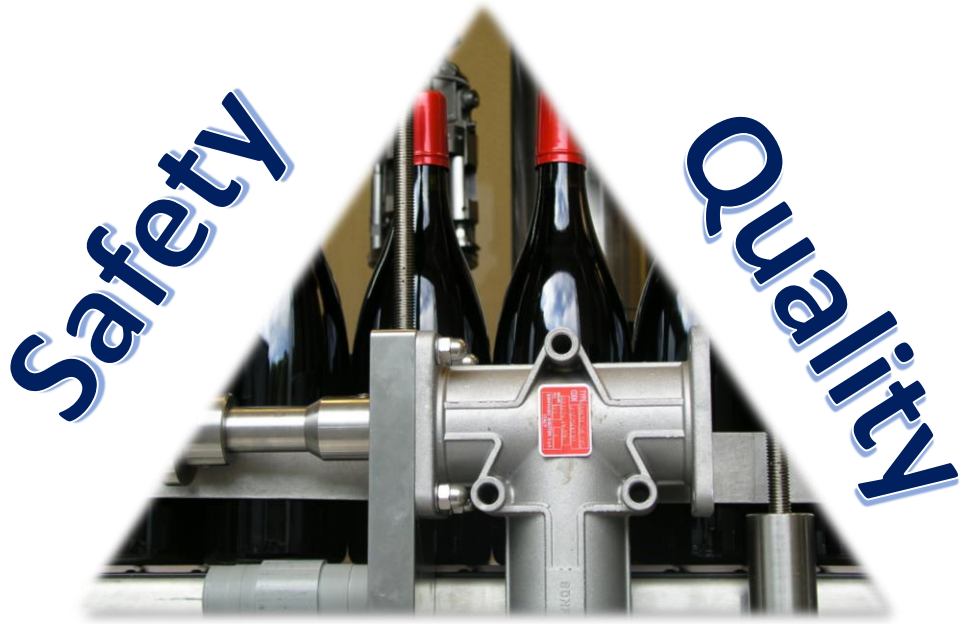
Machine Safety Maturing in the Technology Age

WEA Conference
September 2016

Competitively Safe



Industry hype = Industry Trends?

ADVERTISER.COM.AU TUESDAY SEPTEMBER 6 2016

BUSINESS JOURNAL 29

Big data at the cutting edge

VALERINA CHANGARATHIL

SENSORS installed on Seeley International's domestic and globally located coolers are transmitting key information back to Adelaide that can now be used to improve design and efficiency of its products.

It's one example of the kind of hi-tech advantage at hand for industrial manufacturers like Seeley, electrical switchroom maker Mayfield Industries and oyster basket maker SEAPA – the three pilot adopters of a Big Data Connect Program, funded by the State Government and run by Mawson Lakes-based Federal Data To Decisions Cooperative Research Centre (D2D CRC).

Big data involves using technology to collect, organise and analyse large amounts of data from sources such as a customer survey, daily production information, smart sensors and machine readings to make better decisions.

D2D CRC's program lead Troy Wuttke said he hoped more companies would sign up to the program, which will start projects with two more successful applicants in coming months.

"With Seeley, we used the data collected by sensors installed on their commercial coolers around the world.

> We have built a centralised data platform for sensors installed in products around the world
>
> D2D CRC'S PROGRAM LEAD TROY WUTTKE

"We have built a centralised data platform for them that now collates all that information with relevant weather data, for instance.

"It's a new way of looking at data that can now help in possible future products and services for customers, giving them an advantage," he said.

Seeley International general manager Rob Gilbert said the program had helped expose the potential for data-based opportunities.

"(It is) making us aware of analytics such as machine learning, which has the potential to improve performance and efficiency on a global scale," he said.

With Edinburgh-based Mayfield Industries – a supplier to major projects around Australia, including Nyrstar's Port Pirie smelter and Gina Rinehart's Roy Hill iron ore mine in WA – D2D CRC used internal data on previous tenders to build a system that enables quicker processing of new tenders and uses historic pricing information to more accurately price its bids.

"These are tasks that would probably take weeks for project managers, but using algorithms and estimations, we can transform internal knowledge into a real tool for businesses," Mr Wuttke said.

Mayfield used the new information during a presentation to a new client, leading to a quick quotation request and preferred supplier status, general manager Chris Ware said.

SEAPA, which investigated big data solutions rather than have one developed, was recommended sources where it could find information to build a competitive advantage over other marine equipment suppliers for its oyster farming solutions.

Allen-Bradley • Rockwell Software

Rockwell Automation

Why?

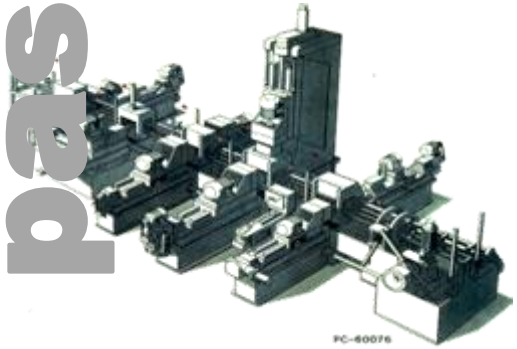
BLOSSOM HILL
BLOSSOM HILL
BLOSSOM HILL
BLOSSOM

Kawasaki
2WINES ONE BOX
GRAN

Trends in Wine Production:

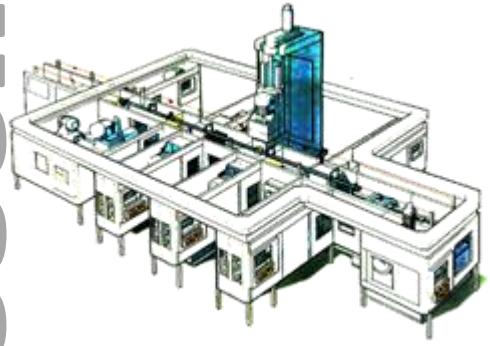
Trends In Safety:

past



- **Functionally Safe!**
- Cumbersome
- Difficult to apply
- Difficult to use
- Often Bypassed

present



- **Functionally Safe!**
- Easy to apply
- Safety Rated Products
- Local Diagnostics

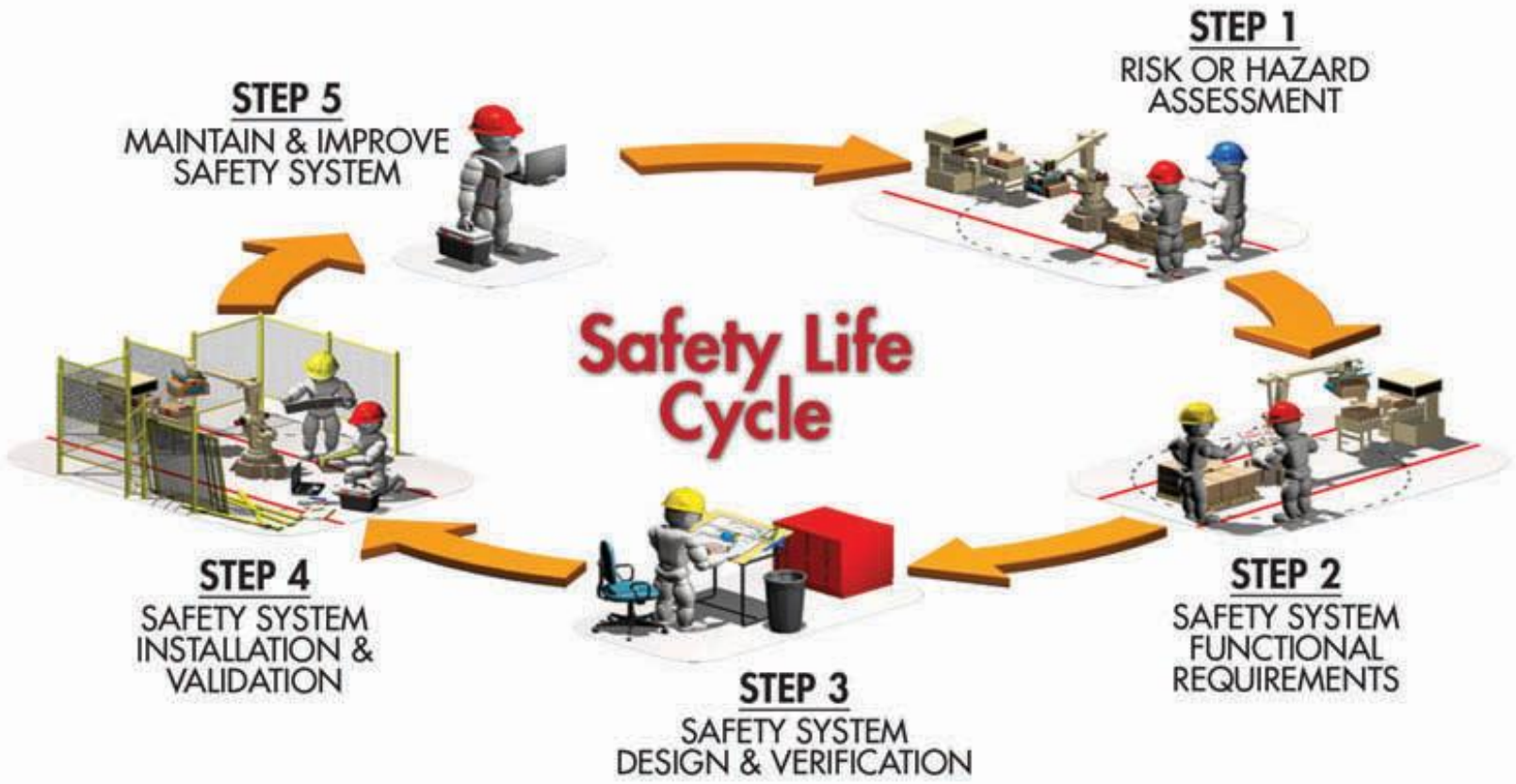
performance

- **Functionally Safe!**
- Flexible
- Task Oriented

Machine safety is also evolving … from a pure safety approach to a valuable productivity enabler.

Rockwell Automation

FUNCTIONAL SAFETY LIFE CYCLE



When ?

How? … Safety Guidance:

STRATEGIC RISK ASSESSMENT TEMPLATE

Specific Risk
A.
B.
C.
D.
E.
F.
G.
H.
I.
J.
K.
L.
M.
N.
O.
P.
Q.
R.
S.
T.

Consequence Description for each Area of Impact (Sample)

Rating	Consequence	Food & beverage Quality	Human health, safety & well being	Economic	Commercial	Environmental	Organisational capability	Reputation & image / brand
1	Insignificant	No loss	No injuries	No economic loss	No financial loss	No environmental impact	Organisational capability intact, negligible impact on objectives	No damage to reputation/image
2	Minor	Limited illness/injuries &/or deaths in single area	Minor injuries; no public health risk; short term well being impact	Few businesses locally affected or single/few properties	Low financial loss; single/few properties affected	Minor,/recoverable short-term isolated/localised environmental impact	Local capability affected, minor impact on objectives, easily remedied	Recoverable / short term local damage to reputation/image
3	Moderate	Some illness/injuries/deaths on multiple properties across a locality	Limited public health risk &/or injuries requiring medical & mental health treatment	Widespread industry impact; multiple industries / properties per district	Medium financial loss; multiple properties per district	Moderate, medium term, medium spread environmental impact	Regional capability affected, some objectives affected	Medium term / regional damage to reputation/image
4	Major	Considerable illness/injuries/deaths on multiple properties across a region	Major public health risk &/or major injuries/well being impact	High economic /trade risk to region &/or state	High financial loss	Serious, long term, widespread environmental impact	State capability affected, important objectives not achieved	Long term (state level) damage to reputation/image/brand
5	Catastrophic	Significant illness/injuries/deaths	Significant public health risk &/or human deaths/ long lasting well being issues	Major national economic implications	Major national financial loss	Irreversible environmental impact	National capability affected, most objectives not achieved	Long term / international damage to reputation / image irreversibly impacted

L-Likelihood Rating	C – Consequence Rating 1	2	3	4	5
A	M	M	H	X	X
B	L	M	M	H	X
C	L	L	M	H	H
D	N	L	M	M	H
E	N	N	L	M	H

Combined Likelihood and Consequence Risk Rating

Level of Risk Rating	Response
X - Extreme	Urgent attention
H - High	Intervention required
M - Medium	Active management
L - Low	On-going monitoring
N - Negligible	Acceptable risk

Sources of Risk
- Food Standards
- Trade and economic
- Organisation and management
- Environment and natural events
- Community and human behavior
- Commercial and legal
- Political
- Sabotage
- Technology
- Regulation and standards

L	Likelihood	
A	Almost certain	- may occur several times over short period or continuously
B	Likely	- may occur monthly to several times a year
C	Possible	- might occur once in a period of one to three years
D	Unlikely	- could occur over time (eg every five to ten years)
E	Rare	- may occur only in exceptional circumstances (eg every 10-20 years)

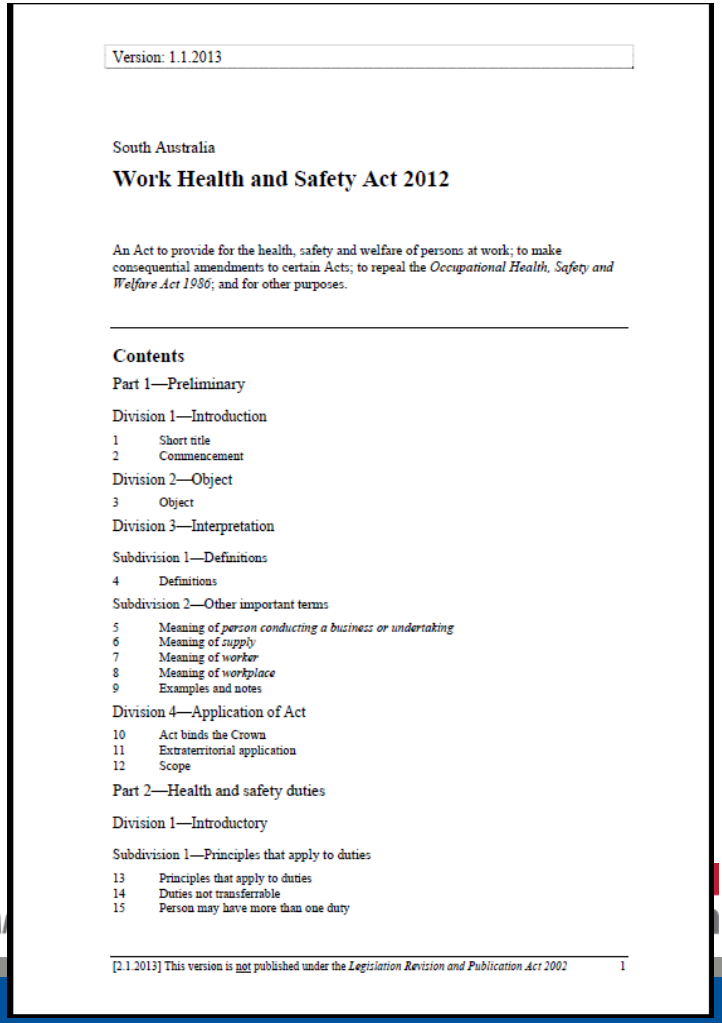
Hierarchy of Control
1. Elimination
2. Substitution
3. Isolation
4. Engineering
5. Administration
6. PPE

Areas of Impact
- Food & Beverage quality
- Human health, safety & well being
- Economic
- Commercial
- Environmental
- Organisational capability
- Reputation and image /brand

Who? … SA Legislation:

Work Health and Safety Act 2012

- **Enforced as of 1st Jan 2013**
- **New Term – Person Conducting a Business or Undertaking** (Subdiv 2, clause 5)
- **Who has the obligations?**
  - Anyone who is associated or affected by the equipment, ie Designers, Manufacturers or Importers, Installers, Employees and Employers
- **Duties are not transferrable**



Version: 1.1.2013

South Australia

Work Health and Safety Act 2012

An Act to provide for the health, safety and welfare of persons at work; to make consequential amendments to certain Acts; to repeal the *Occupational Health, Safety and Welfare Act 1986*; and for other purposes.

Contents

Part 1—Preliminary

Division 1—Introduction

1 Short title
2 Commencement

Division 2—Object

3 Object

Division 3—Interpretation

Subdivision 1—Definitions

4 Definitions

Subdivision 2—Other important terms

5 Meaning of *person conducting a business or undertaking*
6 Meaning of *supply*
7 Meaning of *worker*
8 Meaning of *workplace*
9 Examples and notes

Division 4—Application of Act

10 Act binds the Crown
11 Extraterritorial application
12 Scope

Part 2—Health and safety duties

Division 1—Introductory

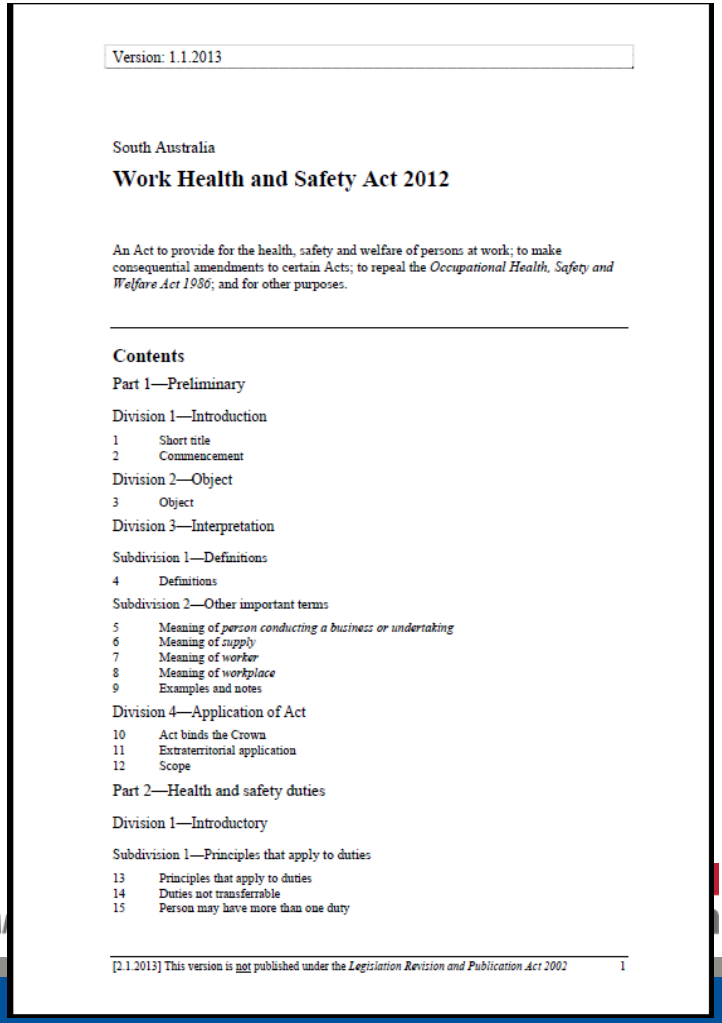
Subdivision 1—Principles that apply to duties

13 Principles that apply to duties
14 Duties not transferrable
15 Person may have more than one duty

Who? …. SA Legislation

Work Health and Safety Act 2012

- **What are they required to do?**
  - Minimise the risk so far as reasonably practicable
- **What is reasonably practicable?**
  - Likelihood of event
  - Severity of injury
  - What person concerned is expected to know
  - Availability and suitability of risk reduction
  - Cost



Version: 1.1.2013

South Australia

Work Health and Safety Act 2012

An Act to provide for the health, safety and welfare of persons at work; to make consequential amendments to certain Acts; to repeal the *Occupational Health, Safety and Welfare Act 1986*; and for other purposes.

Contents

Part 1—Preliminary

Division 1—Introduction

1 Short title
2 Commencement

Division 2—Object

3 Object

Division 3—Interpretation

Subdivision 1—Definitions

4 Definitions

Subdivision 2—Other important terms

5 Meaning of *person conducting a business or undertaking*
6 Meaning of *supply*
7 Meaning of *worker*
8 Meaning of *workplace*
9 Examples and notes

Division 4—Application of Act

10 Act binds the Crown
11 Extraterritorial application
12 Scope

Part 2—Health and safety duties

Division 1—Introductory

Subdivision 1—Principles that apply to duties

13 Principles that apply to duties
14 Duties not transferrable
15 Person may have more than one duty

SA Code of Practice

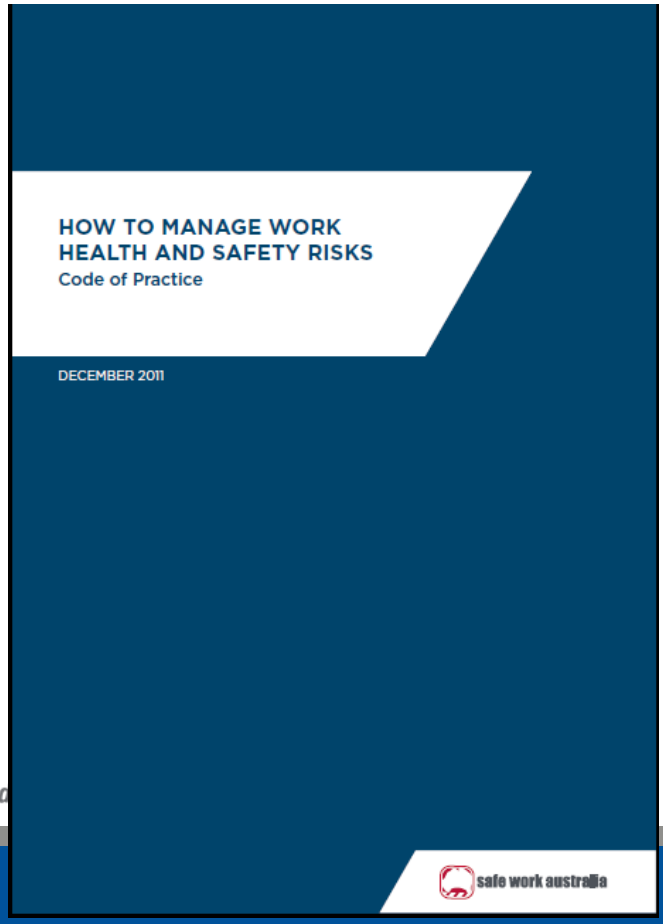
Code of Practice

- **Codes of practice can be sourced from the government website:**

http://www.safework.sa.gov.au/show_page.jsp?id=5892

How to manage risks

- Guidance on the risk assessment process
- Guidance on risk control selection
- Information on PCBU and officer definitions

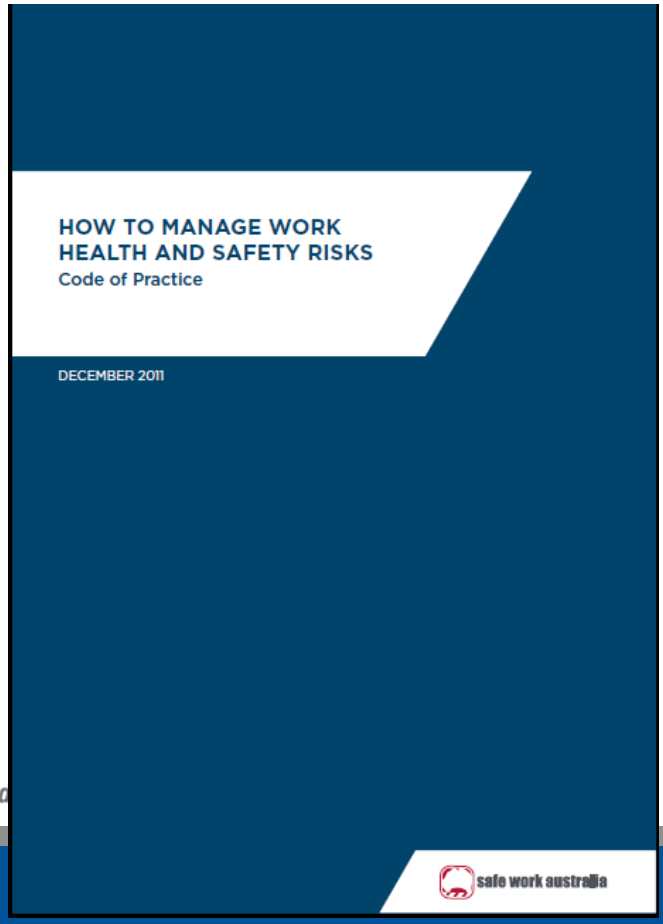


SA Code of Practice

How to manage risks of Plant

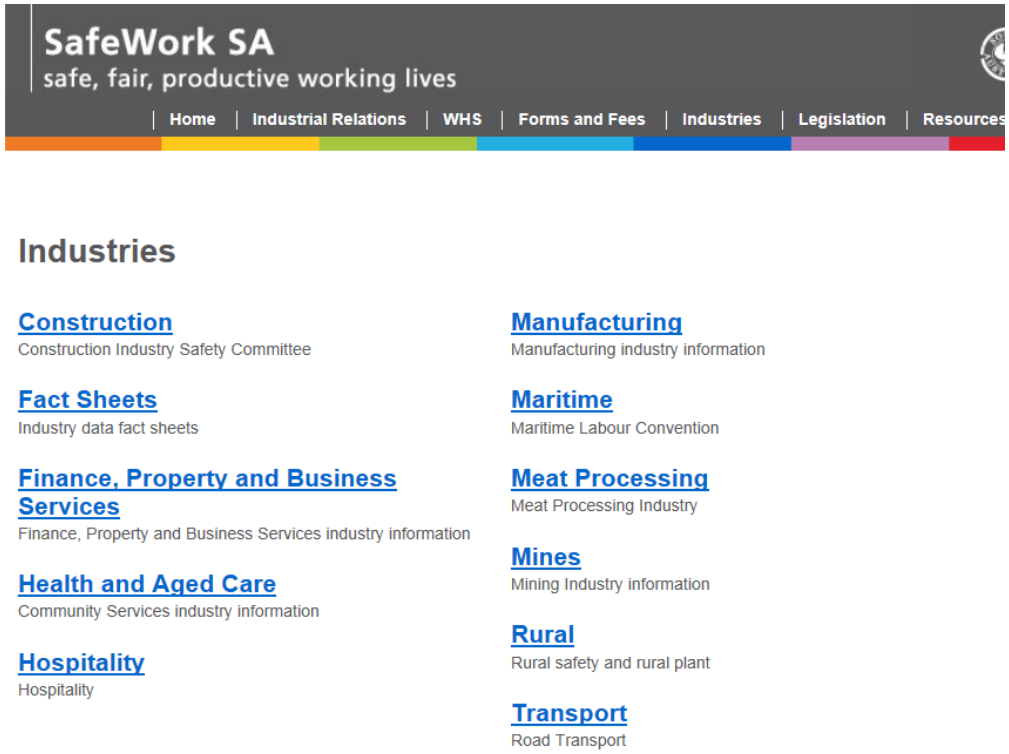
- Guidance on the risk assessment process
- Guidance on risk control selection
  - Section on guarding options
  - Section on isolation
  - Section on complimentary devices

- Recommended standards for machine safety:
  - AS 4024 series
  - ISO 13849
  - IEC 62061



SA Industry Reference Material

Reference material can be found at: http://www.safework.sa.gov.au/show_page.jsp?id=1378

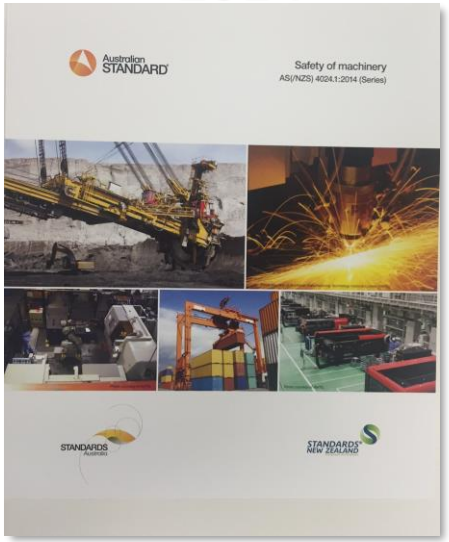


Evolution of Safety Standards:

AS4024
1996

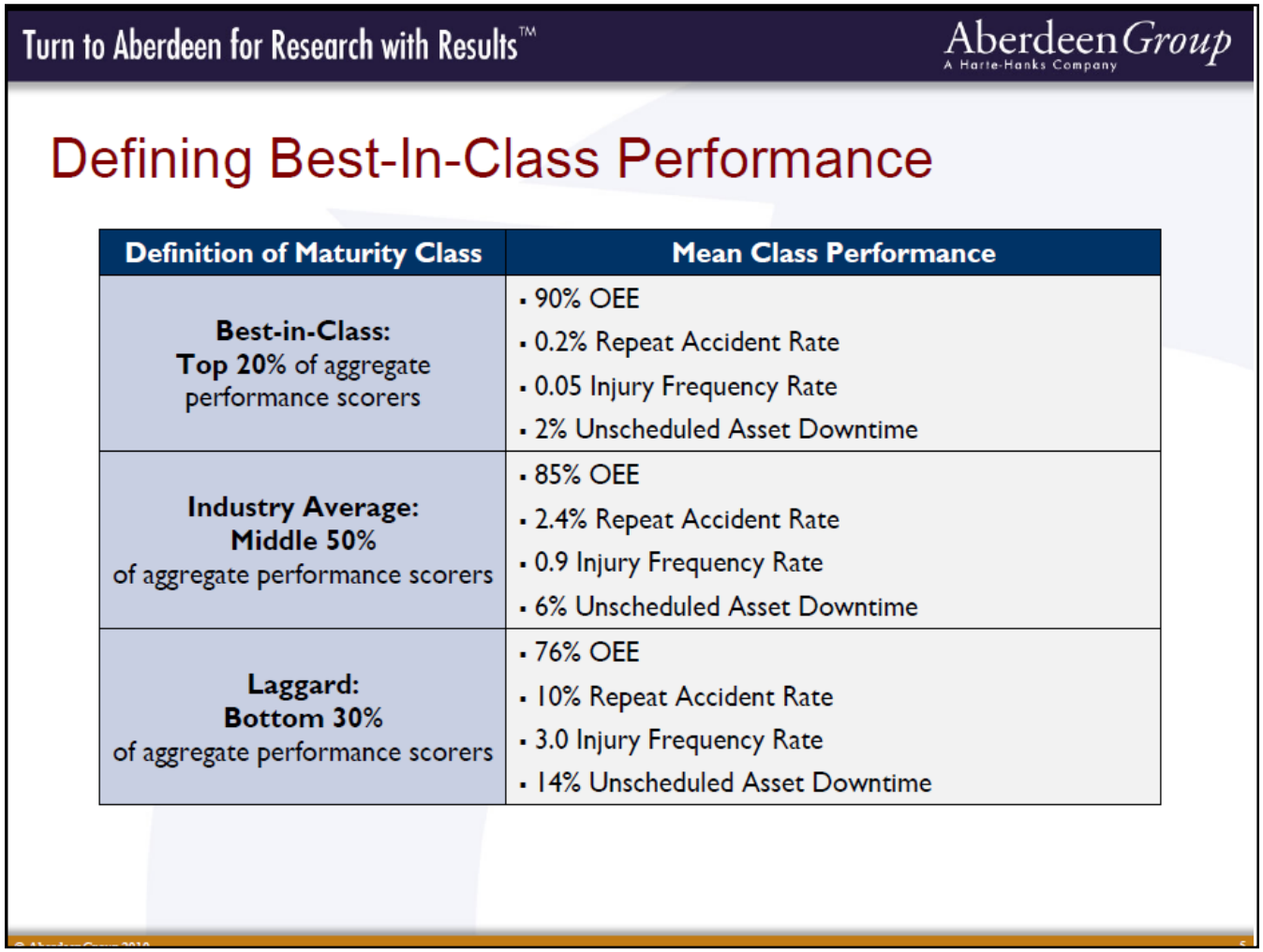
- Categories
- Basic Design Principals

2014



- Categories
- Performance Levels
- Risk Assessment Guidance
- Validation
- Detailed Guarding Principals

Safety and Productivity



Turn to Aberdeen for Research with Results™

Aberdeen Group
A Harte-Hanks Company

Defining Best-In-Class Performance

Definition of Maturity Class	Mean Class Performance
Best-in-Class: **Top 20%** of aggregate performance scorers	▪ 90% OEE ▪ 0.2% Repeat Accident Rate ▪ 0.05 Injury Frequency Rate ▪ 2% Unscheduled Asset Downtime
Industry Average: **Middle 50%** of aggregate performance scorers	▪ 85% OEE ▪ 2.4% Repeat Accident Rate ▪ 0.9 Injury Frequency Rate ▪ 6% Unscheduled Asset Downtime
Laggard: **Bottom 30%** of aggregate performance scorers	▪ 76% OEE ▪ 10% Repeat Accident Rate ▪ 3.0 Injury Frequency Rate ▪ 14% Unscheduled Asset Downtime

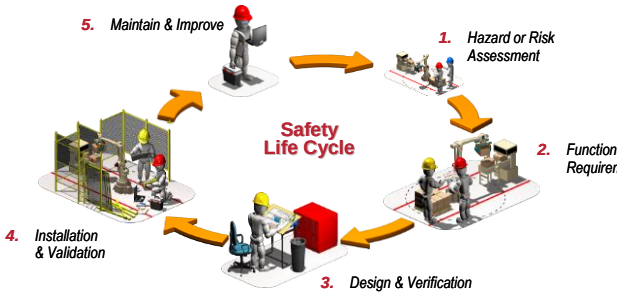
Rockwell

Safety = Productivity = Profit

Safety and Productivity

What differentiated Best-in-class Manufacturers from their Peers?

- **Developed Safety Culture** - Without the buy-in of everyone from upper management down, implementation of effective safety systems is difficult.



- **Formalized Risk Management processes** - Establish a formalized risk management strategy to identify, prioritize and mitigate risks.

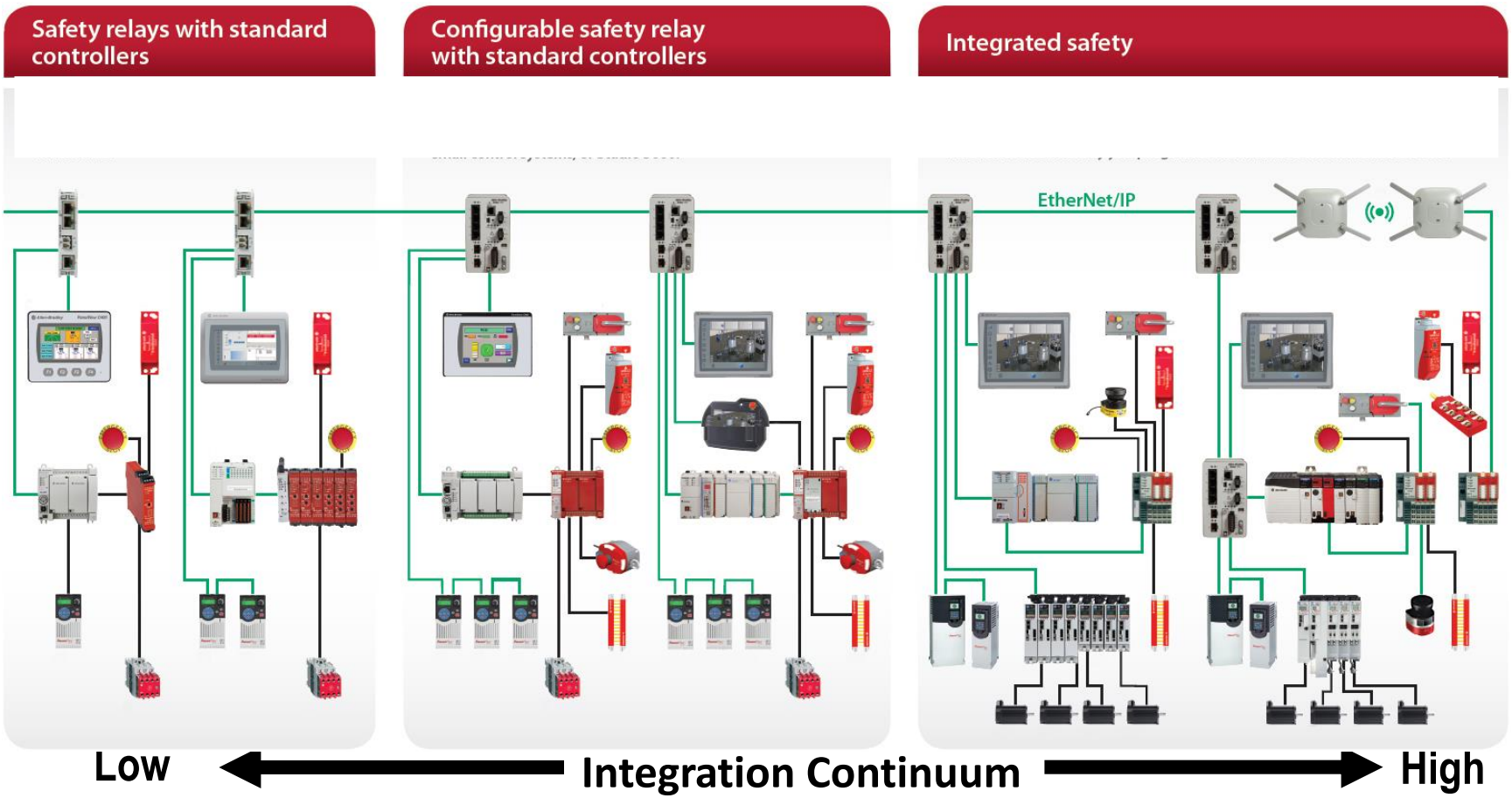
- **Investments in technologies** that improve both safety and productivity – taking advantage of available diagnostics, and the use of information technologies to provide information to the broader manufacturing environment.

Allen-Bradley • Rockwell Software

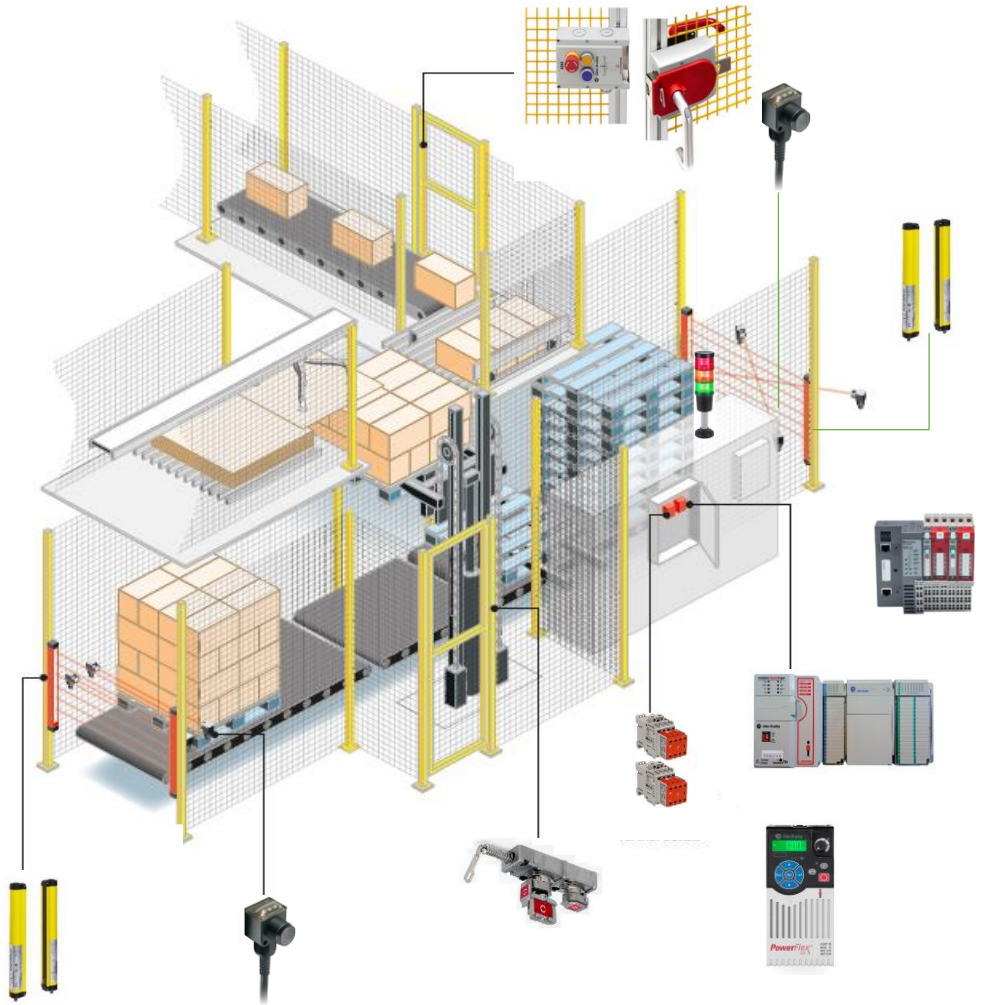
Rockwell Automation

(Confidential – For Internal Use Only) Copyright © 2011 Rockwell Automation, Inc. All rights reserved.

Safety Integration Strategies



Example - Palletiser



Machine Hazards

- Pinch
- Cut
- Crush – product load area
- Entanglement
- Entrapment within the machine
- Electrical

Methods for reducing risk

- Emergency Stop
- Access Control – Prosafe
- Speed Control
- Energy Isolation
- Presence Sensing with muting

Questions

Amcor - Food

Amcor upgrades with integrated safety

An innovative integrated safety control system – founded on Rockwell Automation's GuardLogix – helps fast-track a safety upgrade at Amcor's NSW beverage can manufacturing facility, while simplifying operation and optimising efficiency.

Solutions

The introduction of an integrated safety control system included:

- 12 GuardLogix controllers
- Category 4-compliant DeviceNet Safety communications
- Distributed I/O on DeviceNet
- Allen-Bradley InView message displays
- EtherNet/IP connectivity

Results

The Rockwell Automation integrated safety control solution delivers:

- Advanced diagnostics and troubleshooting capabilities
- Programming and management of safety control systems using familiar standard control methods
- Faster installation and commissioning
- Streamlined/concurrent system configuration and troubleshooting
- Easy system expansion
- Reduced downtime
- Increased safety functionality and optimised operational efficiency
- Plant back on line quicker

The Revesby facility incorporates 12 bodymaker and trimming pairs. Control panels on each incorporate operator interfaces wired to distributed I/O, plus a InView message display.

High-throughput manufacturing processes that produce millions of units per day often rely on sophisticated process equipment and control systems to ensure uninterrupted production. In such high-volume manufacturing applications, the effects of production stoppages can be crippling. In particular, unscheduled downtime, due to emergency stoppages and shutdowns caused by breaches of safety systems, can impact the company's bottom line in a matter of minutes.

One company that is leading the way in high-volume manufacturing is global packaging giant, Amcor which produces a range of innovative packaging solutions using a variety of plastics, cardboards, glass and metals.

A significant proportion of Amcor's Australasian operation is devoted to the manufacture of aluminium beverage cans. Its manufacturing facility in Revesby NSW is equipped to produce nearly 2.5 million aluminium cans per day, and is a vital element of the company's global packaging network.

As part of the company's ongoing commitment to safety, Amcor recently embarked on a safety upgrade at the Revesby facility. The upgrade included a transition to Allen-Bradley® control systems, and the redesign and replacement of the facility's legacy safety control system architecture.

LISTEN. THINK. SOLVE.™

Allen-Bradley · Rockwell Software

Rockwell Automation

suitable to receive a lid or closure. The cans are then washed, etched, decorated, packed and shipped to various beverage manufactures.

Streamlining safety

The first stage of Amcor's site-wide safety and control upgrade was completed mid-2008. Prior to the 'in progress' upgrade, the plant's 12 bodymakers and trimming machines were controlled using individual conventional programmable logic controllers (PLC). Each bodymaker/trimmer pair was equipped with its own PLC interlocked with a separate hard-wired safety control system. A second PLC was employed at each machine pair to accommodate high-speed control applications.

According to Chris Hilton, Amcor beverage cans engineering manager, the safety upgrade provided Amcor with the opportunity to implement a more streamlined safety control solution. "Our legacy control system had served us well over the years, but we needed a more user-friendly system with advanced diagnostic and troubleshooting capabilities," he says. "Our production schedule didn't allow for a prolonged design and installation process, so we enlisted the services of control and automation specialists."

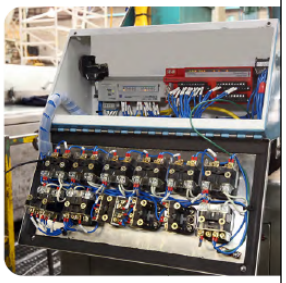
IGR Consulting developed a new integrated safety and standard control solution, founded on the Allen-Bradley GuardLogix® controller from Rockwell Automation®. Featuring two-processor safety architecture, the Allen-Bradley GuardLogix controller provides integrated safety and conventional control within the one platform.

"This is a more elegant solution compared with the previous safety control architecture," says Karl Schiesser, IGR Consulting project engineer. "Both standard and safety control of each of the 12 bodymaker/trimmer pairs will now be managed by 12 individual GuardLogix controllers. The high-speed of the Logix platform means

system diagnostics," says Hilton. "They allow on-site technicians to carry out fault analysis without having to directly access the GuardLogix program code."

Previously, access to Amcor's 12 bodymakers and trimmers was guarded by three separate hard-wired pneumatic guarding systems, each incorporating a series of relays and pneumatic switches. "If a guard was opened, the air was cut off and the pressure switch was tripped, activating the safety response," says Hilton. "On occasion, these pneumatic switches would fail in the open position, raise a 'false alarm' and cause the line to shut down."

The legacy pneumatic safety system was replaced with a range of safety switches and devices wired back to local I/O, connected to GuardLogix controllers via a DeviceNet Safety communications network. "With the GuardLogix integrated control system, troubleshooting false alarms and product jams is much easier,"



Body trimmer operators panel incorporates both standard and safety I/O wired to Compact 5Block and Guard I/O on DeviceNet.

Hilton envisages further applications for the GuardLogix solution. "Once again we'll be able to save time and resources by developing conventional and safety control concurrently, using the GuardLogix controller," he says.

By implementing a transition to the Logix control platform, Amcor was able to leverage the benefits of Rockwell Automation's GuardLogix controller, while fast-tracking a safety upgrade at its Revesby manufacturing facility. Instead of interrupting or slowing production, the transition has yielded optimised operational safety and efficiency.

n, Inc.

382.4444
663 0600. Fax: (32) 2 663 0640
ax: (852) 2508 1846

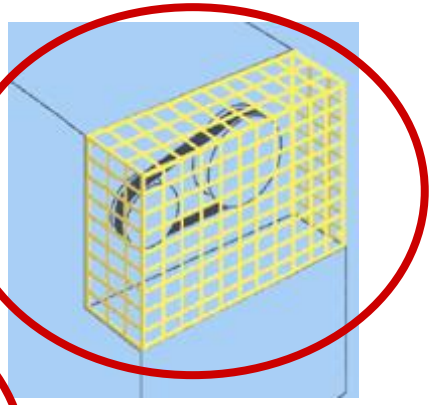
ockwell Automation, Inc. All Rights Reserved. Printed in Australia.

Rockwell Automation

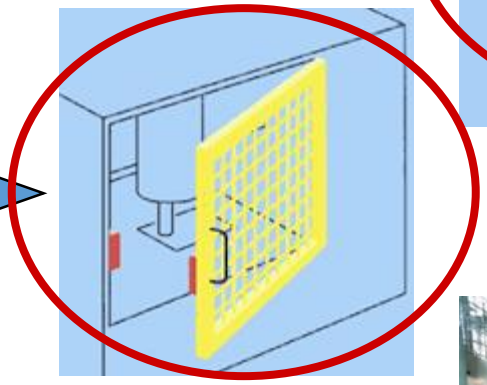
Hierarchy of Protective Measures

Design it out

Fixed enclosing guard



Monitoring Access / Interlocked Gates



Awareness, Training and Procedures (Administrative)

Personal protective equipment

Most Effective

Least Effective

Benefits of a Contemporary Safety Solution

- Reduced time to design, program, install and start-up
- Reduced space requirements – floor space and panel space
- Wiring reduction, wiring simplification and network integration
- Improved operator diagnostics and increased opportunities for alternative methods to Lock-Out-Tag-Out for routine tasks (where applicable)
- Reduced maintenance MTTR, reduced downtime
- Accommodates future process or safety changes
- Accommodates tasks and processes and does not require workers to “work around” the safety system,…reducing risk