ivy Ong</td>
<td>21 Feb 08</td>
</tr>
</tbody>
</table>

Conducted by: (Name, designation) Ivy Ong, Kee Wah & David Ng

Approved by: (Name, designation) Prof Lim See In (Project Supervisor)

**Signature:**

Date: 20 Feb 2008
Summary
Risk Management Process Overview

1. Preparation
   - All information necessary for risk assessment should be obtained as far as possible.

2. Hazard Identification
   - Identify workplace hazards associated with each work activity or trade, and potential accidents or incidents.

3. Risk Evaluation
   - Estimate the risk levels of the workplace hazards identified.
   - Prioritise measures to control the hazards and minimise the safety and health risks

4. Risk Control
   - Control hazards and reduce risks by following the Hierarchy of Control measures:
     - Elimination
     - Substitution
     - Engineering Controls
     - Administrative Controls
     - Personal Protective Equip.

5. Record Keeping
   - Keep the written description of the risk assessment for at least 3 years.
   - All risk assessment records should be concise and kept in a register.

6. Implementation & Review
   - Risk assessment plans should be reviewed:
     - Once every 3 years (making reference to the previous risk assessment.
     - Whenever new information on safety and health risks surfaces.
     - There are changes to the area of work and / or
     - After any accident or serious accident.
Things to note

1. Evaluation of risk is for each hazard

2. Human factor should be considered in the risk assessment

3. All Risk Assessment form must be signed & endorsed by PI or Management

4. All hazards & controls must be communicated to affected parties.

5. Conduct Risk Assessment in a group or team.
Website

NUS OSHE website:
http://www.nus.edu.sg/osh

FoE Safety Unit website:
http://www.eng.nus.edu.sg/SafetyUnit/index.html
Any...
Thank you