Common Occupational Scenarios
A boat building business approaches you to become their doctor. They have never had a doctor before, but they do get a nurse in to do a general health check and hearing tests and spirometry once every two years.
Putting frameworks to use

Aim: overview of initial workplace assessment and advice on hazard management programme using I.A.M.A. format.

- Identify
- Assess
- Manage
- Audit
Identify

• Identification (of hazard)
  • historical
  • previous monitoring
  • hazard register / MSDS sheets
  • work site assessment
  • task / materials inventory

• Identification (of exposed population / individual)
  • particularly vulnerable individual / groups
Hazards

Physical

Ergonomic

Chemical

Biological

Psychosocial

Legal / legislative
Physical

- Noise
- Lighting
- Vibration from power tools
- UV radiation
- Heat sources
- Electricity
- Heat and cold - weather dependant
Chemical

• Welding fume **
• Kerosene
• Metal dust debris
• Shield gas
• Forklift Exhaust
Other / General

• House keeping
• Forklift, lifting gear, machinery with blades and moving parts
• Manual handling
• Ergonomic posture
• Confined spaces
• Psychological
Welding
The concept of combining two pieces of metal together with a wire that is connected to an electrode current, is referred to as Metal Inert Gas (MIG) welding. In this type of welding process, a shielded gas is used along the wire electrode, which heats up the two metals to be joined. A constant voltage and direct current power source is required for this method, and this is the most common industrial welding process. The MIG or GMAW process is suitable for fusing mild steel, stainless-steel as well as aluminium.
Arc welding is also called as Shielded Metal Arc welding, or simply referred to as ‘Stick’. This is the most basic of all welding types. The welding stick uses electric current to form an electric arc between the stick and the metals to be joined. To weld iron and steel, this type of welding is often used in the construction of steel structures and in industrial fabrication. Stick welding can be used for manufacturing, construction and repair work.
TIG (Tungsten Inert Gas) or GTAW (Gas Tungsten Arc Welding)

A non-consumable tungsten electrode is used in this type of welding process. This tungsten electrode is made use of to heat the base metal and create a molten weld puddle. By melting two pieces of metal together, an autogenous weld can be created. For this type of welding, the welder needs to have a lot of expertise as it’s a very complex process. This welding process is employed to carry out high-quality work when a superior standard finish is required, without making use of excessive clean up by sanding or grinding.
**Welding Exposures**

- Multiple chemical exposures depending on type of welding and products being welded:

<table>
<thead>
<tr>
<th>Process</th>
<th>Base Metal</th>
<th>Contaminants</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shielded metal arc (stick welding)</td>
<td>Mild steel</td>
<td>Dust, iron oxide, manganese</td>
</tr>
<tr>
<td>Shielded metal arc (stick welding)</td>
<td>Stainless steel</td>
<td>Chromium, nickel, manganese, fluorides</td>
</tr>
<tr>
<td>Gas metal arc (MIG)</td>
<td>Stainless steel</td>
<td>Chromium, nickel, manganese, nitrogen oxides, ozone</td>
</tr>
<tr>
<td>Tungsten inert gas (TIG)</td>
<td>Aluminium</td>
<td>Ozone, aluminium oxide</td>
</tr>
<tr>
<td>Gas Brazing, cutting</td>
<td>Variable</td>
<td>Nitrogen oxides, cadmium oxide, metal fume</td>
</tr>
</tbody>
</table>
# Health hazards of welding

## Chemical Hazards

<table>
<thead>
<tr>
<th>Air contaminants</th>
<th>Health hazard</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Metals</td>
<td>Health hazard</td>
</tr>
<tr>
<td>- Iron oxide</td>
<td>Benign pneumoconiosis</td>
</tr>
<tr>
<td>- Manganese</td>
<td>Neurotoxicity, pneumonia</td>
</tr>
<tr>
<td>- Cadmium oxide</td>
<td>Acute lung injury</td>
</tr>
<tr>
<td>- Zinc Oxide</td>
<td>Metal fume fever</td>
</tr>
<tr>
<td>- Chromium VI</td>
<td>Lung cancer, allergy</td>
</tr>
<tr>
<td>- Nickel</td>
<td>Lung cancer, allergy</td>
</tr>
<tr>
<td>- Fluoride</td>
<td>Skin or respiratory irritation</td>
</tr>
<tr>
<td>Gasses</td>
<td></td>
</tr>
<tr>
<td>- Ozone</td>
<td>Respiratory irritation, asthma</td>
</tr>
<tr>
<td>- Nitrogen oxides</td>
<td>Acute lung injury</td>
</tr>
<tr>
<td>- Carbon monoxide</td>
<td>Systemic poisoning</td>
</tr>
<tr>
<td>Particulates</td>
<td></td>
</tr>
</tbody>
</table>
Don’t forget **other aspects of role**
- Cleaning products including solvents and degreasers

Don’t forget **contaminants**
- Galvanised metals
  - Zinc oxide
- Paints
  - Lead, cadmium, isocyanates, aldehydes, epoxies
- Biocides
  - Organic mercury, organic tin
- Chlorinated solvents
  - Phosgene
- Rustproofing
  - Phosphorus, phosphine
- Alloys, sheet metal
  - Cadmium, nickel, manganese, beryllium
- Solders
  - Rosin, colophony
<table>
<thead>
<tr>
<th>Physical Hazards</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>• Radiation</td>
<td></td>
</tr>
<tr>
<td>o Ultraviolet</td>
<td>Photokeratitis, skin erythema</td>
</tr>
<tr>
<td>o Infrared</td>
<td>Burns, cataract</td>
</tr>
<tr>
<td>• Heat</td>
<td>Burns, heat exhaustion, eye injury</td>
</tr>
<tr>
<td>• Electricity</td>
<td>Electric shock, electrocution</td>
</tr>
<tr>
<td>• Noise</td>
<td>Hearing loss</td>
</tr>
<tr>
<td>Ergonomic</td>
<td></td>
</tr>
<tr>
<td>• Slips, trip, falls</td>
<td></td>
</tr>
<tr>
<td>• Repetitive stress injury</td>
<td></td>
</tr>
<tr>
<td>Biological</td>
<td></td>
</tr>
<tr>
<td>• ? any</td>
<td></td>
</tr>
<tr>
<td>Psychosocial</td>
<td></td>
</tr>
<tr>
<td>• Working in isolation</td>
<td></td>
</tr>
<tr>
<td>• Bullying</td>
<td></td>
</tr>
<tr>
<td>• Job satisfaction</td>
<td></td>
</tr>
</tbody>
</table>
Assessment of Identified Hazards

Workplace and Hazards
• MSDS and toxicology information
• W.E.S.
• Noise surveys
• Air or dust sampling
• Previous workplace monitoring results

Workers
• Worker monitoring results
• Of workers – any with asthma or other medical illnesses?
LeqA = 119 dB(A)
When reporting back to a workplace, how do you go about recommending what hazards money is spent on managing?
## Risk Prioritisation

<table>
<thead>
<tr>
<th>Risk Matrix</th>
<th>Risk (consequence)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Likelihood</td>
<td></td>
</tr>
<tr>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>Medium</td>
<td></td>
</tr>
<tr>
<td>High</td>
<td></td>
</tr>
</tbody>
</table>

The Risk Matrix is used to prioritize risks based on their likelihood and consequence.
Risk Communication

- Don’t forget this, very important topic.
- Wont go into this now.
Managing the Hazards

- Source
- Pathway
- Worker

- Hierarchy of controls
  - Eliminate
  - Substitute
  - Isolate
  - Minimise
    - engineering controls
    - organisation controls
  - PPE
Cut protection:
- Chain mesh
- Knitted with steel core

Temperature (heat):
- Kevlar
- Tukon
- Leather

Chemical protection:
- Latex
  - Good for acids and ketones
  - Avoid hydrocarbons/alkanes/petrochemicals/aromatics/alkenes
- Nitrile
  - Good for hydrocarbons
  - Avoid ketones/acids
- Neoprene
  - Good for most
- PVC
  - Good for acids/bases
  - Avoid organic solvents/ketones/aromatics
- Butyl
  - Good for ketones, esters and oxidizing chemicals

Food handling:
- Latex
- Vinyl
- Polyethylene
- Disposable nitrile
Respiratory Protection

Three main types:

• Air purifying respirators
  – Draw inhaled air through a purifying filter.
  – 2 main types:
    • Particulate respirator which filters out dusts
    • Gas respirator which filters out certain gases and vapours
  – Get combination of these two
  – Don’t give protection against lack of O₂
  – Only use when type and concentration of contaminant is known

• Supplied air respirators
  – Deliver clean air from source outside contaminated area
  – Can be supplied:
    • At normal atmospheric pressure
    • From higher pressure source
      – e.g. compressed air line or independent supply

• Self-contained breathing apparatus (SCBA)
  – Supply of clean air from source carried by wearer
  – Used to give protection against dangerous breathing hazards:
    • Lack of O₂
    • Very toxic contaminants
    • When type of hazard is unknown
Dust mask classes

- **P1** – retain about 80% of particles smaller than 2 micrometers
- **P2** – retain about 94% of particles smaller than 0,5 micrometer
- **P3** – retain about 99,95% of particles smaller than 0,5 micrometer
Hearing protection (PPE)

Must be used if exposures above:

- A Noise Exposure Level, (LAeq,8h) of 85dBA, or a Peak Level (Lpeak) of 140 dB (Peak, unweighted)

- Muffs vs plugs

- Every 3dB increase in noise represents a doubling of the noise exposure and hence halving of the allowable exposure times.
## Table 1: Noise Exposure Classes

<table>
<thead>
<tr>
<th>Hearing Protection Class</th>
<th>$L_{Aeq,8h}$ (dBA)</th>
<th>Types of Suitable Hearing Protectors</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Less than 90</td>
<td>Earplugs or Earmuffs</td>
</tr>
<tr>
<td>2</td>
<td>90 to less than 95</td>
<td>Earplugs or Earmuffs</td>
</tr>
<tr>
<td>3</td>
<td>95 to less than 100</td>
<td>Earplugs or Earmuffs</td>
</tr>
<tr>
<td>4</td>
<td>100 to less than 105</td>
<td>Earplugs or Earmuffs</td>
</tr>
<tr>
<td>5</td>
<td>105 to less than 110</td>
<td>Earplugs or Earmuffs</td>
</tr>
</tbody>
</table>
Audit

Review control measures and their effectiveness

– Reassess hazards
– Workplace monitoring
– Worker monitoring
– Review whole system
Spray painting

• What is the major hazard with the spray painting aspect of the workplace.
• What occupational illness can this chemical cause?
Occupational asthma

• Airway narrowing that is reversible over short periods of time, either spontaneously or as a result of treatment
• Occupational asthma is asthma initiated by an agent inhaled at work (as opposed to pre-existing asthma aggravated by a non-specific irritants)
• Spirometry $\geq 12\%$ increase in FEV1 (or FVC) and absolute increase in FEV1 (of FVC) of $\geq 200$ mL post bronchodilator
• Serial peak flows $\geq 20\%$ variability very significant ($\geq 15\%$ probably significant)
Types of Occupational Asthma

- Can be irritant or allergic
- Identify likely irritant or allergen
- Skin testing (usually high molecular wt compounds) – positive tests do not always correlate with asthma
- RAST / ELISA testing if available – positive tests do not always correlate with asthma
- Challenge testing to demonstrate airways hyperresponsiveness or to specific agent, but can be dangerous
Spirometry performed

Abnormal ventilatory function

Obstruction  

Restriction  

Mixed

Normal
**PHYSIOLOGIST COMMENTS**
Data is acceptable and reproducible with good effort and technique.

**INTERPRETATION**
### SPIROMETRY

<table>
<thead>
<tr>
<th></th>
<th>Pre-Bronchodilator</th>
<th>Post-Bronchodilator</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Best</td>
<td>LLN</td>
</tr>
<tr>
<td>FVC (L)</td>
<td>3.90</td>
<td>3.70</td>
</tr>
<tr>
<td>FEV1 (L)</td>
<td>2.02</td>
<td>2.91</td>
</tr>
<tr>
<td>FEV1/FVC</td>
<td>0.52</td>
<td>0.68</td>
</tr>
<tr>
<td>FET (s)</td>
<td>10.3</td>
<td></td>
</tr>
</tbody>
</table>

Reference values: GLI 2012  Test quality: Pre: FEV1 - A, FVC - A; Post: FEV1 - A, FVC - B