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'Safe Design'

A Regulators Perspective

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Cover

- What is safe design
- What isn't safe design
- What NSW legislation says
- What the National body says
- Where Australia is heading
- Case Study – Miner with Drill Rigs
- Other Case Studies – Rig Hydraulic controls, Cable feed mechanism, Miner tilting cutter head, Windblast protection on Diesel Equipment

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What is Safe Design

Relevant Compliance and Consideration to -

- Moral Obligation
- Common Law "Negligence"
- Act
- Regulations
- Code Of Practice
- Standards (AS & ISO)
- Safety Alerts
- DII Guidelines + others
- Risk Assessment Techniques
  - Reliability Concepts
- Code of Ethics (Eng Aust)
- Business Improvement

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Safe Work Australia

(Formally NOHSC -> ASCC)

- Safe design is -
- 'a design process that eliminates OHS hazards, or minimises the potential OHS risk, by involving decision makers and considering the lifecycle of the designed product'
- 'a safe design approach will generate a design option that eliminates OHS hazards and minimises the risks to those who make the product, and to those who use it'

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Safe Work Australia

- Safe Design is
  - 'the integration of hazard identification and risk assessment methods,
  - early in the design process to eliminate or minimise the risk of injury,
  - To cover the lifecycle of a product or structure'
- 'the design approach begins with an emphasis on making choices about design, materials and methods of manufacture or construction to enhance the safety of the finished product'

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Safe Design

- End user (Mines) to specify their needs, requirements and outcomes. (This is very important and historically not done very well).
- Designer to Consider the risks to:
  - Operators (e.g. ergonomically friendly and practical)
  - Trades people (maintainers)
  - Reliability
  - Safety
  - Lifecycle risks
- Safe design is a philosophy (process) that focuses on controlling lifecycle risks at the design stage
- Moral Obligation to design, supply, operate safe equipment, Common Law, Community expectations

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What is safe design

- "A design that people use as intended"
- Real consideration of risks to:
  - Operators (friendly)
  - Trades people (maintainers)
  - Safety
- Look for what people may do to bypass and ask why do they do that?
- Consider Human Behaviour
- Use risk assessments as a tool to find issues not a tool for justification
- Always look at lifecycle
- Reliability analysis
- Must consider failure of risk controls
- Identify acceptable levels of risk and residual risks
  - CATs / SILs
  - Monitoring of risk controls
- Reassess risk assessments

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Poor Examples of Design Issues

Improvements

Most Importantly

- Safe design is **NOT**
  - Copying what has been done in the past. Statute Law and Community expectation is continually changing.
  - Modifying plant at the mine site after it has been delivered
  - Designing a machine not taking consideration of ergonomic issues
  - Designing equipment on the knee
  - Taking into consideration of all of the hazard where and how the equipment is used.

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Hierarchy of Legislation

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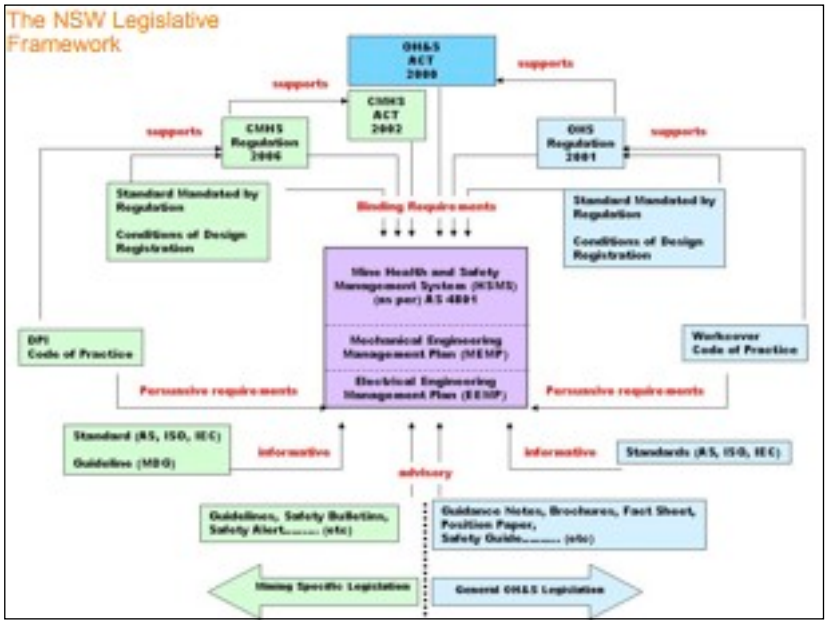
The NSW Legislative Framework



OHS Act Duties – Designers, manufacturers, suppliers

- **Designers, manufacturers and suppliers** of plant must (§11):
- ensure plant is safe and without risk to health or safety when properly used, and
- provide adequate information about the plant to persons to which the plant was supplied to ensure its safe use.

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Occupational Health and Safety Legislation

- General 'duty of care' to provide a safe place of work without risk to health, safety or welfare
- ***Designers, manufacturers and suppliers*** (§11) obligations
  - ensure plant is without risk to health or safety when properly used
  - provide adequate information to ensure its safe use
- ***Employers*** obligations
  - Ensure the health, safety and welfare of employees and others, extends to –
  - plant is safe and without risk when properly used,
  - systems of work and the working environment is safe
  - providing adequate information, instruction, training and supervision

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OHS Reg – Clause 5. "Control" of Risk ***'Hierarchy of Controls'***

Risks (in which the **elimination** of the risk is not reasonably practicable) to be controlled in the following order (cl 5):

- **Substitute** the hazard
- **Isolate** the hazard
- Minimise risk by the use of **engineering** means
- Minimise risk by **administrative** means,
  - e.g. adopting safe work practices or providing appropriate training, supervision, instruction or information
- Use of personal protective equipment (**PPE**).

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OHS Reg – Designers Duties

Designers' duties - Part 5.2 Division 1.

- Plant designed outside state must meet designers responsibilities *(cl 85)*
  - *A person who imports plant designed outside NSW must ensure the responsibilities of a designer are met.*
- Designer to identify hazards *(cl 86)*

  must identify any foreseeable hazards - potential to harm health or safety - during lifecycle of the plant.

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OHS Reg – Designers Duties

- Designer to assess risks *(cl 87)*
  - *must assess the risk arising from any hazard identified and must identify design requirements to eliminate or control the risk.*
- **must consider:**
  - **working environment,**
  - **range of environmental and operational conditions**
  - **ergonomic needs**
  - **safe access and egress for persons,**

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OHS Reg – Designers Duties

- Designer to review risk assessment whenever *(cl 88)*
  - evidence risk assessment is no longer valid
  - owner provides information about a design fault
- Designer to control risks *(cl 89)*
  - lifecycle risks are eliminated or if not reasonably practicable, controlled.
  - regards to ergonomic principles,
  - safe access gained for use
  - build-up or unwanted material that creates a risk is minimised.

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OHS Reg – Designers Duties

- Designer to provide information *(cl 96)*
  - must provide other persons all available information necessary to enable the persons to fulfil their responsibilities with respect to the following:
    - identifying hazards,
    - assessing risks arising from these hazards,
    - eliminating or controlling those risks,
    - providing information.
- must provided the following:
  - the purpose for which the plant is designed,
  - testing or inspections to be carried out on the plant,
  - installation, commissioning, operation, maintenance, inspection, cleaning, transport, storage and, if the plant is

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OHS Reg – Designers & Employer Duties

- Designer to obtain information *(cl 97)*
  - If designer has contract with an employer the designer must obtain any relevant information about matters that may affect health and safety
- Employer to provide information (cl 144) (3)
  - An employer who contracts out the design of plant for use at work must ensure that the person who is engaged to design the plant is provided with all relevant information about matters relating to the plant that may affect health and safety.

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Cover

- What is safe design?
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- Where Australia is heading

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Role of design in the workplace. Injuries and fatalities

Safe Work Australia research findings (1997-2002).
Design contributed to -

- 37% of work related serious and fatal injuries
- Most prominent in the 'machinery and fixed plant' and 'mobile plant and transport' group
- Most affected industries: mining, construction, transport, agriculture, trade and manufacturing
- Most solutions to identified problems are readily available or already exist.

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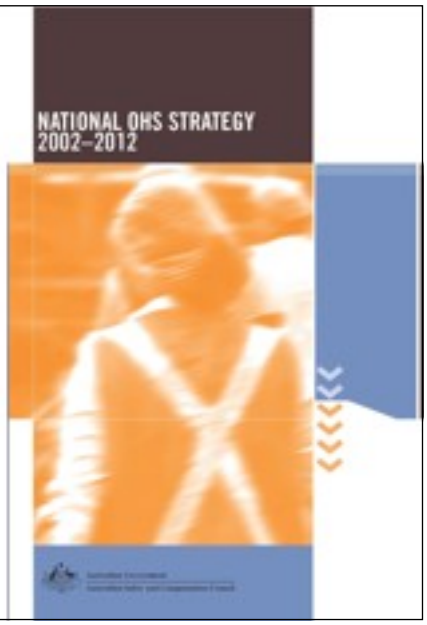
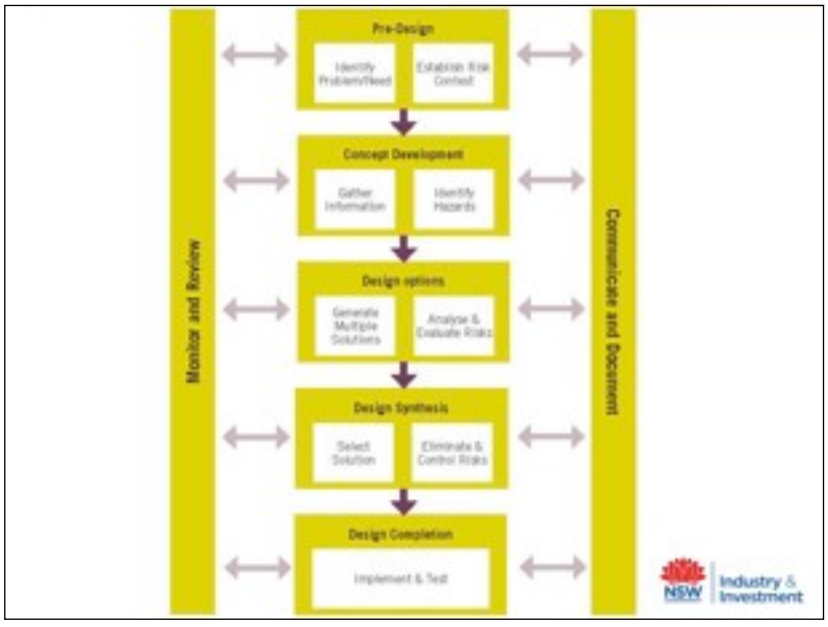
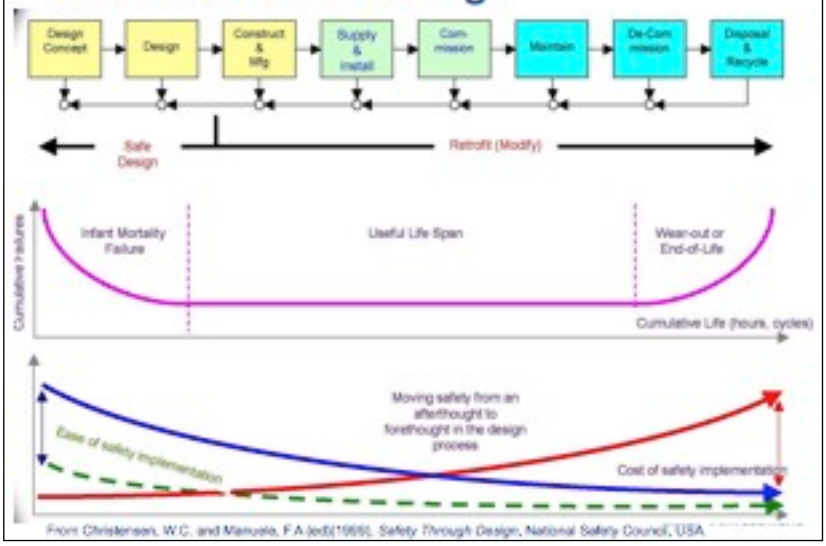
National OHS strategy

- Eliminate hazards at the design stage





The cost of safe design



From Christensen, W.C. and Manuele, F.A.(ed)(1999). Safety Through Design, National Safety Council, USA

Cover

- What is safe design?
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Model Work Health and Safety Bill

Proposed implementation 2012 (National Bill)

(§22) persons conducting plant design

- (2) the designer must ensure, so far as is reasonably practicable, that plant is designed to be without risk to health or safety of persons:
  - (a) who use the plant at a workplace for a purpose for which it was designed for
  - (b) who handle the substance
  - (c) who store the plant at a workplace
  - (d) who construct the structure at a workplace
  - (e) who carry out a reasonably foreseeable activity at a workplace in relation to:
    - (i) the manufacture, assembly or use of the plant for the purpose for which it was designed or proper handling, storage or disposal of that plant
    - (ii) same as (i) but for substance
    - (iii) same as (ii) but for structure
  - (f) in the vicinity of a workplace and who are exposed to the plant …

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Management Systems Model – AS 4801

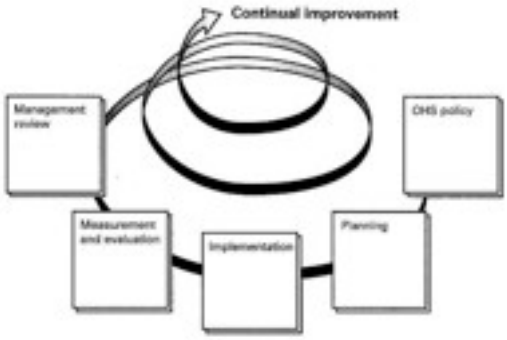

Figure 1 OHS Management System Model

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Case Studies

Nertney Wheel

- Case Study No 1
  - West Wallsend Miner
- Case Study No 2
  - Drill Rig Controls upgrade (continuous improvement)
- Cast Study No 3
  - Cable bolt feeder on mobile drill rig
- Case Study No 4
  - Personal experience

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PROVIDING A USER FRIENDLY CONTINUOUS MINER

Continuous Miners may have be fit for purpose to cut coal, but on the other hand not ideal for operator use.

Chris Gearing - Formally West Wallsend Colliery.

This presentation was given at the NSW Minerals Council OHS Conference 2006.

Thanks to Xstrata Paul Gill (UG Group Engineer) for permission to show this presentation.

PROVIDING A USER FRIENDLY CONTINUOUS MINER.

THE PROBLEM !

- Historically, Continuous Miners have been designed specifically to cut coal and support the roof. The operators have had little attention paid to their needs. The operators had to fit to the machine rather than the machine fitting for the operator.

  Ergonomics was a word people used but rarely understood or applied.

- The work recently conducted by West Wallsend began with a shared vision and resulted in a user friendly operator work environment.

PROVIDING A USER FRIENDLY CONTINUOUS MINER

HAZARD IDENTIFICATION AND CONTROLS

- West Wallsend had identified some ergonomic problems. A study conducted by Xstrata and Robin Burgess Limerick from QLD University confirmed commitment and actions.
- Further investigation showed that mining injuries broke down into 5 areas.

  Environment 17% Manual handling 17% Slips/trips/falls 17%
  Access/ Egress 17% Work Method 32%
- The identified problems in these areas were gathered in consultation with the workforce, the solutions developed by Engineering.
- Ongoing reviews and risk assessments with the end users ensured the final modifications overcame the specific problems and did not present any unforeseen risks within themselves.
- Australian and overseas engineering standards where appropriate.

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PROVIDING A USER FRIENDLY CONTINUOUS MINER
HAZARD IDENTIFICATION AND CONTROLS

1. **Environment** 17%
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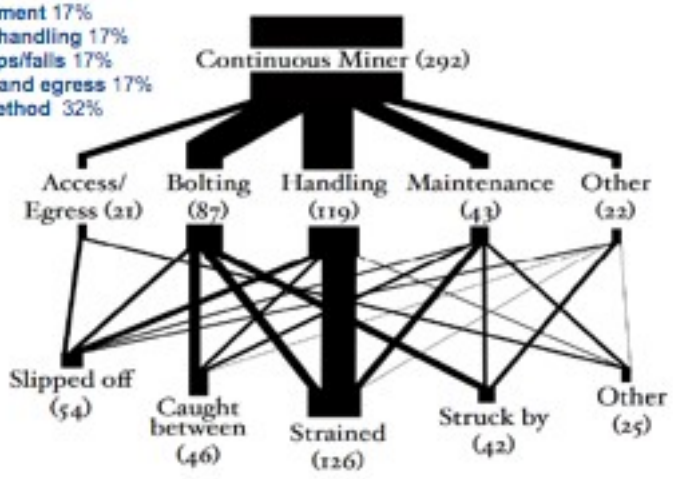

PROVIDING A USER FRIENDLY CONTINUOUS MINER

THE PROBLEMS !

1. **Work place, access and egress.**
2. **Working in elevated positions.**
3. **Having inadequate work space area to interact with equipment and even other operators.**
4. **Using bolting equipment with poor ergonomics.**
5. **Poor work environment. ie lighting, humidity, vibration.**
6. **Manual Handling issues with consumables.**
7. **Excessive dust.**
8. **Injuries during the bolting process.**

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PROVIDING A USER FRIENDLY CONTINUOUS MINER

Problem – 1 &2 Access, egress and Working at height.

THE SOLUTION

- Platforms and access to the work area are level, clear and open.
- Access ladder provides 3 point contact
- Non slip and anti-vibration floor mats for reduced fatigue/vibration related problems.



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PROVIDING A USER FRIENDLY CONTINUOUS MINER

Problem - 3&4 Inadequate workspace and poor ergonomics.

THE SOLUTION

•All machine components, controls, steps etc have been "designed" out from work area. Work areas have been designed as large as possible

•Bolting rigs rotated north south orientation to eliminate twisting during bolting and incorporate mast controls

•All stored materials to suit ergonomic and open work area philosophy.



PROVIDING A USER FRIENDLY CONTINUOUS MINER

Problem - 5 Poor work environment regards lighting and humidity

THE SOLUTION

- New type lights tried, tested, and fitted around access, walkways, work areas and controls.
- Hydraulic fans provide evaporative cooling in a hot steamy environment. The air flow prevents safety glasses from fogging up and assist with dust control !



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PROVIDING A USER FRIENDLY CONTINUOUS MINER

Problem – 6 MANUAL HANDLING

THE SOLUTION

- Purpose designed mesh and w strap "load, carry and position" system.
- Material pods, mesh and w straps loaded with machines eliminates manual lifting
- Flexible ducting "connect/reconnect" designed for single man operation.


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PROVIDING A USER FRIENDLY CONTINUOUS MINER

Problem – 7 Dust Control

THE SOLUTION

- Minimum 50% increase in vent duct ventilation with the same vent fan
- Dust control system integrates flow concepts.



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PROVIDING A USER FRIENDLY CONTINUOUS MINER

Problem – 8 Injuries while bolting

THE SOLUTION

- Bolting equipment and hydraulic controls designed to keep operators hands away from moving parts.
- Elimination of manual drill guides
- Consistent operating procedures providing safer work methods
- Re-designed hydraulic control system to assist operators with normal problems encountered during drilling.
- Goes beyond draft MDG35 prescription that recognises additional safety requirements for rigs



PROVIDING A USER FRIENDLY CONTINUOUS MINER

SIGNIFICANCE

- For Xstrata Coal NSW a new standard has evolved regards our current and future equipment packages.
- The realisation that improved work environments have lead to safer and more productive output.
- It is the commitment to engineer quality integrated solutions that has enabled success compared to the methods of the past.
- This presentation is not only about the improved engineering solutions but the realisation that a change in mindset towards operator interaction and work environments must be one of our prime objectives.

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PROVIDING A USER FRIENDLY CONTINUOUS MINER

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Case Study No2

- Incident Serious Bodily Injuries occurred at a mine.
- The rig controls may have contributed to the incident.

- Drill Rig controls were replaced and updated to the latest MDG35 requirements (according to OEM) installed in the same location. This system included ergonomic controls.
- Unplanned Movement issue developed on the new rig controls.

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Drill Rig Controls in operation, experienced some issues

- OEM Carried out a second FMEA.
- Additional controls identified.
- Hydraulic modelling of the controls conducted.
- Confirmed the additional controls from the FMEA and identified a few more controls.
- Work being carried out.
- Monitor and review operations.

- Continuous Improvement.

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Case Study No 3

- Cable bolting introduces additional hazards.
- Ergonomics
- Strains and Sprains
  - Twisting,
  - Forces required for person to install cable bolts
  - Additional weight of bolts to be handled
  - Additional interaction of persons with drill rig.

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Process Followed

Personal Experience

- Continuous Miner with tilting cutter head
  - To obtain a constant thickness of coal (beam) on the roof for good strata control.
- Additional operator protection on UG mobile plant.
  - Hazard: Windblast & flying debris.
  - Control: Bullet resistant Glass in man transporters (Glass 42 mm & 38mm thick laminated glass.
  - LHD Fully enclosed canopy fitted with grating and thick perspex.

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Industry working as a collective group to influence the Manufacturers

- EMESRT (All major mining companies & UQL)
- Nominating the hazards generally encountered with mining equipment.
- Manufacturers Design the hazards out
- Manufacturers asked to design controls to eliminate or minimise the hazards
- To minimise rework after equipment delivery
- Safer, reliable and more productive equipment.
- www.mirmgate.com

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If all else fails - Remember !!

- Fit for Purpose Equipment
- Competent People
- Safe Work Procedures

Engineering & Management Framework

- All Within a Controlled Work Environment

Leads to **SAFE PLANT**

The End

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