Get ready for the latest on Health and Safety

Work Safe Week
Seminar Series 2012
Controlling dangerous machines

How to identify, assess and reduce the risks
For the respect of others please ensure your mobile phone is switched off or on silent.

In the event of an emergency a Convention Centre team member will direct us to the nearest Evacuation Assembly Area which is Flinders Wharf Park (across the new Yarra River Footbridge) or John Batman Park. Please remain seated until directed to leave.

Presentations for most seminars will be available on our website after the conclusion of Work Safe Week 2012.

Please complete your evaluation, which will be emailed to you after this session for a chance to win a $100 Coles Myer gift card.
Dangerous Machinery

Identifying, maintaining and assessing hazardous plant in your workplace

WorkSafe Week 2012
The impact of Dangerous Machinery on Victoria workers

Over the last **five years** alone machines commonly used in Victorian workplaces have,

- taken the lives of **57** Victorians
- resulted in **10,802** claims leading to time lost from work and medical treatments
- **441** body parts were amputated
- **71% (7733)** occurred in **manufacturing, construction, transport, warehousing** and **storage** industries
- collectively the injury claims have cost Victoria **$222 million**
The impact of Dangerous Machinery on Victoria workers

Injury type

- Amputations: 4%
- Cuts: 27%
- Muscle strain: 22%
- Fractures and joints: 15%
- Burns: 1%
- Other (e.g. nerve damage): 31%

Machinery type

- Crushing, pressing and rolling machinery: 19%
- Other pressure, and production line machinery: 22%
- Conveyors: 3%
- Cutting, slicing and sawing machinery: 18%
- Powered equipment and tools: 38%
The impact of Dangerous Machinery on Victoria workers

Body part affected

- Back: 14%
- Head and neck: 28%
- Hand and fingers: 32%
- Other (Nervous system): 2%
- Legs and feet: 7%
- Arms: 17%
- Other: 1%

Injuries to hands and fingers

- Cuts: 63%
- Muscles and nervous system: 11%
- Broken bones: 11%
- Amputations: 13%
- Burns: 1%
- Other: 1%
Victoria’s reported injuries from machinery and equipment (July 2007 to June 2012)
Victoria’s injuries from machinery and equipment in regional Victoria by Local Government Authorities

Mildura
Claims (5yrs): 201
Claims costs (5yrs): $6,501,538

Greater Shepparton
Claims (5yrs): 372
Claims costs (5yrs): $7,953,248

Wodonga
Claims (5yrs): 258
Claims costs (5yrs): $4,880,937

Greater Bendigo
Claims (5yrs): 340
Claims costs (5yrs): $6,237,475

Ballarat
Claims (5yrs): 446
Claims costs (5yrs): $10,482,768
Cost comparison based on recent prosecutions by WorkSafe Victoria

Worker’s finger crushed & another’s finger tip amputated
Bypassed machine guards; poor supervision of work

- Fined $124,000
- Cost to prevent $5,000 in both cases

Worker’s arm crushed
Poor integrity of machine guards; Lack of procedures to electrically isolate unguarded moving parts

- Fined $90,000
- Cost to prevent $5,000

Worker’s hand crushed & burned
Lack of procedures to electrically isolate unguarded moving parts

- Fined $50,000
- Cost to prevent $2,000
The focus of the WorkSafe Inspectorate over the next 12 months

- Machine Guarding
  - Conveyors
  - Stamping and cutting machinery
  - Mixers and mixing machinery
New online system to register prescribed items of plant
The changing landscape of Victorian workplaces

Australia's top 10 import markets 2010 ($ billion) (a)

- United States: $35.3, 13.2%
- China: $41.0, 15.3%
- Japan: $20.4, 7.6%
- Singapore: $14.1, 5.3%
- Republic of Korea: $7.7, 2.9%
- Thailand: $13.0, 4.8%
- Germany: $12.0, 4.5%
- Malaysia: $10.3, 3.8%
- New Zealand: $9.9, 3.7%
- United Kingdom: $10.3, 3.8%

(a) Totals are in $billions and percentage figures represent share of total market.
Based on ABS trade data on DFAT STARS database and ABS catalogues.
The things you must do for all machinery and equipment

Check the machine for key hazards

► Ensure that machinery is not broken and has all its appropriate parts

► A person could not be injured using or maintaining the machine (eg by entanglement or crushing)
The things you must do for all machinery and equipment

Check for key controls

► The machinery is properly guarded and safety interlocks are regularly checked before operating
► People do not operate the machinery without the guarding attached
► Production schedules allow for safe operation
► Operator controls are easily accessible and clearly labelled. Warning lights and sounds are working
The things you must do for all machinery and equipment

Check maintenance procedures

► Energy supply and services such as power, water and air are physically isolated before any maintenance is done

► Energy stored in the machine such as spring tension, gravity or hydraulic pressure is released before maintenance is done
The things you must do for all machinery and equipment

Train your workers
► Workers are provided with regular information about the hazards associated with machinery and how to operate it safely
► Workers can identify when the machinery is not safe to use

Supervise the work
► Regularly observe workers using the machinery to ensure operations are undertaken in the correct way
► Untrained workers are not allowed to operate or maintain machinery
Young workers are particularly vulnerable

- Young workers have the highest proportion of work-related injuries; 17% higher than the average across all ages.

- Young workers have a higher rate of hospitalisation; 21% higher than other age groups.
Controlling dangerous machines

How to identify, assess and reduce the risks
Controlling Dangerous Machines
How to identify, assess and reduce the risks

Paul Rawlings
Safety Services and Training Manager
October 2012
Machinery Safety Process

These are the steps that should be considered when making your machinery safe:

1. Risk Assessment
2. Safety Concept
3. Safety Design
4. System Implementation
5. Safety Validation
Step 1 - Risk Assessment

Conduct an on-site inspection and a technical evaluation of your machines in consultation with your workers to:

- meet the obligations for machine designers and users stated in the OHS Regulations
- to assess the hazards in order to identify all those which apply to the machinery
Step 1 - Risk Assessment (cont.)

Typical Machinery Hazards

- Vibration
- Noise
- Mechanical
- Materials & Substances
- Electrical
- Ergonomics
- Thermal
- Radiation
**Step 1 - Risk Assessment (cont.)**

### Hazard Identification

<table>
<thead>
<tr>
<th><strong>Hazard No:</strong> xy</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Title:</strong> End clamp on shaping drum</td>
</tr>
<tr>
<td><strong>Location:</strong> Shaping drum</td>
</tr>
<tr>
<td><strong>Target:</strong> Hand</td>
</tr>
<tr>
<td><strong>Activity:</strong> Normal Operation</td>
</tr>
<tr>
<td><strong>Task:</strong> Normal Operation</td>
</tr>
<tr>
<td><strong>Sub Task:</strong> Clamping/Fastening the work piece</td>
</tr>
</tbody>
</table>

**Hazard Type:** Mechanical

**Sub Type:** Crushing Hazard

**Description:** End clamp locates on shaping drum - nothing to stop operator intervention

### Risk Estimation and Evaluation

| **Likelihood of Occurrence:** | 2 |
| **Frequency of Exposure:** | 5 |
| **Degree of Possible Harm:** | 2 |
| **Number of Persons at Risk:** | 1 |

**Hazard Rating Number (HRN):** 20.0

**Summary Level:** Significant Risk

### Risk Reduction

- ESPE to monitor operator position
- EN 999
- EN 61496-1/2
- EN ISO 13849-1:2006

### Possible Residual Risk

| **Likelihood of Occurrence:** | 0.033 |
| **Frequency of Exposure:** | 5 |
| **Degree of Possible Harm:** | 2 |
| **Number of Persons at Risk:** | 1 |

**Hazard Rating Number (HRN):** 0.33

**Summary Possible Level:** Negligible Risk
Step 2 - Safety Concept

Following from Risk Assessment a review of the machine should be conducted to:

- identify areas of improvement
- develop concepts required to achieve compliance and safety
- select technical measures in consultation with your workers
  - Mechanical
  - Electrical
Step 2 - Safety Concept (cont.)

- Risk Assessment review
  Overall risk reduction plan

  Overall safety concept

  Risk reduction by design
  - Safeguarding concepts
    - Guard monitoring
    - Position monitoring
    - Presence detection
  - Risk reduction by engineered measures
    - Safety related control system concepts
    - Emergency stop
    - Speed monitoring
    - Safe power removal

  Risk reduction by organisational measures
  - Risk reduction by other measures, training, PPE
Step 2 - Safety Concept (cont.)

Original Machine Layout: Machine without Safety Measures
Step 2 - Safety Concept (cont.)

Develop some possible solutions in consultation

Safety Concept 1  
Safety Concept 2
Step 2 - Safety Concept (cont.)

- Mechanical Guarding with Light Curtain, and upgraded Functional Safety System
Step 3 – Safety Design

At the design stage the following should be defined:

- safety requirements specification
  - Function of emergency stops
  - Function of interlock devices
  - Function of presence sensing devices
  - Function of Guarding
- generation of detailed designs e.g. guarding, electrical, pneumatic and hydraulic circuits
- planning System Implementation and System Validation stages
Step 3 – Safety Design (cont.)
Step 3 – Safety Design (cont.)

Guard Design
Step 3 – Safety Design (cont.)

Hydraulic/Pneumatic Circuit Design
Step 3 – Safety Design (cont.)

Electrical Panel Design
Step 3 – Safety Design (cont.)

Safety System Design for Production Line
Step 4 – System Implementation

This step includes installation and commissioning systems:

- project planning and controlling
- procurement of components
- selection of suppliers and contractors
- mechanical and electrical construction and erection
- programming of control devices
- installation and commissioning
- training
Step 4 – System Implementation (cont.)

Guarding and light curtain installation

BEFORE

AFTER
Step 4 – System Implementation (cont.)

BEFORE

AFTER
Step 4 – System Implementation (cont.)

BEFORE

AFTER
Step 4 – System Implementation (cont.)

BEFORE

AFTER
Step 4 – System Implementation (cont.)

BEFORE

AFTER
Step 4 – System Implementation (cont.)

BEFORE

AFTER
Step 4 – System Implementation (cont.)

BEFORE

AFTER
Step 4 – System Implementation (cont.)

BEFORE

AFTER
Step 5 – Safety Validation

A structured method for inspecting the safety critical elements of plant and machinery

- Assessment of implemented design versus safety requirements in standards and legislation
- Check of sensor and actuator installation and wiring configuration
- Function test with fault simulation
- Inspection of guarding and presence sensing devices
Step 5 – Safety Validation (cont.)

Validation of safety features on machinery should be performed by a person independent of the design and installation phases.

It should be performed by a competent person with suitable vocational education, practical experience and knowledge of relevant legislation and standards.

The results of the validation should be documented and kept as design records.
Step 5 – Safety Validation (cont.)
Guarding design considerations

- Must prevent access to the danger point or danger area of the plant. Refer to AS 4024.1801, 1802 & 1803 for safe reach distances.

Guarding hierarchy applies:

1. Permanently fixed guards
2. Interlock guards where access is greater than once/shift. Guardlocking interlocks need to be fitted where machine rundown is long
3. Fixed guarding that can be removed by use of a tool(s) e.g. hex keys, spanners, torx drives. Use retained fasteners where practicable.
4. Presence sensing devices
Guarding design considerations (cont.)

- Must be of solid construction and securely mounted so as to resist impact or shock
- Make by-passing or disabling of the guarding, whether deliberately or by accident, as difficult as is reasonably practicable.
- Must not to cause a risk in itself e.g. sharp edges, protrusions, etc.
- Must prevent debris from being ejected from the plant ie. do not use mesh guards or presence sensing devices.
Guarding design considerations (cont.)

- Is of a kind that can be removed to allow convenient repair, servicing and maintenance of the plant when not in normal operation.
- If the guarding is removed, the plant cannot be restarted unless the guarding is replaced. This can be achieved by interlocking or isolating the energy sources.
- Use contrasting colours on mesh guarding.
- Must be *properly maintained* by the business using it.
Inspection of Presence Sensing Devices

Presence sensing devices need to be inspected prior to putting into service to ensure that safety distances are adequate.

A series of stop time measurements need to be made followed by a safety distance calculation.

The presence sensing devices should also be checked periodically to ensure that there has been no decline in stopping performance on the machine.
Safety Control System Design

AS 4024.1501-2006 is the most common standard used. It describes SRP/CS in terms of categories.

Severity of the injury:
- S1 = slight (normally reversible) injury
- S2 = serious (normally irreversible) injury or death

Frequency and/or exposure to the hazard
- F1 = Seldom to less often and/or exposure time is short
- F2 = Frequent to continuous and/or exposure time is long

Possibility of avoiding the hazard or limiting harm
- P1 = possible under specific conditions
- P2 = scarcely possible
AS4024.1501 Category B
AS4024.1501 Category 1

Forced contact in accordance with EN 60947-5-1
AS4024.1501 Category 2
AS4024.1501 Category 3

Feedback loop

EN 50205 04/97 Abs. 4.6.2
AS4024.1501 Category 3

Feedback loop

EN 50205 04/97 Abs. 4.6.2
AS4024.1501 Category 4

EN 50205 04/97 Abs. 4.6.2

Feedback loop
Important Documents on Machinery Safety

Note: Documents are obtainable from www.safeworkaustralia.gov.au
Important Documents on Machinery Safety

The machinery safety bible.
THE END

Thanks for coming.

Go forth and make your machinery safe!

Questions Please.
Look out for your evaluation email for your chance to win a $100 voucher.