Are Risk assessments worth the paper they are written on?

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Risk Assessment
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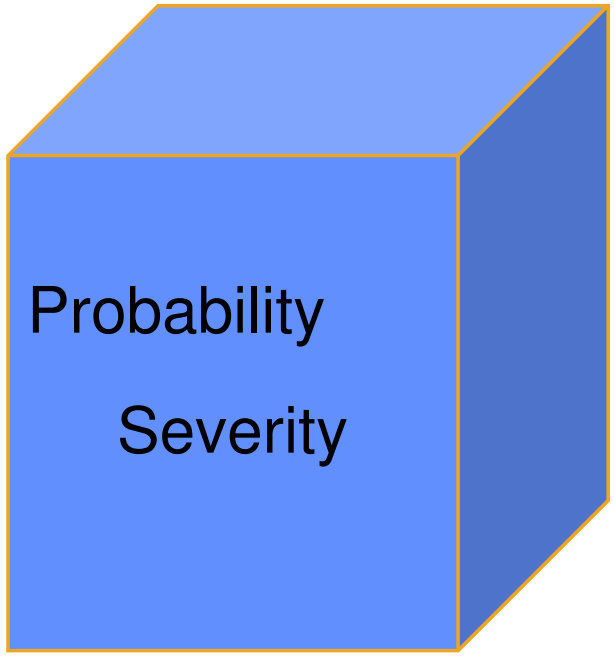
Pilz Australia June 2009

the spirit of safety

Risk assessment – Pandora's box



= **RISK**

Some Recent History of Risk Assessment in Law

- 1986, Adoption of the single European act.
- 1989, Framework Directive passes into law, legislates that employers have duty to carry out risk assessments.
- 1994, National standard for Plant (NOHSC) in Australia specifies risk assessment for employers, designers, manufacturers, importers, suppliers, installers.
- 1995/6, Most states enact regulations with these requirements, NSW 2001
- 2007, Victoria changes regulations to emphasize risk control and remove obligation for Risk Assessment where the risk control is obvious

From Worksafe Victoria website.....

Risk assessment is the process used to determine the likelihood that people may be exposed to injury, illness or disease in the workplace arising from any situation identified during the hazard identification process.

Risk control is the process used to identify all practicable measures for eliminating or reducing the likelihood of injury

The term "reasonably practicable“ means practicable having regard to:

- the likelihood of a hazard or risk occurring (i.e. the probability of a person being exposed to harm);
- the degree of harm that woudl result if the hazard or risk occurred (i.e the potential seriousness of injury or harm);
- what the epson concerned knows, or ought reasonably know, about the hazard or risk and any ways of eliminating or reducing that hazard or risk;
- the availabilityand suitability of ways to eliminate or reduce the hazard or risk; and
- the cost of eliminating or reducing the hazard or risk.

From Workcover SA....

Sample Risk Assessment Matrix

Likelihood	Major (eg death/ disability)	Serious (eg serious injury /lost time)	Minor (eg first aid injury)	Insignificant (eg incident but no injury)
Very likely (and will almost certainly happen)	Extreme	High	High	Medium
Likely (and will probably happen at some time)	High	High	Medium	Medium
Unlikely (but could happen at sometime)	High	Medium	Medium	Low
Very unlikely (and might happen only rarely)	Medium	Medium	Low	Low

WorkCover CORPORATION

60 1948–2008 AUTOMATION

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From a famous Australian University...

HAZARD IDENTIFICATION & RISK ASSESSMENT							
Procedure:							
Name:		Position:			Signature:		
Approved:					Signature:		
Risk Assessment No							
Potential Hazards	Risk Assessment					Controls	Comments
	None	Low	Medium	High	V High		

HSE –UK View of Risk Assessment

"Reducing Risks, Protecting people"

"Even using all available data and best science and technology, many risk assessments cannot be undertaken without making a number of assumptions such as relative values of risks and controls or even the scope of the study"

".....there is overwhelming evidence that, properly used, the results of a risk assessment provide an essential ingredient in reaching decisions on the management of hazards"

European Trade Union Technical Bureau TUTB View of Risk Assessment

- " ...there is no European model or system of risk assessment. There are different national practices and many industrial schemes"
- "....legislation, too, has often defined risk assessment in the vaguest of terms"
- "Only a minority of firms have carried out proper risk assessment"
- "There is certainly much more paper generated on assessment than real assessments carried out with the intention of putting prevention systems in place"
- "In the worst cases....the employer signs a written statement certifying that they have had the assessment performed without drawing up a prevention plan"
- "Where risk assessments have been carried out, only a minority of firms have really involved their workers"

Australian National OHS Strategy 2002-12

Five National Priorities:

- **Reduce high incidence/severity risks**
- **Improve capacity of business and workers to manage OH&S effectively**
- **Prevent occ. disease more effectively**
- **Eliminate hazards at the design stage**
- **Strengthen capacity of Govt. to influence OHS outcomes**

National target: Reduce workplace injury by 40% by 2012 (20% by 2007); fatalities by 20% - 2012 (10% by 2007)

Statistics (source NOHSC, now called ASCC)

2000 Work related fatalities annually(1750 road fatalities)
139,000 compensated work-related injuries annually
Annual Cost of the above ~$30 Billion
Design related Incidents: (Source R Pugsley Team leader Safe Design NOHSC)

42% of plant related fatalities and serious injuries occurred as a **direct** result of poor design, 95% machinery/fixed plant fatalities partly caused by design, 10 amputations per working day in Australia due to inadequately guarded plant

Design related incidents in manufacturing 50% ,67% in mining

Statistics

Causes: (Source R Pugsley Team leader Safe Design NOHSC)

- Inadequate Guarding
- Inadequate interlock safety systems
- Equipment failure eg failed hydraulic systems
- Poorly situated control devices
- Sticking Drills

Equipment:

- Crushing, pressing, rolling machinery 72% of incidents involved design
- Cutting, slicing, sawing machinery 91% design related

Recent legal examples

Victoria: Employer, Importer and supplier successfully prosecuted when High School student seriously injured by dust extraction system.

NSW: Employer and Wood-chipping machine designer & manufacturer successfully prosecuted after council worker had both arms amputated by the machine when clearing blockage.

WA: Grape picking machine designer & manufacturer (from SA), prosecuted in WA using cross jurisdictional provisions in constitution.

Risk Control Hierarchy in SA Law

(a) firstly, the application, so far as is reasonably practicable, of engineering controls, including substitution, isolation, modifications to design and guarding;

(b) secondly, if steps taken under paragraph (a) do not minimise the risk, the application, so far as is reasonably practicable, of administrative controls, including safe work practices;

(c) thirdly, if steps taken under paragraphs (a) and (b) do not minimise the risk, the provision of appropriate personal protective equipment.

Guarding Hierarchy defined by law

(a) a permanently fixed physical barrier where no part of a person requires access to the dangerous area during normal operation, maintenance or cleaning; or

(b) an **interlocked** physical barrier where access to dangerous areas is required during the operating sequence; or

(c) if compliance with paragraph (a) or (b) is not reasonably practicable—a physical barrier securely fixed in position by means of fasteners or other suitable devices, which ensures that the **guard** cannot be altered or detached without the aid of a tool or key; or

(d) if compliance with paragraph (a), (b) or (c) is not reasonably practicable—a **presence sensing safeguarding system**.

Definition of a Designer

"A Designer includes anyone who designs plant, or who alters the design of existing plant so that new measures for controlling risk are required"

Control of risk needs to be considered during:

Design, manufacture, storage, transportation, installation, commissioning, use, setting, cleaning, adjustment, inspection, maintenance & servicing, repair, modification, refurbishment, decommissioning, dismantling, demolition or disposal

Think of intended use and reasonably foreseeable misuse

"Reasonably practicable"

Having regard to:

- Likelihood of hazard or risk eventuating
- Degree of potential harm
- Knowledge of risk and controls
- Availability and suitability of controls
- Cost

(2) To avoid doubt, for the purposes of this Part and the regulations, regard must be had to the following matters in determining what is (or was at a particular time) reasonably practicable in relation to ensuring health and safety—

(a) the likelihood of the hazard or risk concerned eventuating;

(b) the degree of harm that would result if the hazard or risk eventuated;

(c) what the person concerned knows, or ought reasonably to know, about the hazard or risk and any ways of eliminating or reducing the hazard or risk;

(d) the availability and suitability of ways to eliminate or reduce the hazard or risk;

(e) the cost of eliminating or reducing the hazard or risk.

What is Risk?

RISK = Consequence X Likelihood
= Severity X Probability

What is a Hazard?

Something which has the potential to cause harm, damage or loss.

So, what the @#$% is a Risk assessment!!?

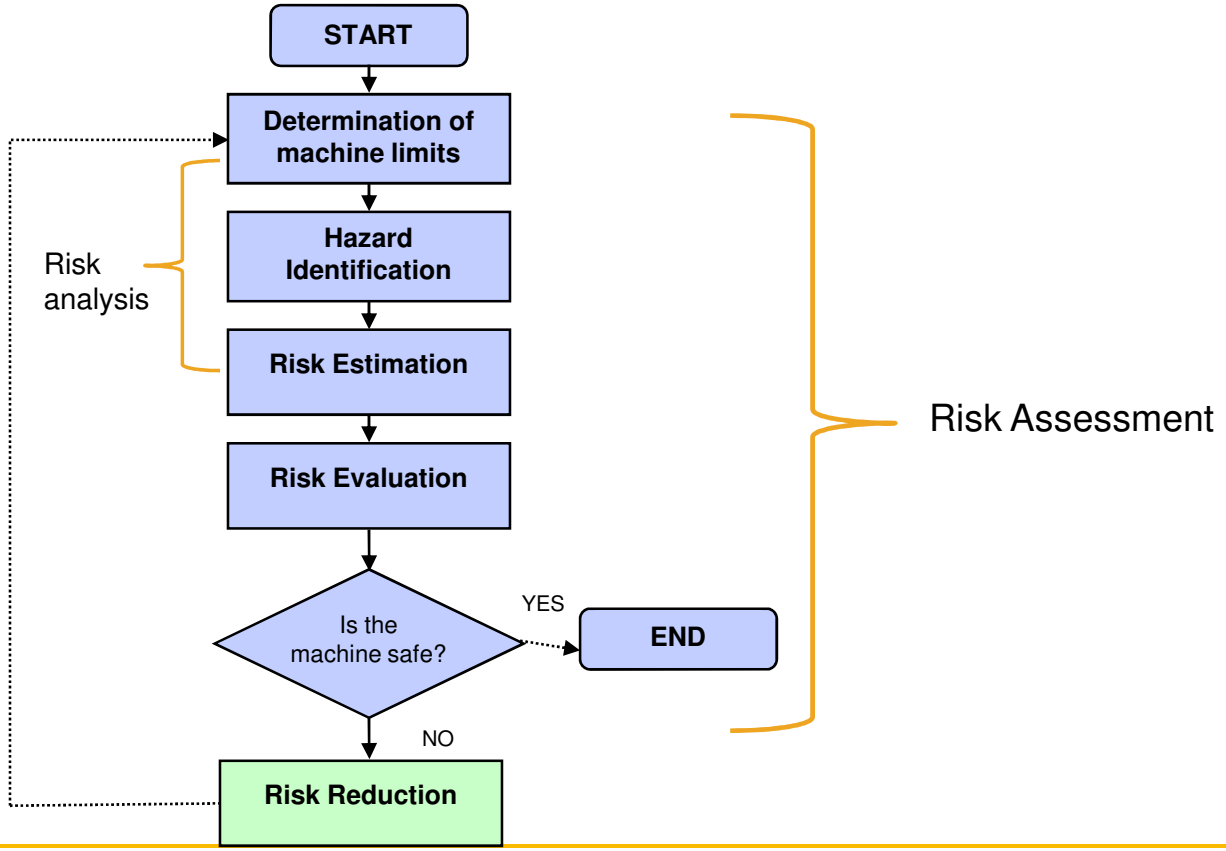
HSE –UK View of Risk Assessment

Is more needed to control the Risk? Do the controls:

- Meet the requirements of law (acts and regulations)
- Meet the standards required by law
- Comply with recognised industry standards
- Represent good practice
- Reduce Risk so far as is reasonably practicable
  (Improve, or at the very least do not reduce productivity!)
- Document and review when new machines/modifications, substances or procedures are added

Risk Assessment Process

The process as defined in ISO14121 (AS4024.1 part 1301) Principles of risk assessment



RISK ESTIMATION

Subjective evaluation of the:
Probability of occurrence and severity of a hazardous event
Elements that should be considered include the—

- (a) reliability and other statistical data;
- (b) accident history; "Absence of evidence of risk does not imply evidence of absence of risk"
- (c) history of damage to health; and
- (d) risk comparison

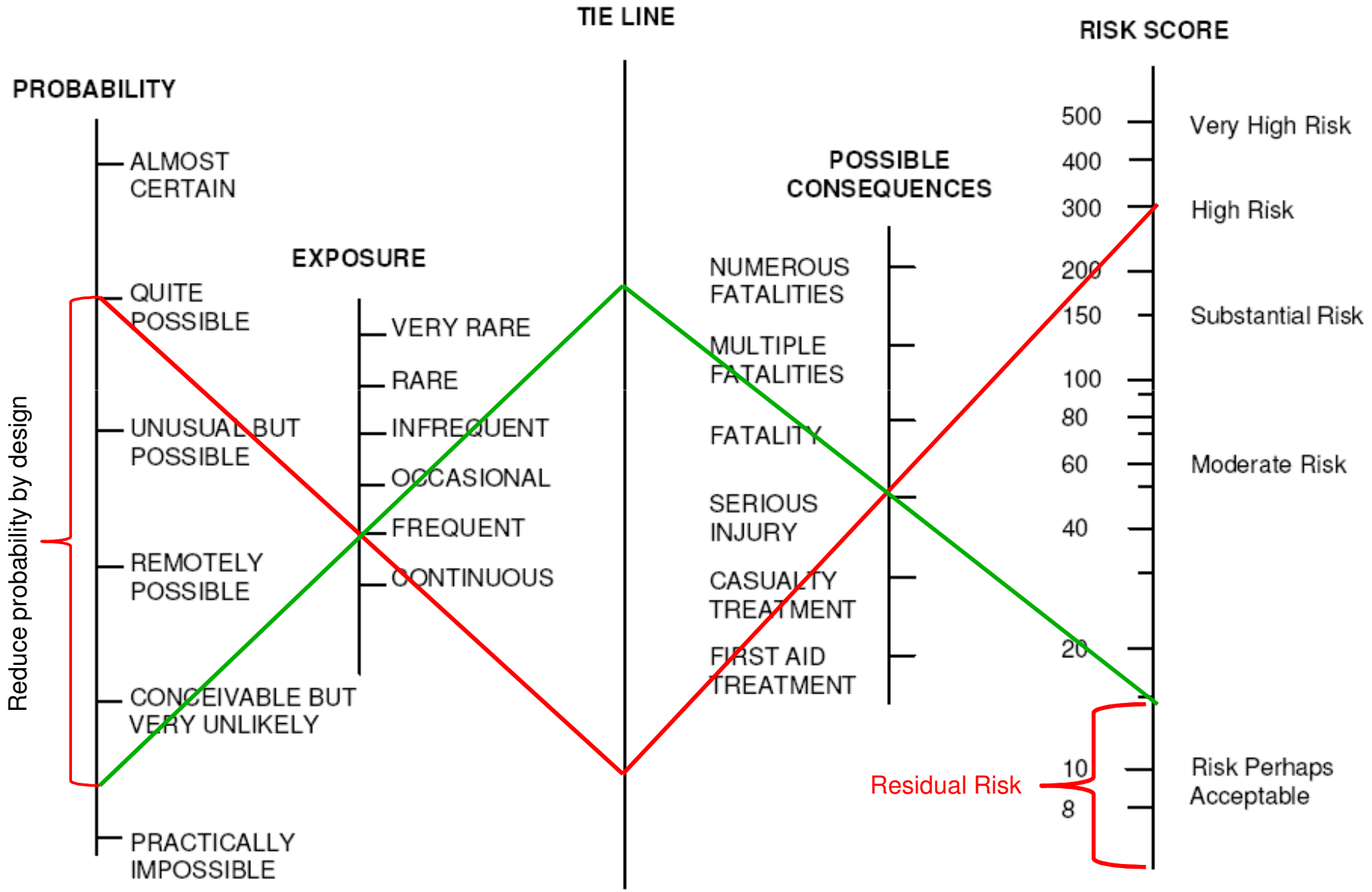
Risk Estimation methods – 5X5

Example. A matrix for determining the level of risk.

Likelihood	Consequence				
	1 insignificant	2 minor	3 moderate	4 major	5 catastrophic
A v.likely	Medium	High	High	Extreme	Extreme
B likely	Medium	Medium	High	High	Extreme
C moderate	Low	Medium	High	High	High
D unlikely	Low	Low	Medium	Medium	High
E rare	Low	Low	Medium	Medium	High

(Source. AS4360-2004 Risk Management)

Risk Estimation Methods - Nomogram



Consider this case: concrete plant conveyor, following hand crush incident

Initial risk estimation: AS 4360

Severity of injury –major

Frequency – 2/3 per day access

Probability- likely

Risk - High

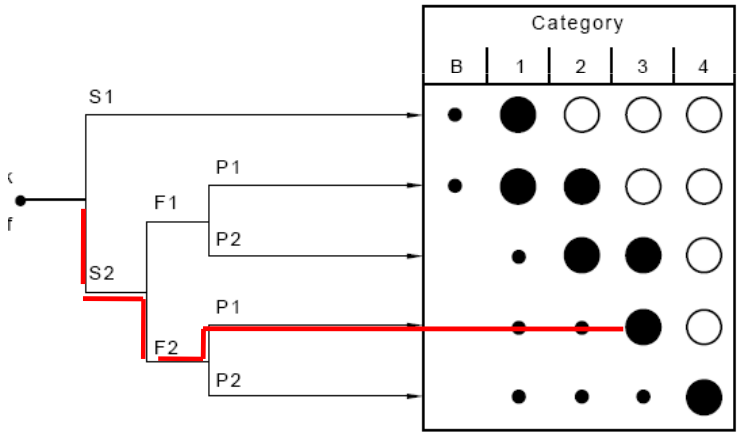
Recommendation: Guarding with authorised access

Solution:?

What should have been done?

Design based solution:

- Use 5x5 with team consisting of engineer, operator, OH&S, supervisor – determine raw risk estimate – accept HIGH, means do something now.
- Go to guarding hierarchy in regulations which demands interlocked guard if access is required
- Go to design Standard (AS 4024.1-2006 Safety of Machinery) to determine how guard, interlock and control system should behave according to risk.
- Guard strong enough to withstand expected expected influences, reach over/through tables followed.
- S2, F2, P1= Category 3, single fault tolerant with fault detection SRPCS Architecture required, covers interlock(s), control system and energy delivery devices.



Case 2: Maintenance on a crusher

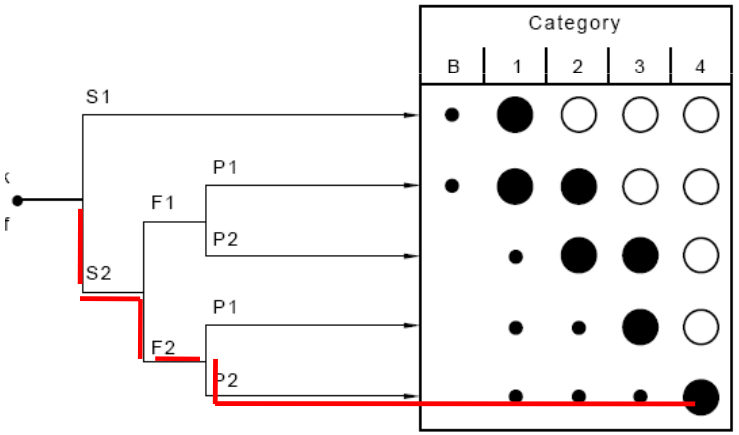
Initial risk assessment:
None conducted

Control Solution:
Use a LOTO approach to allow maintenance into the danger area – subject to human whim, single failures, outcome- fatality

What should have been done?

Design based solution:

- Use 5x5 with team consisting of engineer, operator, maintenance guy, OH&S, supervisor – determine raw risk score – accept HIGH (instant fatality if the crushers starts unexpectedly), means do something now.
- Go to guarding hierarchy in regulations which demands interlocked guard if access is required
- Go to design Standard (AS 4024.1-2006 Safety of Machinery) to determine how guard, interlock and control system should behave according to risk.
- Guard strong enough to withstand expected expected influences, reach over/through tables followed.
- S2, F2, P2= Category 4, Multiple fault tolerant with fault detection SRPCS architecture required, covers interlocks, control system and energy delivery devices all dual channel with fault detection.

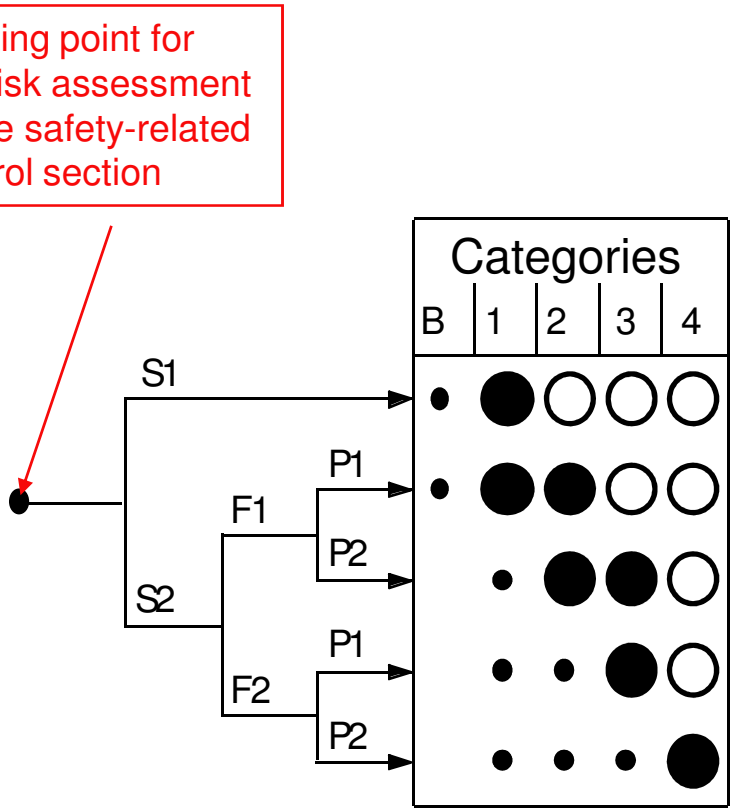


Risk Assessment leading to Category of control AS4024.1-2006 safety of machinery

S Severity of injury:
- **S1** = Slight (reversible)
- **S2** = Serious (non-reversible) including fatal injuries

F Frequency and exposure times
- **F1** = Seldom and/or short exposure
- **F2** = Frequent to continuous and/or long exposure

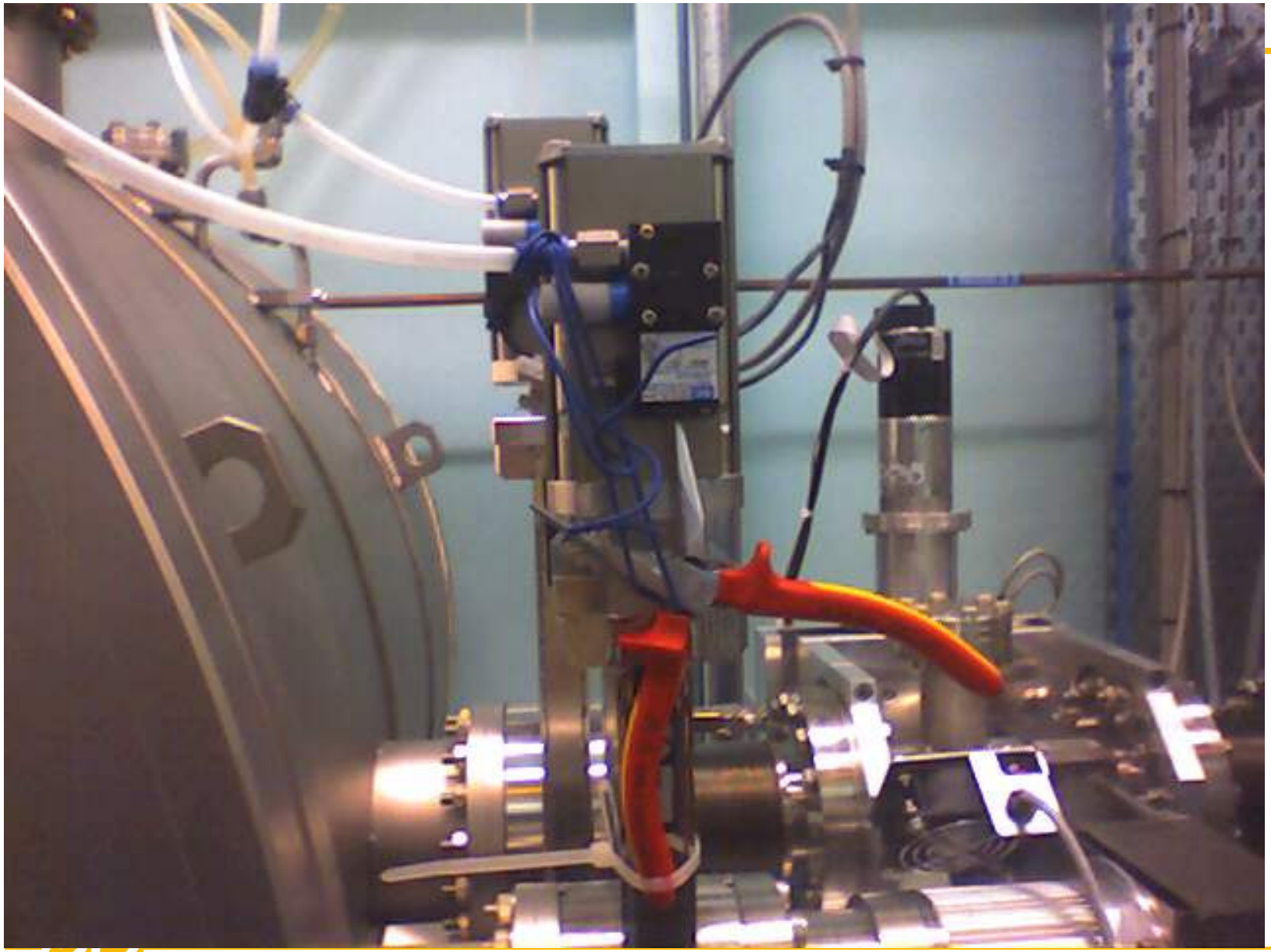
P Possibility of avoiding the hazard This is generally related to the speed and frequency at which a hazard arises and the proximity to the hazardous point.
- **P1**= possible under certain conditions
- **P2**= Scarcely possible



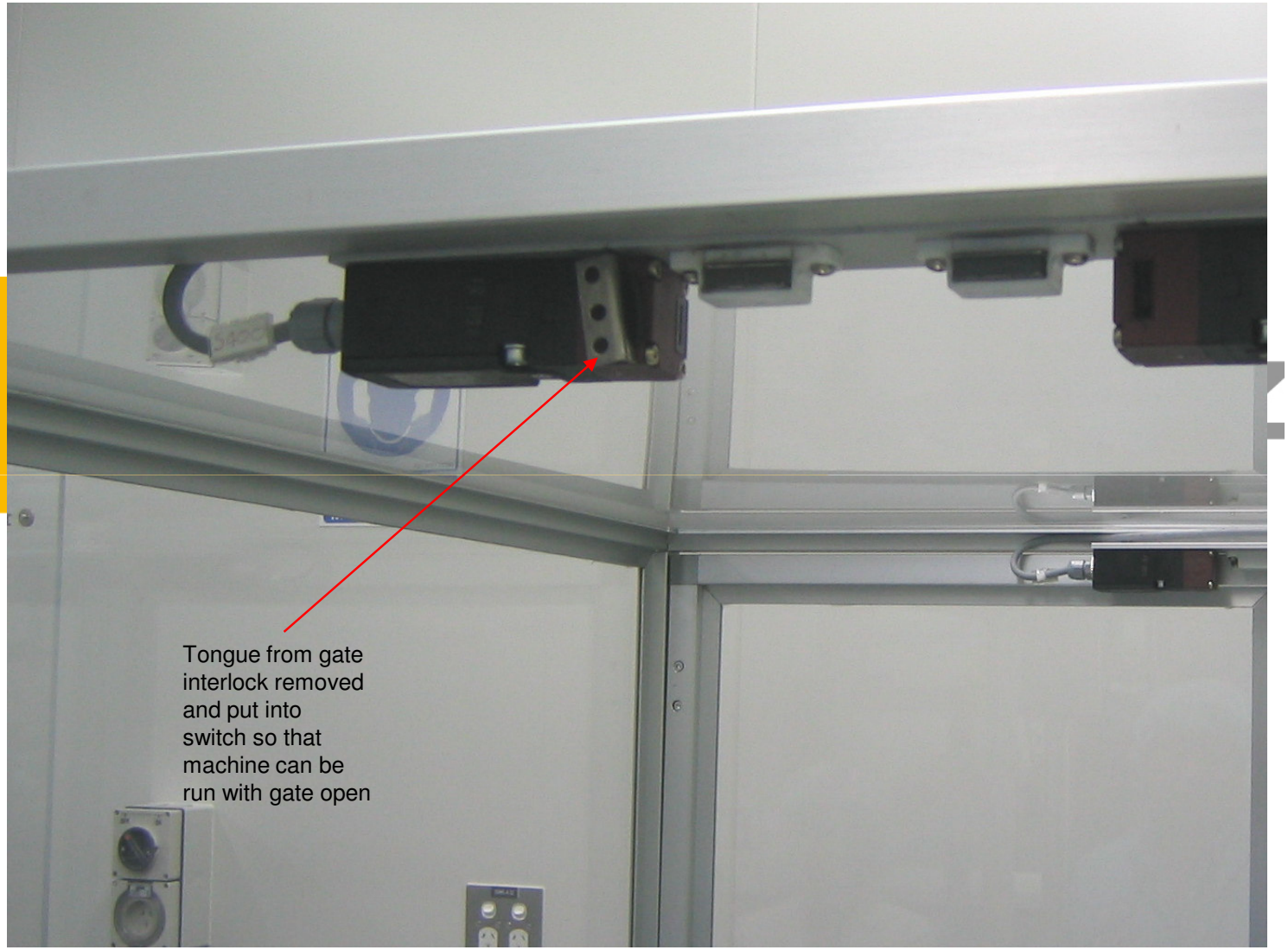
Consider productivity

Finally, let us consider not just the safe design, but the productive safe design, because anything that slows down the process will upset many people : the managers, the operators, the shareholders etc. If we don't get this right we haven't completed a holistic Risk assessment, because people will seek to bypass the solution.

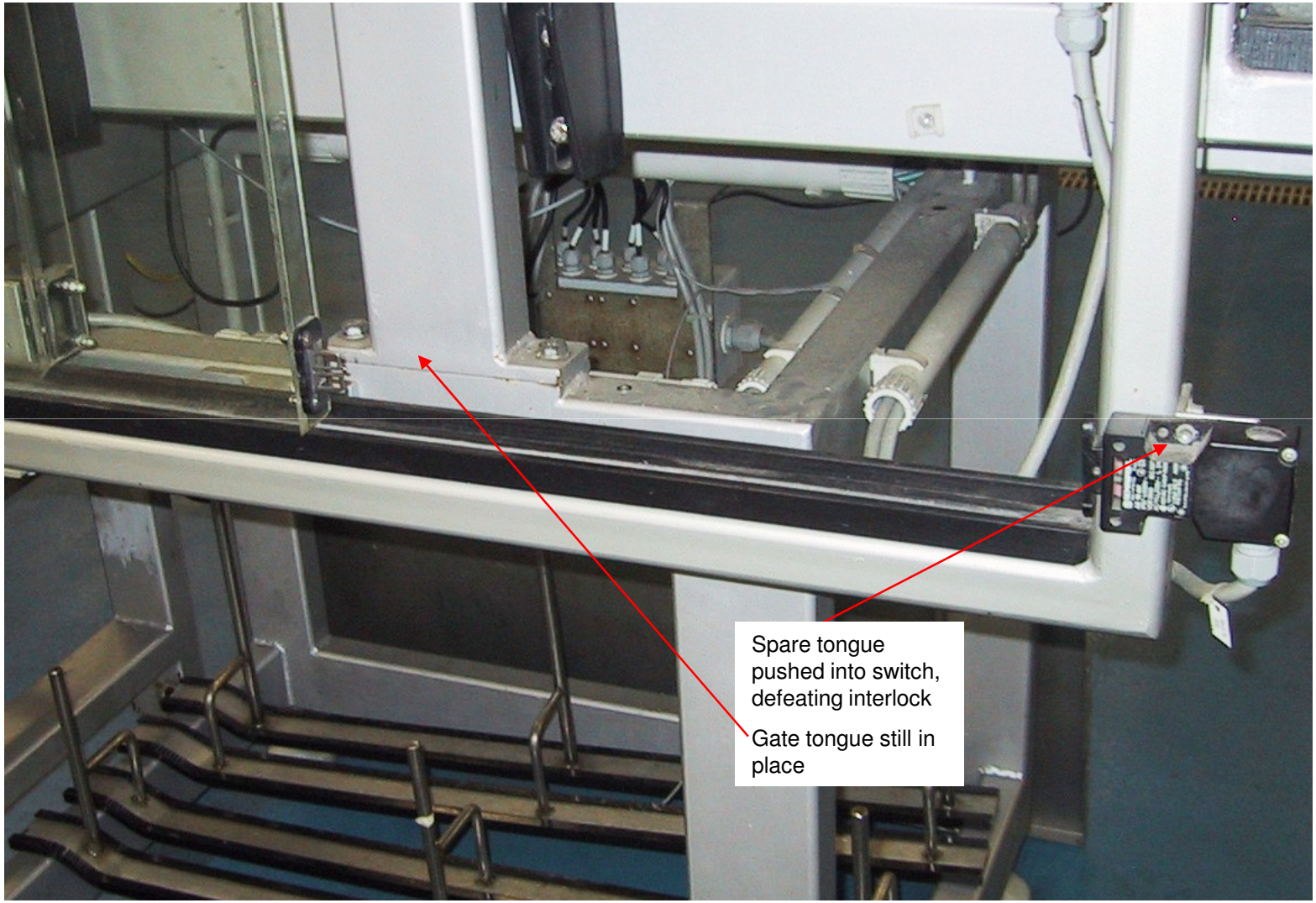
“A common mistake that people make when trying to design something completely foolproof, is to underestimate the ingenuity of complete fools”. Douglas Adams



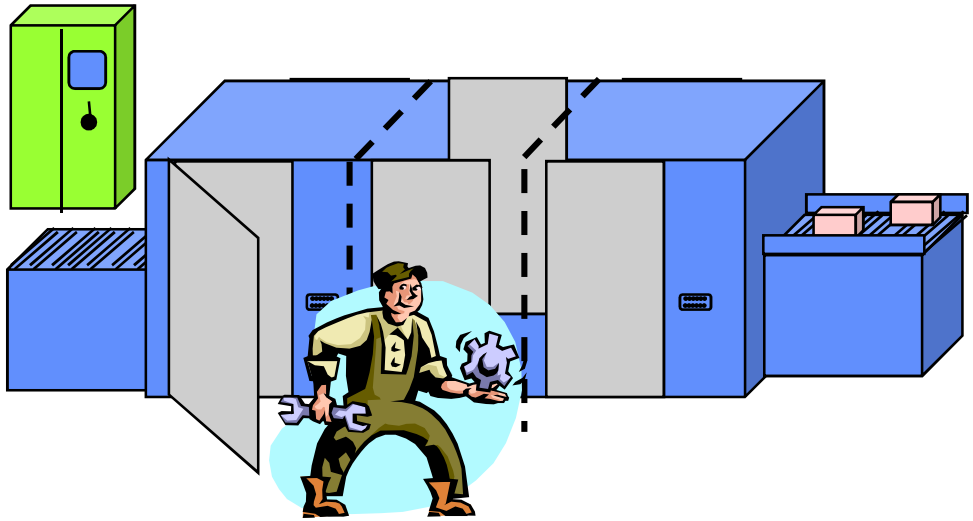
Defeated tongue switch



Defeated tongue switch with gate tongue still in place



Safety bypassing -Typical Situation

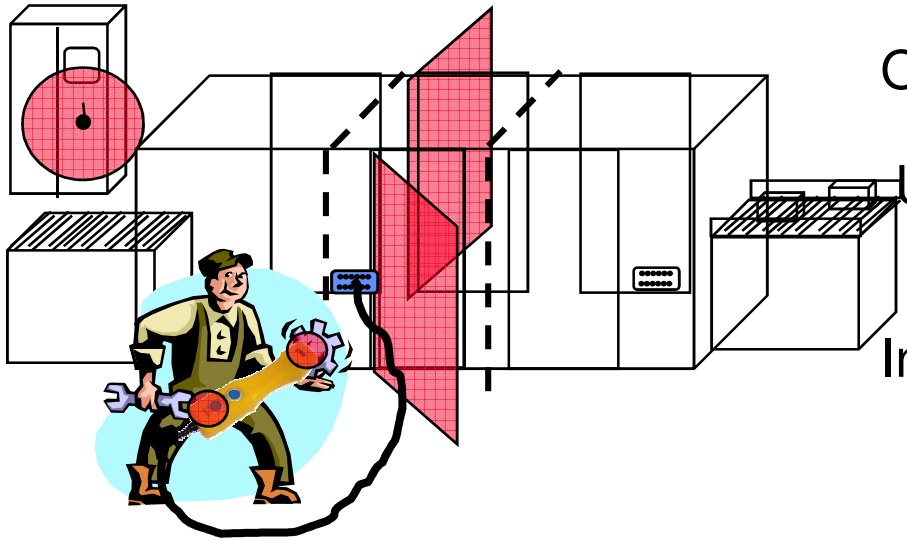


Several safety doors and several safety segments
Maintenance has to open a door
Start machine for adjustments while door is open

Critical Hazards During Maintenance

- Turning wheels
- Moving robots
- Moving chains
- Linear moving parts
- Cutting or (hot) sealing process

Safety Concept for safe suspension



Chose Operation Mode: *Maintenance*

Plug safety device (Jog Switch) at the segment/door you want to open

Open the door at the plugged segment
Use two hand buttons of Jog Switch to start the machine

In case of open door in other safety segments, the machine has to stop

Summary

- Everyone is confused about risk assessment

- Different jurisdictions here and globally don't agree on what it involves

- Practitioners give different recommendations rarely with a comprehensive safety design solution in mind
(No wonder, because nobody is taught how to do it from a safe design perspective, and there is no accreditation.)

- Very rarely is a productive design solution recommended, and... If this is not done, it is not worth the paper it is written on!

Thank you