Health and Safety Executive – Hazardous Industries Directorate

Mines Inspectorate Unit

Major Hazard Topic Inspection Guide Asset integrity

1. Purpose

This document sets out how inspectors will assess operators' compliance with the relevant statutory provisions in respect of asset integrity. Asset integrity is required across all of the major hazard controls.

Previous incidents have included:

- Fires on large diesel operated plant where the automatic on board suppression system and portable extinguishers were ineffective, leading to total burn out of the plant, evacuation of the mine resulting in major capital asset loss and revenue.
- The main compensating pulley support beam failed catastrophically on a mineral winding skip, the failure also caused significant damage to structural steelwork in the shaft. Production was affected for months. The failure occurred due to a combination of a reduction in the skip design and construction integrity, use beyond planned service life and unsatisfactory inspection and maintenance.
- A mine worker was fatally injured when a powered roof support (PRS) inadvertently lowered down onto him. This incident occurred due to fluid bypass in the PRS hydraulic control valve caused by wear and tear from contaminated hydraulic fluid, other factors included an unstable PRS electronic control system and excessive build-up of debris within the PRS. Production was halted for 2 weeks until faults on the PRS system had been rectified.
- Several hard landings have occurred due to failure of carriage monitoring systems. These have occur due to the incorrect selection of monitoring switches, unsatisfactory installation and maintenance standards and inadequacies in the design of the control circuits in relation to fault tolerance. Revenue was lost during the periods when the cableways were closed to remediate the faults.
- When all 4 suspension ropes failed catastrophically, a materials carriage on a drift haulage system plummeted to the bottom station causing serious damage. This occurred due to the absence of safety apparatus to arrest the carriage in the event of rope failure or over speed, failure to select suitable ropes, an absence of a program for changing the ropes based on condition, inadequate maintenance and third party inspection arrangements.

2. Scope

The inspection will focus on the key hazards and the associated safety management systems for managing the risks. The format of the inspection will follow the established Plan, Do, Check, Act structure, as defined in HS(G) 65 and summarised in HSE leaflet INDG 275.

HSE defines asset integrity encompassing the assurance that any asset forming a preventative or mitigating barrier for major hazard control or a potential major accident significance, is fit for its intended purpose at all times it is in use; the asset lifecycle can be split into **4 stages;**

- selection of plant and equipment
- initial integrity
- through life integrity or ageing
- end of life/life extension

The inspection will be undertaken in line with the HID Regulatory Model and will explore the following elements:

- has the operator completed suitable and sufficient assessments for selecting assets and/or integrating these with existing assets or systems
- has the operator identified the requirements of that asset in respect of major hazard control?
- has the operator a suitable system for asset specification?
- has the operator evaluated the potential failure modes of the asset and consequences?
- have suitable measures been put in place to prevent failure of the asset and mitigate consequences?
- have roles and responsibilities been allocated for the control measures identified?
- is there a suitable competency management system in place for ensuring asset integrity?
- are the control and mitigating measures being monitored and reviewed?

3. The intervention

The intervention team can if necessary ask the operator to provide copies of documentation in advance of the site visit. The on-site part of this stage of the intervention could take a day or more depending on the scope. Once the documentation has been reviewed the intervention team will select part of the site to inspect and evaluate the effectiveness of the safety management arrangements and risk control systems.

Asset integrity is a key component of:

- transport systems

- roof support systems
- electrical equipment
- mechanical equipment
- ventilation
- shafts and winding systems
- conveying systems
- mineral processing plant
- civil structures

Assets are parts of systems, supplied by various equipment manufacturers. These assets are typically used as part of the risk controls for all the major hazards. Not maintaining assets correctly is a major risk that could result in a loss of major hazard control, fatality or major injury and a reportable dangerous occurrence.

Inspectors should determine how well the operator is controlling the risks by assessing:

- the adequacy of the information that the operator has obtained to determine the asset integrity requirements
- the adequacy of the assessment of this information by the operator to identify the appropriate selection and application of asset integrity requirements
- the adequacy of the control measures to prevent failure of the asset and maintain its integrity. This should describe the methods of work, the equipment to be used and the rules to be applied
- how well the procedures have been implemented i.e. the arrangements in place (management, inspection, monitoring) to ensure that the rules are applied and enforced
- the effectiveness of the monitoring arrangements to ensure that the asset integrity system is performing as specified
- that if the monitoring indicates asset integrity is inadequate a system is in place to implement remedial action and review the original design.
- the arrangements for developing and maintaining an accurate asset register
- the recognition and adoption of technological advances in the specification and improvement of assets to ALARP.

4. Reporting findings and conclusions

Inspectors will summarise the outcome of the inspection with the operator, management team and the safety representatives whilst on site.

This summary will include the team's assessment on how the operator is complying with the relevant provisions, priorities for any further action and the operators' performance score in accordance with the **Performance Assessment Table** shown below.

Where further action is required to achieve compliance this will be taken in accordance with HSE's Enforcement Policy Statement.

5. Key legislative requirements

Health & Safety at Work etc Act 1974

Section 2(1), 3(1)

The Mines Regulations 2014

Regulation 7 General duties of the mine operator

Regulation 9 Health and Safety document

Regulation 10 Management structure

Regulation 11 Competence

Regulation 12 Instructions, rules and schemes

Regulation 15 Maintenance and inspection of equipment

Regulation 22 Explosive atmospheres

Regulation 23 Ignition risks

Regulation 36 Shaft construction and modification

Regulation 37 Equipment in relevant shafts and outlets

Regulation 38 Safety features of winding apparatus

Regulation 39 Inspection, maintenance and testing

Management of Health & Safety at Work Regulations 1999

Regulation 3 Risk assessment

Regulation 5 Health and safety arrangements

Provision and Use of Work Equipment 1998

Regulation 4 Suitability of work equipment

Regulation 5 Maintenance

Regulation 6 Inspection

Electricity at work regulation 1989

Regulation 4 Systems, work activities and protective equipment

Regulation 6 Adverse or hazardous environments

1. Performance scores

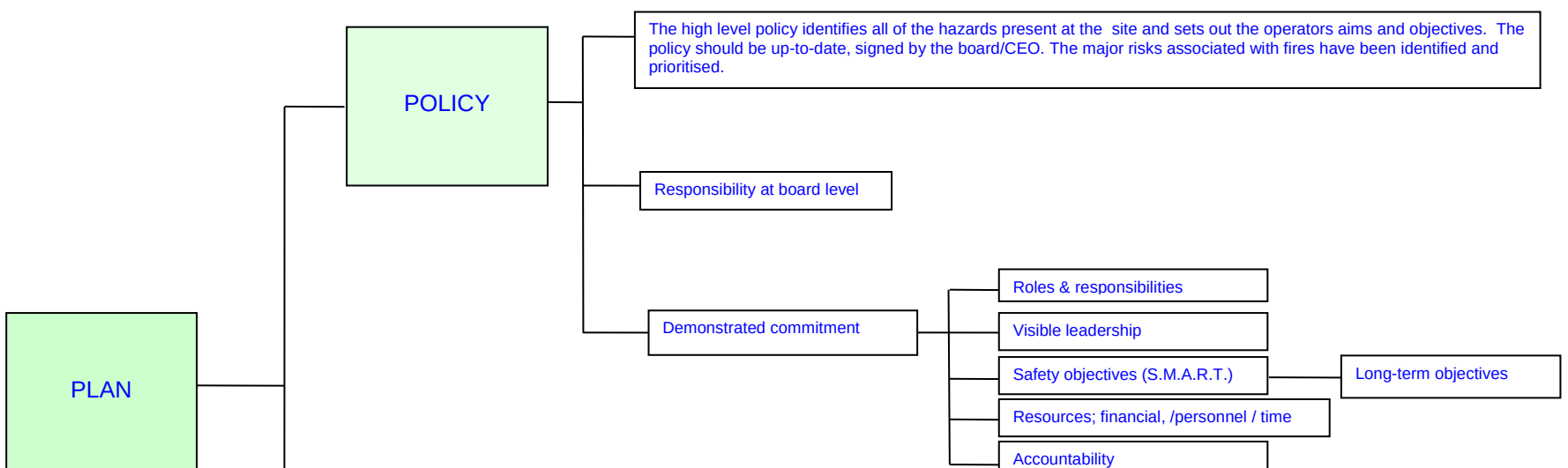
Following the intervention, Inspectors should performance score the operator's degree of compliance in accordance with the Table below.

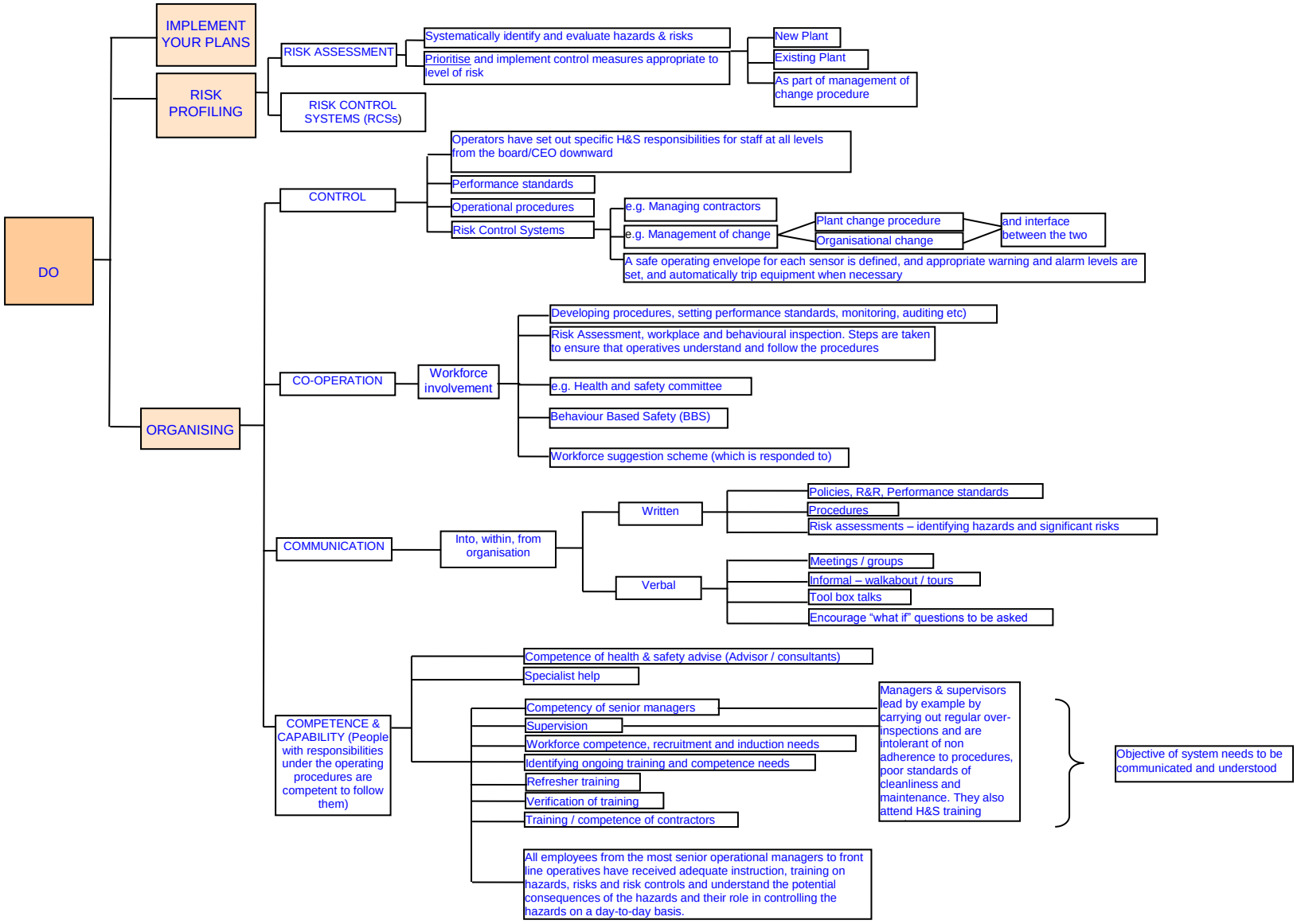
EMM RISK GAP					
EXTREME	**SUBSTANTIAL**	**MODERATE**	**NOMINAL**	**NONE**	**NONE**
TOPIC PERFORMANCE SCORE					
60	**50**	**40**	**30**	**20**	**10**
Unacceptable	**Very Poor**	**Poor**	**Broadly Compliant**	**Fully Compliant**	**Exemplary**
Far below relevant minimum legal requirements. Degree of non-compliance extreme and widespread. Failure to recognise issues, their significance, and to demonstrate adequate commitment to take remedial action.	Substantially below the relevant minimum legal requirements. Degree of non-compliance substantial. Failures not recognised, with limited commitment to take remedial action.	Significantly below the relevant minimum legal requirements. Degree of non-compliance significant. Limited recognition of the essential relevant components of effective health and safety management, but demonstrate commitment to take remedial action	Meets most of the relevant minimum legal requirements. Degree of non-compliance minor and easily remedied. Management recognise essential relevant components of effective health and safety management, and commitment to improve standards.	Meets the relevant minimum legal requirements. Management able to demonstrate adequate identification of the principal risks, implementation of the necessary control measures, confirmation that these are used effectively; and subject to review.	Exceeds the relevant minimal legal requirements. Management committed and proactive in devising and implementing an effective safety management system to achieve 'best practice' and beyond legal requirements. Actively seeks to further improve standards.
EMM INITIAL ENFORCEMENT EXPECTATION					
Prosecution / Enforcement Notice.	Enforcement Notice / Letter.	Enforcement Notice / Letter.	Letter / Verbal warning.	None.	None.

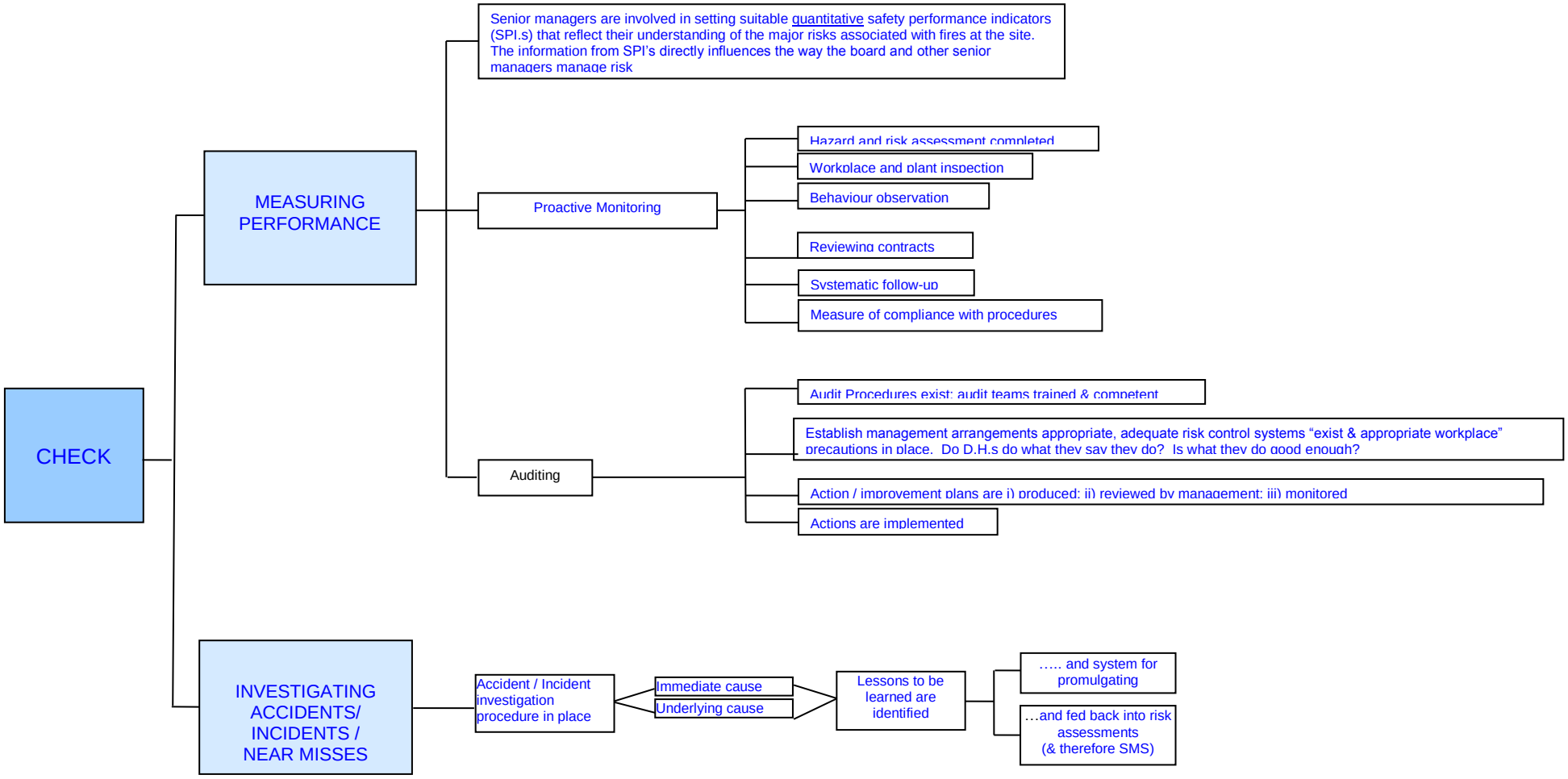
PLAN	1. There is a health and safety policy that is dated and signed that identifies major hazards, including asset integrity arrangements, which sets out the operator's aims and objectives. 2. The operator has put in place a suitable management structure and set out specific H&S responsibilities for staff at all levels to control the risk of the major hazards present, including asset integrity. 3. The operator and those appointed to the management structure understand asset integrity principles. 4. The arrangements include clear procedures for those with H&S roles or responsibilities in relation to asset integrity. 5. Managers and supervisors at all levels accept their responsibilities in relation to asset integrity and lead by example in ensuring that risk control measures are properly maintained. 6. All employees from the most senior operational managers to front line operatives have received adequate instruction and training on asset integrity hazards, risks and risk control measures and understand them. 7. The operator has in place arrangements for ensuring that asset integrity forming part of the escape and rescue arrangements are periodically tested. 8. Adequate arrangements are in place for informing and consulting staff (Safety Reps + Safety Committees Regs 1977). 9. There is a management of change system in place in respect of asset integrity

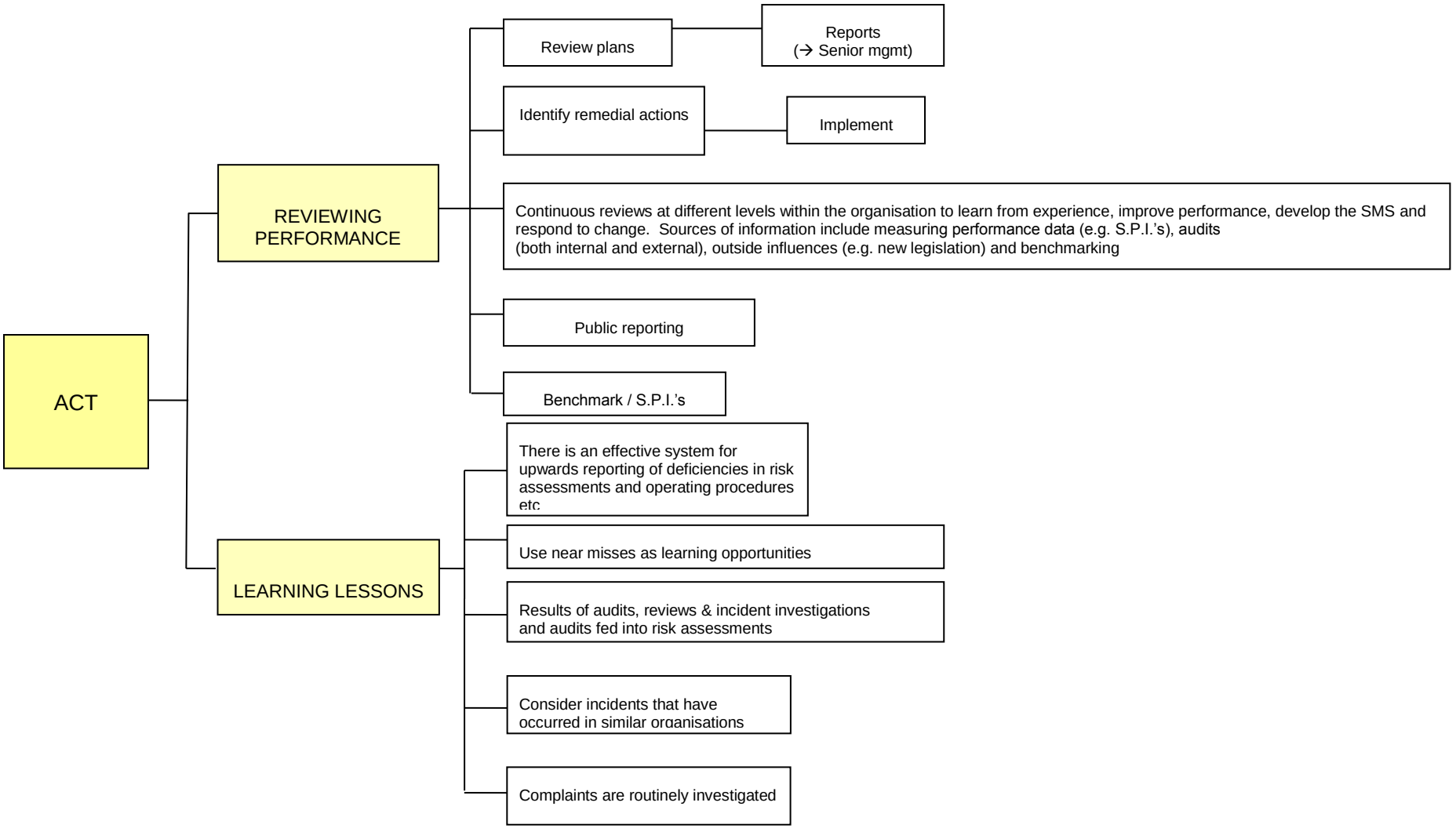
DO	1. The operator has put in place a suitable management structure and set out specific H&S responsibilities for staff at all levels: • how asset integrity assessments will be completed, implemented and reviewed? • who is responsible for the selection of suitable plant and equipment ensuring asset integrity? • who defines the frequency of the inspection and monitoring regimes The frequency of maintenance activities should take into account the: (a) intensity of use – frequency and maximum working limits; (b) operating environment, for example environmental issues such as water; (c) variety of operations – is the equipment performing the same task all the time or does this change? (d) risk to health and safety from malfunction or failure. • do managers and supervisors have sufficient resources to implement the asset integrity plan? • are staff competent to deliver their responsibilities? any periodic independent oversight applied? 2. How is the workforce involved in the design and construction of asset integrity rules? 3. Are all procedures and any changes communicated to those to whom they apply? 4. The control measures required by the risk assessment have been implemented? 5. Is there an effective system for reporting of deficiencies in risk assessments and operating procedures? 6. There is an effective system for upwards reporting of deficiencies in assessments, design documents and control measures? 7. Are procedures in place to evaluate changes

CHECK	1. Are there monitoring systems for: • inspection of the site, its plant and equipment to ensure that asset integrity? • checking management arrangements exist to ensure that asset integrity performs as specified and are effective? • ensuring staff understand and follow the procedures that are in place to control asset integrity risks? 2. Complaints and incidents are investigated? 3. Is there an effective closed loop reporting system for any asset integrity defect? 4. Are there any arrangements for independent third-party audit? 5. Are structured periodic audit arrangements are in place to ensure arrangements are monitored to measure their performance? 6. Is the audit programme risk-based and targeted at major hazard risk control and safety management systems?
Act	1. Are there effective arrangements for reviewing performance? 2. Has an improvement plan been established? 3. Have procedures been reviewed and amended as a result of accident/incident outcomes? 4. Has remedial action addressed deficiencies identified? 5. What safety performance indicators are in place?




DO
IMPLEMENT YOUR PLANS
RISK PROFILING
ORGANISING
RISK ASSESSMENT
RISK CONTROL SYSTEMS (RCSs)
Systematically identify and evaluate hazards & risks
Prioritise and implement control measures appropriate to level of risk
New Plant
Existing Plant
As part of management of change procedure
CONTROL
CO-OPERATION
COMMUNICATION
COMPETENCE & CAPABILITY (People with responsibilities under the operating procedures are competent to follow them)
Operators have set out specific H&S responsibilities for staff at all levels from the board/CEO downward
Performance standards
Operational procedures
Risk Control Systems
e.g. Managing contractors
e.g. Management of change
Plant change procedure
Organisational change
and interface between the two
A safe operating envelope for each sensor is defined, and appropriate warning and alarm levels are set, and automatically trip equipment when necessary
Workforce involvement
Developing procedures, setting performance standards, monitoring, auditing etc)
Risk Assessment, workplace and behavioural inspection. Steps are taken to ensure that operatives understand and follow the procedures
e.g. Health and safety committee
Behaviour Based Safety (BBS)
Workforce suggestion scheme (which is responded to)
Into, within, from organisation
Written
Verbal
Policies, R&R, Performance standards
Procedures
Risk assessments – identifying hazards and significant risks
Meetings / groups
Informal – walkabout / tours
Tool box talks
Encourage "what if" questions to be asked
Competence of health & safety advise (Advisor / consultants)
Specialist help
Competency of senior managers
Supervision
Workforce competence, recruitment and induction needs
Identifying ongoing training and competence needs
Refresher training
Verification of training
Training / competence of contractors
All employees from the most senior operational managers to front line operatives have received adequate instruction, training on hazards, risks and risk controls and understand the potential consequences of the hazards and their role in controlling the hazards on a day-to-day basis.
Managers & supervisors lead by example by carrying out regular over-inspections and are intolerant of non adherence to procedures, poor standards of cleanliness and maintenance. They also attend H&S training
Objective of system needs to be communicated and understood


CHECK
MEASURING PERFORMANCE
Senior managers are involved in setting suitable quantitative safety performance indicators (SPI.s) that reflect their understanding of the major risks associated with fires at the site. The information from SPI's directly influences the way the board and other senior managers manage risk
Proactive Monitoring
Hazard and risk assessment completed
Workplace and plant inspection
Behaviour observation
Reviewing contracts
Systematic follow-up
Measure of compliance with procedures
Auditing
Audit Procedures exist: audit teams trained & competent
Establish management arrangements appropriate, adequate risk control systems "exist & appropriate workplace" precautions in place. Do D.H.s do what they say they do? Is what they do good enough?
Action / improvement plans are i) produced; ii) reviewed by management; iii) monitored
Actions are implemented
INVESTIGATING ACCIDENTS/ INCIDENTS / NEAR MISSES
Accident / Incident investigation procedure in place
Immediate cause
Underlying cause
Lessons to be learned are identified
….. and system for promulgating
…and fed back into risk assessments (& therefore SMS)


ACT
REVIEWING PERFORMANCE
Review plans
Reports (→ Senior mgmt)
Identify remedial actions
Implement
Continuous reviews at different levels within the organisation to learn from experience, improve performance, develop the SMS and respond to change. Sources of information include measuring performance data (e.g. S.P.I.'s), audits (both internal and external), outside influences (e.g. new legislation) and benchmarking
Public reporting
Benchmark / S.P.I.'s
LEARNING LESSONS
There is an effective system for upwards reporting of deficiencies in risk assessments and operating procedures etc
Use near misses as learning opportunities
Results of audits, reviews & incident investigations and audits fed into risk assessments
Consider incidents that have occurred in similar organisations
Complaints are routinely investigated