Chemical Management and Handling

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Chemical Management and Handling

A Great Workforce
A Great Workplace
Scope of Presentation

1. Introduction
2. Management of Hazardous Chemicals
   - Safety Data Sheet
   - Risk assessment and control
   - Case Study
3. Handling of chemicals
4. Chemical hazards control
5. Related WSH legislation
Chemicals used in pest control works

- Toxic - 688 brand name of pesticides and repellents registered with NEA
- Flammable – Diesel and kerosene/petrol
- Corrosive/reactive
Thermal fogger explodes in his face

REPORT: KERRI HENG
kerrhyn@spth.com.sg

ONE fogger fell into a swimming pool. Another a manhole.

Then, there’s Mr Muhd Farhan Abdullah, 26, who was fogging near a rubbish chute when his fogging machine exploded.

These are the dangers foggers face on the job daily as they battle the dengue scourge the country is grappling with.

Mr Muhd Farhan, a pest control technician at pest management company The Pestman, was fogging a chute in a condominium in January when things went wrong.

He said: “I was fogging the chute when someone threw rubbish down. The pressure in the chute went down and this clashed with the high pressure of my fogger.”

He was holding a hot fogger which weighed about 7kg.

The resonator, a heating device inside the fogger, can reach a temperature of about 550 deg C. He said: “There was a loud explosion right in front of me. It was this sudden burst of flames.

“At first, I didn’t realise that I was hurt. Then I touched my face and there was blood.”

The left side of his body started aching, so he instinctively threw the burning fogger aside and rushed to the toilet and stood under a shower.

He said: “There were many burn marks. It was so painful that I wanted to cry.”

Scarred

Mr Farhan was standing one step away from the chute during the accident, with his left side facing the chute.

“Luckily it wasn’t my whole body that was burned. I was also wearing safety goggles, so my eyes were spared,” said Mr Farhan, who was later rushed to the hospital in an ambulance.

He said the burns on the left side of his face and left hand took about five days to heal. The scars are still clearly visible.

Mr Farhan explained that petrol in the fogger, together with oxygen in the chute and a pressure change, led to the explosion.

This is called a “back fire” in industry terms, where flames shoot backwards during fogging.

“Now, whenever I fog, I stand far from the chute and I fog only for about five seconds,” he said. He used to fog chutes for 15 to 20 seconds before his accident.

Mr Farhan, who dons protective gear on jobs, fogs three to four times a day, six days a week.

He said: “There have been more fogging jobs since the dengue outbreak.”

Fogging can be dangerous and Mr Sulaiman Mansor, 35, projects supervisor at The Pestman, said that tripping and falling are some of the more common accidents on the job.

He said: “When pest control technicians are fogging, sometimes they can’t see in front of them when the fog gets too thick. I’ve known technicians who have fallen into swimming pools and manholes.”

Said 19-year-old student Clarence Sim: “I’ve always felt that foggers are part of the backstages workers who serve the community – like cleaners. We need foggers to get rid of our mosquitoes, especially now when the dengue cases are climbing. Foggers really deserve our respect.”
Management of Hazardous Chemicals Programme

1. Policy & Strategy
2. Selection & Procurement
3. Register and Safety Data Sheets
4. Labelling and Warning Signs
5. Storage and Transportation
6. Risk assessments and control
7. Safe work procedures and Personal Protective Equipment
8. Workplace Monitoring and Medical Surveillance
9. Information and Training
10. Emergency Planning & First Aid
11. Waste Disposal
12. Contract Work
Safety Data Sheets

• There are 16 sections including
  – Exposure controls/personal protection
  – Physical and chemical properties
  – Toxicological information
  – Fire fighting measures
  (refer to the *WSH Management of Hazardous Chemical Programme* guidelines for the full list of information)

• Management should study the information in the SDS and take measures to ensure the safe use of the hazardous chemicals

*Reg 43 WSH (General Provisions) Regulations*
# GHS Pictograms

<table>
<thead>
<tr>
<th>Flame</th>
<th>Flame over circle</th>
<th>Exploding bomb</th>
</tr>
</thead>
<tbody>
<tr>
<td>☐ Emits flammable gas</td>
<td>☐ Oxidisers</td>
<td>☐ Explosives</td>
</tr>
<tr>
<td>☐ Flammables</td>
<td></td>
<td>☐ Organic peroxide</td>
</tr>
<tr>
<td>☐ Self-heating</td>
<td></td>
<td>☐ Self-reactives</td>
</tr>
<tr>
<td>☐ Self-reactives</td>
<td></td>
<td></td>
</tr>
<tr>
<td>☐ Organic peroxide</td>
<td></td>
<td></td>
</tr>
<tr>
<td>☐ Pyrophorics</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Corrosion</td>
<td>Skull and crossbones</td>
<td>Gas cylinder</td>
</tr>
<tr>
<td>☐ Corrosives</td>
<td>☐ Acute toxicity (severe)</td>
<td>☐ Gases under pressure</td>
</tr>
<tr>
<td>Health</td>
<td>Environment</td>
<td>Exclamation mark</td>
</tr>
<tr>
<td>☐ Aspiration toxicity</td>
<td>☐ Environmental toxicity</td>
<td>☐ Acute toxicity (harmful)</td>
</tr>
<tr>
<td>☐ Carcinogenicity</td>
<td></td>
<td>☐ Irritant</td>
</tr>
<tr>
<td>☐ Germ cell mutagenicity</td>
<td></td>
<td>☐ Narcotic effects</td>
</tr>
<tr>
<td>☐ Target organ toxicity</td>
<td></td>
<td>☐ Respiratory tract irritation</td>
</tr>
<tr>
<td>☐ Respiratory sensitiser</td>
<td></td>
<td>☐ Skin sensitiser</td>
</tr>
<tr>
<td>☐ Reproductive toxicity</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Safety Data Sheets

• **Example Cypermethrine**

  **Section 2 Hazard Identification**

  ![GHS label elements with signal word: Danger]

  **Section 8 Exposure controls/personal protection**

  ![Personal protection icons including: gloves, goggles, helmet, boots, mask]
Risk Assessment and Control

• Every workplace should conduct RA for all routine and non routine operations

• Basic steps
  
  - Hazard identification
  - Risk evaluation
  - Risk control

• Control measures must be based on the principles of hierarchy of control

WSH (Risk Management) Regulations
Hierarchy of Controls

Most effective

Elimination

Substitution

Engineering

Administrative

Personal Protection

Least effective
## Risk Assessment and Control

### Example

<table>
<thead>
<tr>
<th>Department:</th>
<th>RA Leader:</th>
<th>Approved by</th>
<th>Reference Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Process:</td>
<td>RA Member 1:</td>
<td>Signature:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>RA Member 2:</td>
<td>Name:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>RA Member 3:</td>
<td>Designation:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>RA Member 4:</td>
<td>Date:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>RA Member 5:</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Hazard Identification

<table>
<thead>
<tr>
<th>Work Activity</th>
<th>Hazard</th>
<th>Possible Injury/ill-health</th>
<th>Existing Risk Controls</th>
<th>S</th>
<th>L</th>
<th>RPN</th>
<th>Additional Controls</th>
<th>S</th>
<th>L</th>
<th>RPN</th>
<th>Implementation Person</th>
<th>Due Date</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fogging of rubbish chutes using diesel as carrier</td>
<td>Presence of flammable liquid may lead to flash fire</td>
<td>Bodily injury - burn</td>
<td>Wear fire retardant coverall, implement safe work procedures</td>
<td>4</td>
<td>2</td>
<td>8 - Medium Risk</td>
<td>Substitute diesel with non flammable carrier</td>
<td>2</td>
<td>1</td>
<td>2 - Low Risk</td>
<td>Lim Ah Kao</td>
<td>01/06/2014</td>
<td>Check on efficiency of fogging</td>
</tr>
</tbody>
</table>

For purpose of illustration
Hierarchy of Controls

Most effective

Elimination

Substitution

Engineering

Administrative

Personal Protection

Least effective
Case study

Worker was carrying out thermal fogging at rubbish chutes when the flash fire occurred.

<table>
<thead>
<tr>
<th>Case 1</th>
<th>Case 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Date of accident</td>
<td>5 Sept 2012</td>
</tr>
<tr>
<td>Place of accident</td>
<td>Private condominium</td>
</tr>
<tr>
<td>Injury</td>
<td>Burn to face, neck, both arms Hospitalised 2 days Given 2 months of MC</td>
</tr>
<tr>
<td>Job experience of worker</td>
<td>New</td>
</tr>
</tbody>
</table>
Case study

Worker was carrying out thermal fogging at rubbish chutes when the flash fire occurred.

<table>
<thead>
<tr>
<th></th>
<th>Case 1</th>
<th>Case 2</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Pesticide used</strong></td>
<td>Bentacide: 25% vol Cypermethrine as active ingredient</td>
<td>Newcyper 6.5EC: 6.5% w/w Cypermethrine as active ingredient</td>
</tr>
<tr>
<td><strong>Carrier used</strong></td>
<td>Diesel</td>
<td>Diesel</td>
</tr>
<tr>
<td><strong>Dilution rate</strong></td>
<td>1:99</td>
<td>1:39</td>
</tr>
<tr>
<td><strong>Fogging duration</strong></td>
<td>2 minutes</td>
<td>10 seconds</td>
</tr>
<tr>
<td><strong>Quantity of solution (pesticide &amp; diesel) sprayed</strong></td>
<td>500 cm$^3$</td>
<td>42 cm$^3$</td>
</tr>
</tbody>
</table>
Diesel as a Carrier
- Flammable Fuel

Diesel’s AIT is 257°C. It can burn by itself at this temperature.

Diesel has a flash point of about 52°C. It can burn at temperature ≥ 52°C if there is source of ignition.

*At elevated temperature, the flammable range will be augmented.

Too rich
100% vol

Flammable range
UEL* 4.7% vol
LEL* 0.6% vol

Too lean
0% vol

Case 1: 2.8% vol
Case 2: 0.6% vol
Fire will not take place if any of the above cheeses is blocked
Refuse Chute - Confined Space

Non flammable carrier

Oxygen in Air

Hot Fogging Nozzle - Ignition Source

Fire will not take place if any of the above cheeses is blocked

Swiss Cheese Model

No Flash Fire
Possible substitutes for diesel
Efficiency of non-flammable carriers to be looked into

<table>
<thead>
<tr>
<th>Substance</th>
<th>Flammability</th>
<th>Toxicity</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Permissible Exposure Level</td>
</tr>
<tr>
<td>Diesel</td>
<td>GHS Flammable Liquid Category 4</td>
<td>ACGIH TLV: 100 mg/m³ (TWA)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Glycerine</td>
<td>Not flammable by GHS classification</td>
<td>10 mg/m³ (long term)</td>
</tr>
<tr>
<td>Ethylene glycol</td>
<td>Not flammable by GHS classification</td>
<td>50 ppm (short term)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>127mg/m³ (short term)</td>
</tr>
<tr>
<td>Propylene glycol</td>
<td>Not flammable by GHS classification</td>
<td>No PEL and TLV</td>
</tr>
</tbody>
</table>
Substitute with non-flammable carrier

Oxygen in air

Heat / hot nozzle

Non-flammable Carrier

No Fire
Toxic Chemicals

Routes of entry

• Inhalation (breathing)
• Skin contact
• Ingestion
• (eating or drinking)
Handling toxic chemicals

• Label containers
• Classify and store in proper containers
• Avoid storing in bulk
• Practise good personal hygiene
  - wash hands before eating
  - keep food & drink away from handling areas
• Wear suitable protective equipment
Chemical Hazards Control

1. At the source
2. Along the path
3. At the receiver
At the Source

1. Elimination/Substitution
2. Modification (change of process)
3. Automation or containment
4. Enclosure of process
5. Isolation of process
6. Wet method
7. Local exhaust ventilation
8. Maintenance of plant, equipment,...
Along the Path

1. Dilution ventilation
2. Increase distance between source & receiver
3. Upwind vs downwind
4. Access control
5. Area monitoring
6. Housekeeping (cleanup spill)
At the Receiver

1. Safe work practices
2. Enclosure of workers (control room)
3. Rotation of workers
4. Personal monitoring
5. Personal protective equipment
6. Training & education
7. Biological monitoring
8. Personal hygiene
Related WSH legislation

Workplace Safety and Health Act (WSHA) and its related Regulations

1. WSH (General Provisions) Regulations
2. WSH (Risk Management) Regulations
3. WSH (Medical Examinations) Regulations
4. WSH (First – Aid) Regulations
Workplace Safety and Health Act (WSHA)

WSHA (12) Duties of employers

Take reasonably practicable measures to ensure the safety and health of his employees at work

..ensuring that the person at work has **adequate instruction, information, training** and supervision as is necessary for that person to perform his work.
WSH (General Provision) Regulations

Reg 41 – (2) Warning notices

Warning notices... specifying the nature of the danger shall be placed at all entrances to any workroom ;...
WSH (General Provisions) Regulations

Reg 42 Warning Label

Containers of hazardous substance shall be labelled
WSH (General Provisions) Regulations

*Reg 43 Safety Data Sheet*

Supplier shall provide SDS with accurate & adequate information

Occupier shall
- obtain the SDS
- assess the information
- take precautionary measures to ensure safe use
- make it available to persons at work
WSH (Risk Management) Regulations

• Reg 4 – (2) Safe work procedures
  Where it is not reasonably practicable to eliminate risk, employer shall implement
  such *measures* to minimize the risk; and such *safe work procedures* to control the risk

• Reg 4 – (3) Personal protective equipment
  ...the *measures* referred to any of the following
  – Substitution
  – Engineering control
  – Administrative control
  – Provision and use of suitable *personal protective equipment*
WSHA (15) Duties of persons at work

(1) It shall be the duty of every person at work to use in such manner so as to provide the protection intended, any suitable appliance, protective clothing provided for securing his safety, health and welfare at work.
In Summary

1. Chemicals must be properly handled and managed at workplaces
2. Risk Assessment is the cornerstone of chemical management
3. A key element of chemical management is hazard communication through labelling and SDS
4. Chemical hazards can be managed or controlled
5. All accidents and ill health involving chemicals can be prevented
Thank you