Operating Experience and Learning

A Guide to Good Practice

This guide was produced by the cross-industry OE and Learning Group (OELG) and published on behalf of the Nuclear Industry Safety Directors Forum

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"The effective utilisation of operational experience and learning and a drive for constant improvement is widely recognised as a core part of a strong operational safety culture within the nuclear industry. It is essential that leaders create an environment that avoids complacency and an environment in which all staff can openly report events and opportunities for improvement in safety and operational performance.

However, any operational experience gathered either internally or externally to an organisation, must be effectively analysed and actioned in order to improve performance in the pursuit of operational excellence. Such an approach must become a fundamental part of the organisational culture.

This guide to good practice offers guidance on how to achieve an effective operational experience and learning programme. It is a guide to the key aspects of a successful programme based on the experience of many organisations in the UK."

Paul Newman

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Nuclear Industry Safety Directors Forum Sponsor of OELG

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Acknowledgements

DISCLAIMER

Introduction

This Guide to Good Practice has been prepared and is owned by the UK National OE and Learning Group (OELG), which is a sub-group of the UK Nuclear Industry Safety Directors Forum. Membership of the OELG is drawn from organisations within the UK, with an interest in nuclear activities, both civil and military. It is the main forum for OE (OE) practitioners from UK organisations involved in nuclear related activities.

This document has been prepared as a guide to good practices in the management and delivery of an OE programme within the UK civil and defence Nuclear Regulatory regime. It is not intended as a Code of Practice to be followed in order to meet Regulatory requirements, but to provide guidance to organisations and OE practitioners in the essential elements of a good OE programme within the UK civil and defence nuclear programmes.

A culture that promotes the open reporting of events, non-conformances and deviations is an essential component of a positive safety culture. This guide considers the components of an OE programme and aims to provide advice on how to develop and improve them in order to deliver good practice in an OE programme.

Members of the National Operating Experience and Learning Group

It covers organisational factors, training requirements, information collection and processing and the use of the output from the OE programme in order to ensure that the learning is as effective as possible.

In preparing this document, it is recognised that there are other guides and standards available, notably from WANO, IAEA and INPO and it is acknowledged that the examples provided in this guide draw on practices that have been established in line with their principles. This guide is not intended as an alternative to these other documents, but is intended to be a practical guide to developing good practice in the UK environment.

Requirements

Why OE?

Many, if not all, post-event investigations find that prior knowledge from other industry OE had been available, which, had it been used effectively, could have prevented recurrence of an event. The importance of applying OE was made clear in 1979 when the Kemeny Report[1] of the investigation of the Three Mile Island Nuclear Station accident included the following recommendations:

Chernobyl Disaster - 1986

"There should be a program for the systematic assessment of experience in operating reactors, with special emphasis on discovering patterns in abnormal occurrences. An overall quality assurance measurement and reporting system based on this systematic assessment shall be developed to provide:

1) A measure of the overall improvement or decline in safety, and

2) A base for specific programs aimed at curing deficiencies and improving safety. Licensees must receive clear instructions on reporting requirements and clear communications summarising the lessons of experience at other reactors."

"There must be a systematic gathering, review, and analysis of OE at all nuclear power plants…coupled with an industry wide international communications network to facilitate the speedy flow of this information to affected parties."

These recommendations led to the establishment in 1979 of INPO and one of the four cornerstones of this body is its Events Analysis and Information Exchange capability whereby INPO assists in reviewing any significant events at nuclear power generating plants.

Through INPO information exchange and publications, it communicates lessons learned and best practices throughout the nuclear power industry.

Using OE effectively includes analysing both organisation and industry experience to identify fundamental weaknesses and then determining appropriate

organisation-specific actions that will minimise the likelihood or reduce the consequences of similar events.

The benefits of sharing OE were given even greater recognition in the aftermath of the accident in 1986 at the Chernobyl generating station in the former Soviet Union. The global consequences of this accident and the identification of contributory factors including insufficient management control, inappropriate use of procedures, human error and design problems led nuclear operators worldwide to be determined to work together to ensure such an accident could never happen again. As a result WANO was formed and came into being in 1989 with a purpose of facilitating the exchange of OE throughout the international nuclear community.

[1]Report of the President's Commission on the accident at Three Mile Island (John G Kemeny) October 1979

This process of sharing OE is not unique to the nuclear industry and has a broad application, thus accentuating the significance of the principles of OE. Whilst investigations have the potential to use hindsight inappropriately in drawing conclusions about what could have been done to have prevented an event, there is no doubt that there is a consistency in the validity of OE in cases where it can be shown that such a process did not exist. In his review[2] of the loss in 2006 of RAF Nimrod XV230, Charles Haddon-Cave QC identified that there had been a number of significant incidents in the years before the loss and concluded that:

"These incidents represented missed opportunities to spot risks, patterns and potential problems, and for these to be read across to other aircraft."

"No-one was taking a sufficient overall view."

As the nuclear industry faces a turnover of experienced workers and a new generation of nuclear professionals arrives, it is important that the significant and often hard-won experience the industry has gained over several decades be carried forward. This can be achieved through a process that captures, analyses, records and makes accessible such experience.

RAF Nimrod

The goal for an organisation's OE programme is to use lessons learned from both industry and the organisation's own OE effectively and efficiently to:

- Improve plant safety, reliability and availability

- Reduce the frequency and consequence of unexpected events

- Help other organisations do the same

[2]Report of the Nimrod Review (Charles Haddon-Cave QC) October 2009 Crown Copyright (c) 2009

What is Management's role in OE?

An organisation's management should set clear expectations for an OE process. These include establishing the capability to:

- Promote a 'no blame' / 'just' culture in order to encourage a healthy OE programme

- Review and screen internal and industry OE information for applicability to the organisation in a timely manner

- Establish criteria to help determine which industry OE applies to the organisation

- Make industry OE widely available and easily accessible to the organisation's personnel in a manner that encourages its routine use

- Distribute applicable industry OE to the appropriate personnel for review, analysis, and internalisation

- Investigate and identify the causes of the organisation's events as well as identified trends

- Trend the organisation's own events to identify recurring issues

- Develop, track, and implement actions to correct weaknesses identified by reviews of the organisation's and industry OE

- Periodically assess how effectively OE information is used and the effectiveness of the overall OE programme

- Share OE with the wider industry in a timely manner

- Routinely benchmark industry programmes for best practices through participation in industry working group meetings, seminars, and other similar activities

- Determine attitudes and behaviours related to personal safety, environmental protection and also identify any latent organisational weaknesses

Line managers are responsible for helping personnel learn from industry experience through actions such as communicating important information, analysing the information, conducting event investigations, and ensuring the effective implementation of Specific Measureable Achieveable Realistic Time-bound (SMART) corrective actions.

Line managers should provide resources and encouragement so that their personnel routinely and proactively use OE information.

A common characteristic of organisations that use OE effectively is strong line management involvement. Management support of OE programmes include:

- Establishing responsibilities
- Establishing a learning environment
- Fostering a sense of ownership
- Willingness to honestly appraise the organisation for strengths and weaknesses
- Setting goals
- Communicating and reinforcing expectations
- Monitoring the implementation and use of the information
- Measuring the effectiveness of the OE programme

A primary management responsibility is to develop a culture in which OE information is considered a vital component for top performance in all areas of the organisation's activities. Ideally, diverse methods are put in place for the organisation's personnel to apply OE

One of the eight principles discussed in the INPO document Principles for a Strong Nuclear Safety Culture[3] is that organisational learning is cultivated and embraced. More specifically, it is that OE is highly valued and that an attitude of "it can happen here" is encouraged.

The internalisation of OE is a way of conducting business that recognises the value of understanding previous experience and seeks to apply it at every reasonable opportunity. Organisations that have successfully internalised OE lessons take the time to understand and communicate them to their personnel, search for them before acting, and learn from them to avoid making the same mistakes made by others. One key to successfully internalising OE information is management's commitment to establish strong engagement with the workforce.

What are the regulatory expectations?

Although Licence Condition / Authorisees Condition (LC/AC7) makes clear the requirement to investigate incidents, the deeper philosophy underneath this requirement is addressed within the section of Office for Nuclear Regulations (ONR's) Safety Assessment Principles covering[4] leadership and management for safety. One of the foundation elements (MS.4) is that:

"Lessons should be learned from internal and external sources to continually improve leadership, organisational capability, safety decision making and safety performance."

Emphasis is placed within the Safety Assessment Principles on reflecting on experience in order to identify and understand the reason for any difference between actual and intended outcomes. The significance of learning from near misses as well as from actual events is also highlighted.

What are the components of OE?

The various components of an OE process are illustrated in the simplified diagram below. This attempts to illustrate the inputs into the process, the processing that takes place and the outputs. Each of the components will be described in the sections which follow.

[3]Institute of Nuclear Power Operations - Principles for a Strong Nuclear Culture November 2004

[4]HSE (NII) (now ONR) Safety Assessment Principles for Nuclear Facilities 2006 Rev 1

Organising for OE

Organisational Structure and Responsibilities

In establishing the requirement for learning from and applying experience it is clear that OE has to be an integral part of the organisation's culture and encouraged by managers throughout the organisation. The organisation's personnel should regard OE as helpful and important to them, and be willing to use this information at every opportunity. Methods of using OE should be structured to provide applicable information to the right personnel in time to make a difference. When the organisation's personnel analyse the causes of significant organisational events, OE must be routinely reviewed to determine if and why previous lessons were not effectively learned or applied.

Industry Learning				
Internal Learning				Corrective Actions
Events / Near Misses				Learning

REVIEW

SCREENING INVESTIGATION

TRENDING RECORDING

Corrective Actions

Learning

External Reporting

Internal Level Reporting

Although a specific organisational structure may be implied from these guidelines, the functions addressed might be performed by different on-site or off-site groups, depending on the structure of the organisation.

Clearly defining the responsibilities of personnel involved with reviewing and using OE information within the organisation is essential, as is committing adequate resource in order to ensure that the OE programme can be effective.

Overall responsibility for the effective use of OE information belongs to the organisation's line managers. Line managers need to take a personal interest in communicating important internal and industry OE information. They also need to ensure that OE is being used routinely and that the principles of reviewing and responding to OE information are adopted across all departments including the non-technical domains.

INPO 10-006[5] requires organisations to designate an individual as the OE coordinator and describes the responsibilities of that position. Industry experience has shown the importance of dedicating additional organisational resources to help ensure that the use of OE information is a priority among the organisation's personnel. In many cases, organisations have designated departmental OE representatives to oversee and monitor OE use within their respective groups. These individuals might also be responsible for the initial review of industry experience and may assist other line departments in investigating their own organisation's events. They may also analyse event trends within their respective groups.

To support this effort, each organisation requires guidance that clearly defines the responsibilities and designated coordination activities of line departments in reviewing and applying lessons learned from OE information. Typically, line departments are responsible for investigating local events, reviewing and assessing applicable industry experience, and providing various methods for internalising the lessons learned.

The OE function can typically reside as part of a specific safety management domain or within an internal regulatory function.

The OE function will usually be headed by an OE manager who will be supported by dedicated OE engineers as well as administrative staff. The latter will provide the data acquisition and processing function which will form the feed to the analysis function provided by the engineers.

The structure will typically have a pan-organisation remit in order to avoid working in stovepipes but this does not exclude the use and involvement of SME from other areas.

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[5]INPO 10-006, OE (OE) Program and Construction Experience (CE) Program Descriptions

Line managers will need to commit sufficient resources to meet their departmental responsibilities and encourage the routine use of OE information in day-to-day activities. Ultimately the line managers should champion OE use within their groups.

As well as identifying and putting in place structures that enable identification of learning, an organisation also needs to enable timely dissemination of industry information that might apply to the organisation. Consistent and readily available access to relevant and important industry OE information increases the value the organisation's personnel and their manager's place on OE. Support for OE is further enhanced when plant management and the staff routinely discuss how the organisation has successfully used or might better use the information. Discussing the benefits of OE information with organisational groups, highlighting the value it can provide to line departments, and recommending and ensuring timely corrective actions also increase the profile of OE.

Examples of methods to internalise include:

- **The process must be leadership driven with a route to take issues to a Director level meeting.**

- **Provide performance standards, which are reinforced by leaders, with the OE support network available to inform and coach.**

- **Include OE in procedures / instruction (OE flags), explaining why.**

- **Identify and highlight links to own events.**

- **Incorporate OE into training from induction through to plant specific.**

- **Identify key customers e.g. work management planners (OE into future work); Design (OE into modifications and new build); Procurement (OE specific to their needs); Plant operations team leaders (OE into pre job briefs and OE captured from post job reviews). Target useful and appropriate OE to them, encourage use, ask for feedback (e.g. include feedback prompt in work pack) and provide coaching where required.**

- **Corrective Action Programme - Hierarchy of the communications system e.g. green, amber and red (or levels 3,2,1) to distinguish the importance of different actions.**

- **Prioritise actions and ensure they are SMART to avoid people being swamped with lower value actions.**

- **Checks to ensure the OE is internalised e.g. an effectiveness review of Corrective Actions to review whether the actions taken have resolved the issues.**

- **Benchmarking & Self-Assessment Programme - identifying best practices and linking into an Observation Programme e.g. Tier 1 Self-Assessment, Tier 2 Process Owner review, Tier 3 Independent assessment.**

- **Share best practice - broadcast 'wow' stories**

Staffing, Qualification, and Experience

The people who review and respond to OE information should have considerable technical experience in the nuclear industry and be familiar with the organisation's procedures, operational practices, nuclear plant technology, and event investigation methodology. They should also be aware of key personnel within the organisation and their areas of expertise/responsibility so that specific information can be provided to appropriate personnel for review and analysis.

Because the overall OE effort may be widely dispersed, applicable information needs to be promptly distributed and widely available. The responsibilities, required knowledge, and skills for personnel who review and respond to OE must be clearly defined. Line managers have found that a person with knowledge derived from previous plant operational or engineering experience often produces a more insightful review of OE. It is also important that people involved with OE information champion its use.

The overall motto of the OE programme must be:

Getting the
RIGHT INFORMATION

To the
RIGHT PEOPLE

At the
RIGHT TIME

Procedures and Instructions

As part of the organisational arrangements, appropriate procedures and instructions should be prepared, defining the OE processes and how OE will be used. The procedures and instructions should cover all aspects of the processes, including:

- Organisation-responsibilities and authorities, interfaces, resource and training requirements.

- Process - from receipt of OE to timely implementation of corrective actions, including criteria for personnel to report events, screening of events, trending and analysis of industry experience.

- Investigations - criteria for conducting event investigations, investigation techniques, management guidance for critical review of investigation reports.

- Reporting - categorisation of events, arrangements for internal and external reporting.

- Learning - incorporation of lessons learned from OE into appropriate organisational programmes and processes.

- Self-assessment - arrangements for periodic review of effectiveness of OE activities.
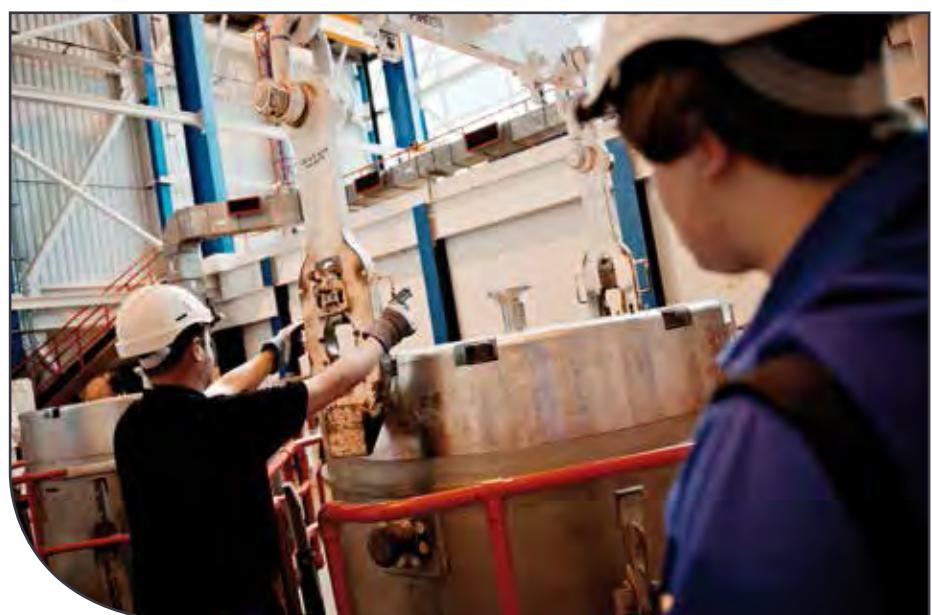
OE Communicators / Champions Programme:

The concept of OE Communicators or Champions, volunteers within departments and teams across the organisation, has been implemented by a number of nuclear facilities, and was brought back to the UK after a series of benchmarking missions to INPO 1 rated US Nuclear Power Plants.

A typical OE Communicator programme would involve volunteers to take on the additional responsibilities of searching for, and communicating relevant OE to their teams at the right time (ideally in pre-job briefs, shift handovers etc.). The concept helps to develop a 'pull' culture (as opposed to 'pushing' requirements onto the workforce) by the very fact that OE Communicators are volunteers with a passion to participate and make a difference.

Typical roles and responsibilities include:

- Carrying out briefs of site event reports, encouraging discussion on any with particular relevance to their team

- Promote the use of OE at every opportunity in the daily work

- Raise awareness of internal or industry events at team / shift briefings

- Communicate relevant OE in a timely manner to avoid mistakes being made

- Promote the use of OE in pre-job briefs and encourage the completion of post-job reviews to capture learning for future use

- Review up and coming works schedules to identify key activities and challenge to ensure relevant OE is included in task preparations

- Encourage the raising of event and near miss reports or good practices

A typical OE Communicator programme would be supported by the OE function at site, using regular workshops or training sessions to ensure the volunteers receive the necessary training and on-going coaching to carry out their role effectively.

The key to the success of a programme such as this is Management and Line Manger support to allow OE Communicators the time to discharge their duties to proactively help the organisation avoid high consequence events.

At Wylfa Power Station for example, OE Communicators are embedded in most teams on site, and they account for approximately 10% of the workforce.

Wylfa Power Station

Inputs

The Reporting Process

It is important to distinguish between the two types of reporting associated with OE. The reporting of events, incidents and near misses etc. by individuals forms an essential input to the OE process. Having processed the information, the onward reporting of relevant information from events both within and external to the organisation is an essential output from the OE process.

In the following paragraphs the reporting of events and near misses by individuals is considered.

What to Report

Whilst the Regulatory reporting requirements are identified in ONR guidance,[6] each organisation will establish its own expectations for the reporting of events, incidents and near misses, in order that the learning is captured. All events, however minor, present learning opportunities to improve standards of safety and performance, mitigate errors and avoid repeat issues. Identified good practices, either external or internal, can also provide opportunities for improving safety and performance. When identifying activities that will warrant reporting, the organisation should focus on all areas of the site such as: organisation, procedures, human performance, plant systems, structures and components.

In a plant with a strong safety culture, the OE programme should capture and report all internal events, near misses, deviations (from accepted procedures, standards, operating/maintenance practices or behaviours), and good practices or opportunities for improvement. Employees should be encouraged to report any concern regardless of whether it is a potential, suspect or actual problem.

In general, events that should be reported include the following:

- Actual operating events, such as plant transients with their associated equipment failures, human errors or other inappropriate actions, anomalous conditions and contributors either technical, organisational, procedural or human performance.

- Deviations from approved safety cases.

- Actual failures of systems, structures or components, or human errors, that may or may not have caused a plant transient.

- Adverse safety or reliability conditions such as design weaknesses, degraded safety or reliability of equipment or ageing effects that could lead to failures of systems, structures or components.

- External challenges such as vulnerability to severe weather, flooding, high winds or security threats.

[6]ONR-OPEX-GD-001 Revision 4, Guidance for Notifying and Reporting Incidents and Events to ONR

- Organisational or human factor issues with their associated failures or contributors such as degraded safety culture, high human error rates, weak quality assurance, inadequate procedures, inadequate training or inadequate control of contractors at a location.

- Vulnerabilities or un-reviewed safety issues showing a previously unknown weakness in a safety systems or inconsistencies.

- Other reliability issues, lower level events and near misses, either safety or not safety related, that can be useful to identify early signs of declining performance and to alert the organisation of antecedents and precursors for more serious events.

More specifically, the types of occurrences to be reported include, but are not limited to the following:

Events with consequences on nuclear safety and plant reliability

- Events with consequences on control of reactivity.

- Loss or degradation of reactor core cooling.

- Loss or degradation of barrier integrity.

- Events affecting nuclear fuel (transportation, handling etc.).

- Plant transients - reactor scrams, reactor coolant pump trip, turbine trip.

- Degradation of steam generators feed water supply, actuation of a safety system, loss of power supply etc.

- Foreign material intrusion events.

- Events with consequences on radiological protection

Many organisations use behavioural safety observation schemes to record low level safety issues/observations rather than formal event reports. These should also be captured for OE purposes.

- Unplanned exposures.

- Contamination or release of active medium inside the plant.

- Release of active medium outside the plant.

- Loss of radioactive source/material.

- Lack of individual Radiological Protection (RP) protection devices/equipment, etc

Equipment failures/damages

- Inoperability of a safety system.
- Equipment failure resulting in production loss.
- Equipment damage.
- Common mode and common cause failures

Other Inputs

- Industrial safety events - injuries, fatalities.
- Environmental events - unplanned releases of toxic materials/ chemicals, or releases beyond legal limits. Late or incorrect reporting against the Permits or Authorisations.
- Fires or explosions at the plant.
- Security events - threats, attacks.
- Nuclear materials accountancy issues.
- External events - earthquake, extremes of weather, degradation of intake cooling water condition etc aircraft related incidents.
- Safety analysis deficiencies, insufficient safety analysis.
- Information system failures either related to plant, process or management organisation, which may influence the safety or reliability of the installation.
- Quality assurance, quality control, supply chain and self-assessment issues - deviations, non-conformances, adverse conditions, non-compliance reports, audit findings, self-assessment recommendations.

- Plant/equipment design inadequacies.
- Human performance, staff attitudes and behaviours, safety culture awareness.

Near Misses

Near misses are defined differently in almost all organisations, but examples include:

- A plant transient could have occurred if the event occurred under different conditions.

- Equipment could have been damaged.

- Personnel could have been injured.

- Incorrect work could have been specified or performed.

- Error likely situations could have been provoked.

- A human slip or lapse occurred while performing critical steps of a task without consequences.

- An event has not occurred, but the action may lead to unwanted hidden situations where the probability of failure in demand is increased or a function impaired.

- A system/equipment could have been in a status not in accordance with expectation/requirement (fire protection barrier would have been affected; a system valve would have been in incorrect position, etc).

- The discovery of a latent error situation ie. an error in a procedure.

Low level human errors and near misses are often corrected immediately by the person who has committed the error or experienced the near miss. These errors or near misses may no longer be accessible for analysis, but if they are not reported a wealth of information may be lost. Sites need to establish requirements to capture near miss information in pre and post job briefings and in other areas such as work reports.

There are two major advantages in reporting this information:

- The person who has committed the error or near miss may have knowledge about the causal factors, and since there was no negative consequence, a free discussion about the origin, lessons learned and potential corrective actions is possible.

- If they are not recognised, latent organisational weaknesses and error traps are left unresolved, and will lay dormant waiting for a potential event to re-occur. One indication of a strong safety culture attitude can be where workers self-report events or near miss by challenging themselves with the question of 'do I want my co-worker to face the same situation'?

Positive Events

Suggestions for improvements from personnel, good practices, good performances and good examples should be positively encouraged and identified. The activities for identifying OE issues also include the review of information contained in other accessible sources, either internal or external. During safety reviews, the existence of a very broad range of separate processes to deal with minor issues has often been identified. Unless good internal communication exists, they may then not be considered in the OE programme, and so the lessons learned may be lost or not integrated into the overall process. If they are identified and reported into another process, they need to be linked to the OE process.

Event/Near Miss Reporting Formats

Whatever format is used for reporting (paper or electronic) it should be logical and easy to complete by the reporter.

IT systems should be simple to navigate and use forms which the reporter has easy access to. The advantage of such a system is that the OE organisation can specify what types of events require reporting and can assist in the identification of the causes of the event. The potential disadvantage is that if the system is poorly designed not all events easily fall into the pre-determined categories and so are either mis-identified or not reported.

A focal point system e.g. a dedicated telephone number or email address for reporting events manned by trained personnel can help ensure consistency and accuracy of data capture. A telephone hotline is easy for the reporter to use but does require manning and so is at a disadvantage compared to a fully automated electronic system. Trained operators can use a prompt system to ensure that essential fields are populated. A hotline system also allows anyone on a site, including contractors or visitors, to report events without the need for them to have access to IT based systems.

Some organisations use drop/suggestion boxes installed at convenient locations along with report forms for easy reporting of events, issues and suggestions for improvement. Using these boxes, all personnel, irrespective of their position, can highlight any plant problem and suggest improvement actions. The reporting can be anonymous but, where possible, feedback should be provided to thank the person, to confirm receipt of the report and to inform of the follow up. This practice helps to raise confidence in the drop box reporting system and hence makes it an effective part of the reporting arrangements. Although the use of a drop box is recognised as a good practice, management should monitor its use as over use of anonymous reporting may indicate that the main reporting procedure is not sufficiently effective. Equally it can also become a vehicle for abusive comments.

An effective OE system may use any combination of these formats and will be dependent on what works best for the particular site or operation to ensure that events are reported and recorded, and that relevant OE is delivered to the workforce.

Barriers to Reporting

Even when a strong safety culture has been established in an organisation, there can still be reluctance for the workforce to report events resulting in them going unrecorded and undermining the OE process. The reasons for this could be some or all of the following:

Practical

- The reporting tools are too cumbersome (e.g. complicated forms to be filled in).

Fear

- When reporting their own errors the reporting individual is not sure whether there will be personal consequences (lack of 'no blame' or 'just' culture environment).

- Where reporting creates an additional unplanned work programme (i.e. duties in addition to normal work activities which may conflict or add to regular duties and may cause an individual's performance rating to be affected when measured against their regular targets).

- Human nature - reporting of an individual's mistakes can be embarrassing or cause an apparent loss of face.

- Group interaction - reporting on others mistakes may cause embarrassment or friction between individuals or groups.

- Fear regarding public/ media/journalist/stock market/shareholder response may prevent organisations from reporting.

Perceived Process Inadequacy

- The report is not taken into consideration, no feedback is provided.

- The outcome of reporting is not visible (the report seems to fall into a 'black hole').

- Staff feel that their efforts to report are not worthwhile and will not contribute to safety improvements.

Risk Acceptance

- The reporting is 'superfluous' because the reporter feels that they can take care of the situation.

- Reporting on long term standing problems, adverse conditions or workarounds may cause significant loss of credit for the organisation, especially when the condition has been present for some time.

- Inadequate perceptions of risk

Management has the responsibility to create and promote a climate of openness and transparency that fosters the reporting of all events, one that supports a culture of continuous improvement and striving to achieve high standards of safety and performance. Open communication amongst an organisation's personnel means that problems are quickly brought to light and are not trivialised.

In the environment of continuously improving safety and performance, low level events, small degradations and near misses all need to be reported. Just as important are good practices and positive examples which need to be reported and communicated. Both types of events are a valuable source of information for a learning organisation.

Quantity of Event Reports

There are a variety of models used within analyses of safety event data which provide indicators of what constitutes an expected level of reporting of low level events or near misses as a ratio of the number of major events. The ratios vary and have differing interpretations and applicability but good practice would indicate that organisations should encourage a culture where a strong level of reporting of near misses prevails, as by doing so there is a greater probability that the major event will be less likely to be allowed to happen.

In basic terms, reporting ratios should show that the greater the number of low level reports received and addressed, the fewer significant events occur (see graph example in Appendix A).

Industry OE

An important source of OE is that which arises external to the organisation. This may be within other parts of the Company's organisation, elsewhere within the nuclear industry or from other industries. It is important to establish mechanisms for capturing this external information, such that it can be evaluated and where relevant fed into the organisation's OE process.

Formal mechanisms exist for the sharing of information: WANO, INPO, Trade Organisations, Health & Safety Executive (HSE), etc. but equally important are the informal networks such as the OELG.

Processing

Screening Internal Events

All event and near miss reports should receive an initial screening, aimed at determining the following:

- Is there a need for immediate action?

- Is further investigation of the event appropriate and if so what level of investigation?

- Is there a need to report the event, either within the organisation or to an external organisation?

The screening should be carried out as soon as practicable after the event/near miss report has been raised and should be carried out by a person or group of people who are able to answer the above questions and place appropriate actions if the answer to any of the above questions is "yes". Following the initial screening, it may be appropriate to carry out a second screening, when further information is available, also using the three questions given above. The results of this initial screening should be recorded, together with any additional relevant information taken into account when considering the three questions.

Screening Industry Events

Screening industry OE is the process of evaluating industry events for local organisational applicability, significance, and determination of the potential

for a similar event to occur. An initial review determines if the information applies to the organisation and recommends a priority for a more thorough evaluation but should have the capability to fast track items requiring immediate attention, with line management expediting the review process. Ideally industry OE information should be examined paying particular attention to causes, contributors, and lessons learned when deciding if it applies to one's own organisation. Because applicability is not always obvious, ensure that subtle but important aspects are not overlooked. Equally, applicability screening must not be biased toward identifying organisation-specific differences that justify classifying the OE as "not applicable."

When initial screening is biased toward finding reasons that events do not apply, industry OE is being underused and the possibility of a similar event occurring is increased. Typically, aspects such as the reactor type, generic design, and vendor should not be the major determinants of whether an issue might apply to the organisation. For example, human performance, management, and many generic component issues typically apply to all reactor types. Instead of justifying reasons why 'it couldn't happen here' consider 'how could it happen here'?

> **Following first line investigation by the reporter's Team Leader, Wylfa sends all reports to the Shift Charge Engineer in order to determine if any immediate actions are required in the interests of nuclear or industrial safety.**

Some organisations have found the following criteria useful when determining applicability:

- Similar equipment is in use, although not necessarily in the same application

- Similar components are used in the organisation's equipment or are in stores

- The plant is of similar design, if design was determined to be a main contributor to the issue

- Current practices increase the chances that a similar problem could occur

- Similar environmental conditions could be present

- A similar event has already been experienced

- Similar management expectations, personnel behaviours, or processes have been observed in the organisation (i.e. organisational factors)

Action for items determined to be "not applicable"

In order to ensure that received OE is not being inappropriately discounted a record should be kept of the rationale when OE is initially determined to be "not applicable." This rationale should be reviewed periodically, perhaps by a multidiscipline team or a technically knowledgeable individual within the organisation. An independent review, to confirm there are no lessons to be learned, will help ensure that important issues are not overlooked.

Determination of follow-up evaluation priority for applicable events

The priority assigned for follow-up evaluation is commensurate with the likelihood and potential consequence of an occurrence at the organisation. For example, events that apply to and could have a substantial effect on the organisation may require immediate line management notification and a follow-up evaluation.

Factors to consider when assigning a priority for evaluation include the following:

- Potential to affect nuclear safety or security

- Potential to affect plant reliability

- Potential to affect personnel safety

- Potential to affect environmental safety

- Likelihood of occurrence

Determining the priority for reviewing industry OE based solely on the type of document may preclude applicable OE from being reviewed in a timely manner. Issues with the potential to affect nuclear safety must receive the attention warranted by their significance.

Include the following essential elements in the evaluation process:

- Provide a concise description of the event or issue

- Determine if the information describes an operability concern

- Describe how the event relates to the applicable organisation process, practice, or equipment

- Search for similar events, and determine if previous corrective actions and lessons apply

- Identify how the organisation might be vulnerable to this situation, what lessons are to be learned, and what corrective actions to take

- Has the evaluator interfaced with affected groups to obtain their input relating to the issues and recommended corrective actions

In some cases, the event may have been described in an earlier document; therefore, an additional comprehensive review may not be necessary. However, it is appropriate to re-examine previous conclusions, including lessons learned and corrective actions. When personnel close a recurring event report simply because they responded to the original event report, they might be missing an opportunity to identify and implement additional actions to prevent recurrence.

Compare this analysis with the actions taken as a result of the initial event report analysis. This focus provides an opportunity to verify that the initial organisation evaluation identified the fundamental weaknesses and appropriate lessons to be learned. Also, this review determines if actions taken following review of the original document are still effective to prevent recurrence.

Experience has shown that some organisations close recurring industry event reports by stating that action has already been taken and that no new action was necessary. Later, however, a similar event occurs, and one of the identified causes was that effective corrective action from previous industry OE was not implemented effectively. When personnel review a recurring event report and take no action because they responded to the original event report, they might not take the opportunity to re-examine the issue to validate that their original actions were appropriate and complete. As a result, they might not benefit from additional insights provided by the recurring event report.

Consider the following actions when recurring industry events are reviewed:

- Review the initial response to the event, and determine if the fundamental weaknesses and issues from the original event were identified and resolved

- Consider any additional insights provided by the recurring event report

- If relevant, re-examine simulator lesson plans that may have been developed from the original event, and determine if they accurately replicate the situation and reinforce the applicable lessons

- Review procedures that were changed as a result of previous industry experience, and determine if they are still appropriate and effective

- Interview personnel, as appropriate, to assess their awareness of applicable lessons learned from the initial event, and determine if new actions are needed to prevent recurrence

Include the following essential elements in the evaluation process:

- Provide a concise description of the event or issue

- Determine if the information describes an operability concern

- Describe how the event relates to the applicable organisation process, practice, or equipment

- Search for similar events, and determine if previous corrective actions and lessons apply

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- Has the evaluator interfaced with affected groups to obtain their input relating to the issues and recommended corrective actions

As a result of identification by EDF of an issue with asbestos being found in a specific type of chain block a cascade notification was sent out which via Sellafield Ltd came to the attention of National Nuclear Labortory (NNL). This led to NNL circulating the information and finding two affected chain blocks at one of their sites and thus being able to take quarantine action.

Determining Corrective Actions from Industry OE

The organisation's OE coordinator can recommend a priority for implementing corrective actions, but the implementing line manager may well actually set the priority. If actions are expected to take longer than management determines is reasonable, interim measures should be taken to reduce the probability of event occurrence and the organisation's management should mutually approve due dates for completion of corrective actions.

Once the evaluation has been completed, the affected departments should review and approve the evaluation report. This review should focus on ensuring that the appropriate lessons learned have been identified and that the recommended corrective

actions address the lessons learned. The organisation's management should review the evaluation to provide a broad perspective and to ensure that generic issues are addressed and all applicable lessons identified. In all cases, the final review and approval should be conducted as specified in the organisation's own procedures. Corrective actions should be tracked to completion using the established action tracking or corrective action programme, with an overview taken by management.

Investigating

All event/near miss reports should receive some level of investigation, appropriate to the actual or potential safety significance of the event. Whilst the types and techniques of investigation may vary between organisations, there are essentially four levels of investigation, which should be considered:

All events should receive some form of first-line investigation (Level 4), aimed at determining the most immediate or direct cause of the event and preserving and gathering of immediate evidence for any subsequent investigation. This investigation is normally carried out by the Line Manager of the person reporting the event. In general, the outcome of a first line investigation would be:

In the case of a relatively minor event or near miss, the immediate problem can be appropriately dealt with and the outcome of the first line investigation can be used in trend analysis, to help prevent more significant events in the future.

or

In the case of a more significant event or near miss, the outcome of the first line investigation can be used to determine whether further investigation is required and the appropriate level of investigation.

If the first line investigation determines that further investigation is appropriate, the next level is a limited investigation to relatively quickly and simply determine the most immediate or apparent cause (Level 3). This level of investigation is usually carried out without recourse to full root cause analysis, however, it is desirable that the person carrying out the investigation has an understanding of root cause analysis techniques, in order that the investigation can be carried out effectively and consistent with recognised investigation methodology.

For the more significant events, the further investigation is likely to be based on use of full root cause analysis techniques (Level 2), in order to determine the fundamental (root) causes and contributing factors for the event, such that if these are corrected a repeat occurrence of the event or condition would be prevented. A root cause investigation should where possible be carried out by an experienced individual trained in root cause analysis techniques, or for more complex events, it can be advantageous to use a multi-discipline team containing a person experienced in root cause analysis.

For those events of the highest significance, the further investigation is likely to involve some form of Panel of Inquiry (Level 1), with a degree of independent membership. This may take the form of a Local Panel of Inquiry, where the panel is led by an independent member, but the other panel members are local to the organisation. Alternatively, a panel consisting entirely of independent members may be appropriate for events of the highest significance. In both cases, the panel would be expected to use recognised root cause analysis techniques as part of their investigation.

It is important that investigations are conducted to a high standard, are completed quickly, efficiently and honestly, correctly identifying the genuine root causes and making suitable recommendations for immediate actions where appropriate and for remedial and preventative actions to prevent re-occurrences.

There are different ways in which organisations may address investigations, each has pros and cons and it will be up to each organisation to find what suits it best.
In many locations, a hybrid of the following options is used:

a. All supervisors/Team Leaders are trained in basic first line investigation techniques (Level 4). (Coaching by the OE practitioners may be an alternative to formal training).

b. A substantial pool of people across the site/organisation are trained formally to conduct Apparent cause Investigations (Level 3).

c. All Subject Matter Experts (SME) are trained in root cause investigations (level 2) - whilst providing a large 'pool' of investigators, it may result in a lack of opportunities to gain practical experience.

d. Selected staff are trained in root cause investigations - and are then available to carry out investigations and assist SMEs. Whilst this approach allows people to gain experience, their availability may be constrained by their normal tasking.

e. A dedicated investigation team are trained in root cause investigation techniques and their only role is to undertake investigations. This option is often not viable for many companies.

Whatever option is chosen, it is imperative that investigators have a suitable level of training in accident/event investigation techniques and fully comprehend the safety culture of the site/location and the requirement for open and honest reporting.

In addition to the training delivered to the investigators, there should be at least one focal point within each facility/organisation/department, preferably at a supervisory/management level that can lead, direct and oversee investigations at that particular facility/organisation/department. These people should have a higher understanding of investigation training.

It may also be considered appropriate to give investigation training to the core members of the Event Review Meeting, in order that they can constructively challenge the quality of investigations presented to the review meeting.

The importance of including Trade Union or Employee Safety Representatives in investigations should not be overlooked, as they can provide valuable insights into behaviours and practices that may otherwise may not be apparent.

There are many different proprietary investigation techniques available, including: HPES (Human Performance Evaluation System), TAPROOT etc. and it is for organisations to choose an appropriate technique for their circumstances. One of the more common tools used within several methodologies is an event and causal factors chart for information sorting, which can prove useful in identifying lines of investigation, failed barriers and causal and root causes. Also worthy of consideration in an investigation methodology is the review of OE from similar internal and external events that have occurred previously. Such a review should be aimed at determining why the corrective actions placed in response to the event failed to prevent a repeat event.

In order to ensure that investigations are consistent and their quality is maintained, the following should be considered:

- Mentoring / coaching service on the requirements and methodologies of investigation techniques (possibly the OE Engineer / Practitioner)

- Quality check by the OE Manager / Central team

- Peer review / endorsement of the investigation report prior to formal authorisation

- Panel review and challenge of the completed investigation (may be conducted in the Event Review Meeting)

- Effectiveness reviews of investigations and their corrective actions - usually conducted 12 months after the initiating event

- Monitoring of investigation completion timeliness

Recording

OE comes in many formats, from events at other locations to suggested improvements from the workforce. In order to derive the maximum possible benefit from the OE, it is important that all of these aspects are captured and recorded in a single central repository, where they can be read, analysed, re-structured and then disseminated as part of the process for identifying improvements.

All aspects of an event from recording of the initial event details, the outcome of the investigation, the placing and tracking of actions arising from event investigations and the trends arising from the analysis of events should be contained within the recording system. The availability of such a comprehensive system enables information to be readily available to all interested parties, which supports the cultivation of a healthy OE programme. The nature of the system used for the recording and storing of the OE information is a matter for the organisation to decide and can be bespoke to the location. There are several proprietary software packages available, but it is for an organisation to evaluate the most appropriate system for its specific circumstances, with the overall aim of providing a comprehensive, user friendly system, which can be used to make OE information available to all.

Reviewing

Event Review Meeting

Event review meetings should be held on a frequent basis and be supported and attended by senior management. The meeting is an opportunity to challenge the initial screening decisions made on each internal event or near miss report raised, including categorisation of the event and any further off site reporting requirements. The event review meeting is also a forum for identification of events to be included in training packages (including simulator scenarios), challenge and discussion of trend reports, investigations, self-assessment or audit outcomes related to events and also to review any relevant industry OE. Ideally, attendees at this meeting should be fully trained in the investigation techniques and criteria in order to be able to best ensure consistency in investigation quality.

Specimen Agenda

1. Attendance & Apologies for Absence

2. Performance Indicators from Previous Meeting

3. Review Notes for Accuracy

4. Actions Closed - to note

5. Open Actions / Issues Raised

6. Review of Event & Near Miss (including Good Practice) Reports since last meeting

Guidance for Event Review

i. Could the Event affect Health, Safety, Security or the Environment?

ii. Could the Event result in Production Loss?

iii. What effect could the Event have on Plant/Systems?

iv. Could a similar Event happen on other Systems (Generic Issue)?

v. Is this a Repeat Event?

vi. What were the failures? Procedural, Behavioural, Communications etc.?

vii What can we learn from this Event?

viii. To whom should this Event be communicated?

ix. Is the correct plant code assigned to the event?

x. Any events to be included in training packages?

xi. Should any events specifically be identified as Outage Related? Including any actions that may be required to be completed specifically during an Outage period?

xii. Are the actions placed SMART?

xiii. And note any emergent trends

7. Review of short term actions

8. Status of open Investigations

9. Investigation Reports for Review (Committee to challenge SMARTness of actions)

10. Investigations for Effectiveness Review

Guidance for Effectiveness Review

i. Have there been any similar or repeat events?

ii. Does the original investigation identify all the issues surrounding this event?

iii. Do further events suggest other related areas that require investigation?

iv. With hindsight, were the root causes identified correct?

v. What further actions need placing to prevent repeat / similar events?

vi. Are the investigation actions effective?

11. Industry OE

For events with significant learning, identify:

i. Any actions to be taken by site

ii. Identify if site should conduct an Effectiveness Review of any resultant actions

12. Review of Mandatory Assessments

13. Urgent Regulator Feedback

14. Trends / Statistics

15. Review of long term actions outstanding

Review of Investigations

The review of the quality of investigations should ideally be carried out by an appropriate group of people. The Event Review Meeting is likely to have the relevant attendees and hence may be the most appropriate venue. The following questions may provide a structure to the review.

Q. Does the analysis focus on the potential as well as actual safety consequences and also cover the wider implications of the event?

The primary aim is to ascertain why the event occurred and whether the event would have been more severe, under reasonable and credible alternative conditions, such as different power levels or operating modes. The safety significance of the event should be considered for actual and potential consequences. An initial safety assessment may be performed before screening takes place. A more thorough safety assessment is performed once the process of investigation and analysis is completed in accordance with the depth defined during the screening process. If at any time during the investigation process the need for urgent corrective action is identified, this should be taken immediately, rather than waiting for the investigation to be concluded.

Q. Are the direct, root causes and causal factors of the event clearly described?

Causes include reasons for equipment malfunctions, human performance problems, organisational weaknesses, design and manufacturing deficiencies and other facts. Whenever appropriate, the cause analysis methodology used should be referenced in the report.

Q. For events involving shortfalls in human performance, are the inappropriate human actions clearly defined (both the effects and causes)?

In order to make the lessons learned readily transferable, in addition to the technical details, it is important to specify the inappropriate human actions, i.e. the effects, and also the causes. Human performance is greatly affected by the management systems that are put in place to help workers perform well, e.g. Planning and scheduling of work, training, level of supervision, written instructions and the work environment.

Procedures used to control work with nuclear safety implications on the Royal Navy's nuclear powered submarines employ a system known as Pink Sheet Comments. The Master Working Copy of each Nuclear Procedure has sheets attached at the rear of the document distinguished by being pink in colour. As well as being used for specific mandated comments, any person using or coordinating the procedure can add manuscript comments on these sheets relating to any issues experienced during the working of the procedure. The comments are formally reviewed by the body authorising the procedure during its completion review process and actioned as appropriate.

When there are latent weaknesses in any of these systems, conditions exist that are likely to lead to error. To enable others to learn effectively from experience, investigation reports should contain clear explanations of what the weaknesses are, how they were detected and the measures taken to remove similar weaknesses.

Q. Are all corrective actions listed and described in sufficient detail, to allow readers to determine their applicability to their plants/ systems?

It is good practice to include the following aspects:

- Priority e.g. preventative or corrective.

- Nature of the corrective action (recovery, short term or long term) and any target dates set for implementation

- Department responsible for authorising corrective actions (e.g. operating organisation)

- Group or person responsible for implementing corrective actions (e.g. operation, maintenance, analysis group, etc.) with a record of their acceptance of the action.

- Cross-reference to the identified causes to help the assessment of adequacy and effectiveness of the corrective action.

- Provision of close-out criteria.

Q. Are the report learning points clearly identified in the investigation report?

The efficient communication of the lessons identified results in enhanced safety, positive changes in working practices, management change, increased reliability of equipment, and improvements in the procedure. In addition to implementing effective corrective actions, the sharing of OE lessons learned is one of the most valuable parts of the feedback process.

Reviewing the Quality of Investigation Reports

The report will require review by the OE team to ensure that it contains all the relevant information relevant to the event/condition. The level of revision that is required should not detract from the meaning or intent of the original report.

The following are examples of checks that should be conducted prior to the report being published/ released.

> **Sellafield Ltd use a system of Quality Score sheets that are used to assess and check the contents of documents including reports of investigation and OE briefs.**

- Is the information complete, concise and describes clearly the condition (or opportunity for improvement)? Is the description sufficient to understand what the issue is?

- Are standard formats templates or databases being correctly used?

- Has the issue been reported in a timely manner?

- Are the affected areas, systems, equipment, documentation and people involved identified?

- Is the status of the plant and other relevant data reported?

- Is the extent of condition and generic implications clearly reported?

- Is the reporting supported with sufficient details, so as to enable subsequent monitoring of adverse trends in different areas of the plant, and to help in understanding generic deficiencies?

- Are any actions made in the report SMART?

- Are the consequences or potential consequences reported?

- Are the benefits of suggestions and good practices reported?

- Have appropriate notifications been made (whether internal or external)?

- If the event is one involving human performance, have the appropriate human performance staff been notified or included in the investigation team?

- Is the report to be submitted to other organisational safety committees?

- Does the report meet regulatory expectations?

Regular reviews of the status of investigations are of great benefit in maintaining momentum and focus and also for ensuring that deadlines for submission of reports to Regulators are achieved. Many sites hold weekly meetings between facility operators and OE personnel which combine a review of key events in the last 7 days with an update of progress in investigating past events. Such meetings serve to both help spread awareness of events as well as ensuring appropriate management attention is drawn to the progress being made.

Trending Organisational Events

The goal of an event trending programme is to identify emerging trends so that management can determine the level of investigation warranted to evaluate causes and contributors and then establish corrective actions to mitigate and eliminate the noted trend, in an effort to prevent repeat or significant events occurring.

Each event can be categorised/characterised using different parameters which can be trended to identify recurring events, typically using an appropriate event or programme-type code (sometimes called an attribute), to assign to an event (for example using key words such as: component mis-positioned, foreign material, or procedure adherence), or cause codes.

Trending these attributes facilitates early identification of similar and recurring events. Attributes are used to establish 'buckets' for each common grouping of similar events and are also useful for self-assessments of cross-functional areas.

Corrective actions that address identified weaknesses may also be specified and implemented through the organisation's corrective action programme.

Responsibilities

Effective event trending may well require support from differing parts of an organisation in order to draw upon the variety of skill sets necessary to analyse fully the data in question. Ideally, though, it should use personnel who are familiar with the organisation's event investigation methodology to enter and analyse data and support department trending requests. These data analysts alert management of an emerging or apparent trend and line managers review the trend and direct further analysis. Some organisations have predefined triggers, usually related to occurrence frequency, that automatically initiate further analysis. Line managers should be aware of the event trending process capability and know how to use the data to improve their department's performance. Management feedback is important to develop and focus event trending so that pertinent and useful information is provided.

Trending Process Elements

The following essential elements of trending are based on best industry practices:

Types of trending that are useful include, but are not limited to:

- Identify repeat events

- Identify trends relating to organisational work groups

- Identify emerging trends during certain major activities

- Identify repeat component failures

- Evaluate the difference between trends that occur during an outage and those during non-outage periods

Consistent use of coded information

The consistent use of coding is essential to obtaining meaningful trend data and results. Hence the number of people responsible for coding OE information should be minimised to achieve consistency. For example, some organisations assign one individual or a small group to review and code all completed event investigation reports and enter the information into the event database. The analytical phase can be performed either by line department personnel or by a designated analysis group.

Methods for determining trends

Because trending is performed to identify a deviation from an anticipated or desired performance level, a method of recognising the deviation is necessary. Some methods used include cognitive analysis, 'bucketing', performance indicators, and statistical analysis. Generally, a comparison is made between the frequency with which a parameter occurs over time and a threshold value that brackets the anticipated value. Any deviation beyond the threshold value becomes a candidate for further analysis. Also, the rate or direction of change of a trended parameter can be important, even if the trend has not yet exceeded the threshold.

Some other analysis considerations are as follows:

- Determine normal values for each trended parameter from past organisational experience or desired performance

- Use suitable time periods e.g. four months or per quarter of event data to identify meaningful trends. Longer or shorter periods may be useful for some parameters to determine if the trend is a current or chronic issue

- If the data can be assumed to be normally distributed, examine the standard deviation of an occurrence, such as the frequency of a mis-positioned component, to determine if the rate of occurrence (trend) is random.

- Use rolling averages to smooth out data that is subject to a large variation over a short time and to help recognise a possible trend

- Use normalisation techniques, such as comparing the frequency of occurrence per number of hours worked per week or number of work requests issued per week, to help identify meaningful trends

Reporting the results of trend analysis

When reporting trend data, only information that is both useful and necessary should be provided to the organisation's management. The primary goal of trending is to provide an early warning of emerging trends and to help management understand the factors that may be responsible for the trend. Line managers are ultimately responsible for addressing the impact of the identified trends. Best practice includes:

- Provide trend reports periodically to line managers

- Focus attention on those items in the trend report for which further action may be necessary, or further analysis required

- Provide sufficient detail in a succinct format within the report so that managers can quickly understand the trend

- Reports should also include progress or non-progress of trends identified in previous reports, e.g. continuing trend, improvements made, actions not completed effectively.

- Reports should focus on what has been found, not what has been reviewed

Trend analyses frequency

Most organisations provide trend analyses reports to their management teams at least on a quarterly basis. Individual line department performance can be trended monthly, or more frequently during an outage period.

Use special trend reports that analyse a longer period (such as longer than a refuelling cycle or plant outage cycle) to compare the most recent period to an earlier similar period. This trending analysis identifies deviations in performance that are slow to develop and, therefore, take longer to recognise.

Infrequently occurring changes, such as an organisational change, are often good reasons for conducting trend analyses. Compare similar parameters obtained before and after the change to assess change effectiveness.

Investigation of identified trends

Once a trend has been identified, it should be treated as an event and the established event reporting programme used to initiate and track an appropriate analysis to determine if the trend identifies declining performance. The level of the analysis should be based on the significance of the trend. A cause evaluation is typically initiated to identify causal and contributing factors that explain why a trend is occurring.

Corrective actions should focus on addressing the most prevalent common causes and be incorporated into the corrective action process or programme. Subsequent follow-up should be conducted to verify that the identified trend has improved; if it has not, the assigned corrective actions are modified.

Some organisations also analyse the causal factor attributes (common causes) obtained from event investigations to identify other areas on which to focus the action plan for the investigation. For example, an increasing number of mis-positioned components may be identified as an emerging trend. The distribution of the causal attributes obtained from the mis-positioned component events reveals that a few causal factors are identified more frequently than others. The investigation then could focus on those areas, increasing the probability that the action items will further reduce repeats of these common causes.
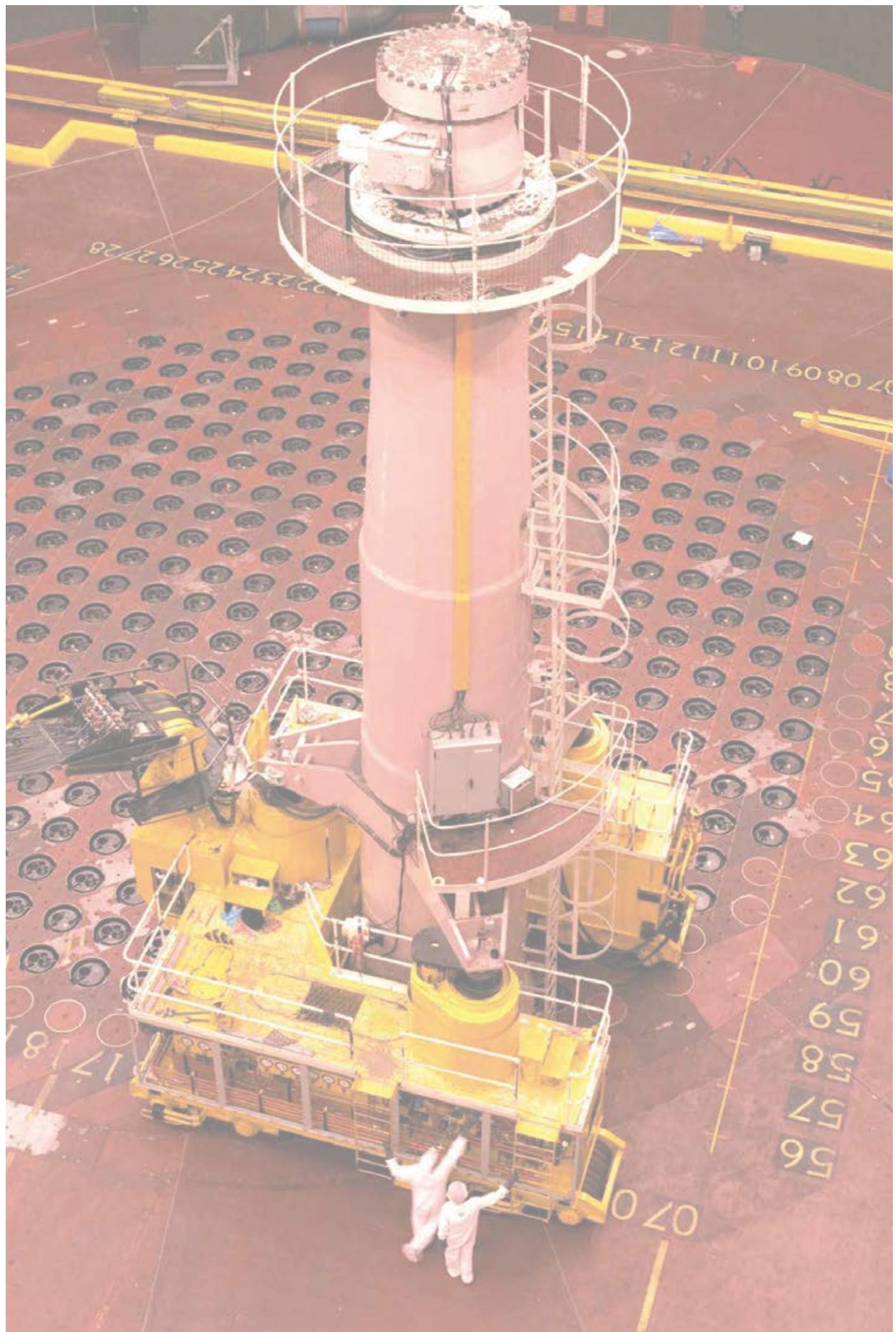
Outputs

Reporting

Having captured events and near misses into the OE 'process' and carried out an initial screening to decide if further action is required, a decision is necessary as to whether the event is of sufficient significance that it requires reporting. Reporting may be required within the organisation, to a corporate function, to the Regulators or other Government related functions. The arrangements for reporting are considered below.

Reporting threshold

Incident and event reporting in the UK nuclear industry has developed from experience of designing, constructing, commissioning, operating and decommissioning numerous nuclear facilities. Incidents and events are notified or reported to the regulators and other governmental organisations as a result of prescription in law. Other requirements should also be considered such as the Ministerial Reporting Criteria (MRC) and agreements between Regulators and licensees and duty-holders on expectations arising from Site Licence conditions and Environmental Permits

The threshold for reporting to the wider industry is mutually defined in agreements with owners groups and nuclear associations and institutes, such as WANO, INPO, and IRS for example. An additional criteria to determine if an in-house event is to be shared externally with the industry, is whether your plant or facility would have liked to have been informed and learned lessons from it if the event occurred at another plant/facility.

The threshold for reporting within the utility should be established by the corporate organisation. As a general rule the sharing is directed to avoid recurrent failures at other stations, improve plant safety and reliability, support the human performance improvement programme, shield the company fleet from generic deficiencies and help to become a learning organisation.

Low level events and near misses still need to be reported within the plant/organisation, but not necessarily reported outside. Nevertheless it is recommended as good practice to share within the wider nuclear industry the lessons learned from in-house collective analysis of low level events and near misses, and identified trends. The lessons learned can be used to avoid more serious events, provide defence in depth targets, and implement action programmes for improvement. This is one of the prime functions of the UK Nuclear Industry's National OE and Learning Group (OELG).

How to report

The operating organisation should produce guidance and direction on how to report events at their locations. The use of such a procedure ensures that events with major safety significance are quickly communicated to the appropriate organisations both internally and externally, to the organisation's headquarters, regulatory body, the industry, owners groups, world nuclear associations, and any other relevant organisation.

It should be noted that this guidance relates to the activities conducted within an organisation for the purposes of OE. It does not replace and should be read in conjunction with existing regulatory reporting requirements[7] (and the definitions therein regarding notification and reporting) for Licenced Sites and the equivalent for Ministry of Defence (MoD) Authorised Sites.

The process of reporting may require several steps to be completed. For most significant events the reporting is organised in three steps:

Step 1 - Notification

The organisation should have clear protocols identifying, by type or category of event, who is to be informed both on and offsite and within what timescales.

[7]ONR-OPEX-GD-001 Revision 4, Guidance for Notifying and Reporting Incidents and Events to ONR

Step 2 - Initial report

Completion of an initial report from information that is collected in the short term. Depending on the severity and significance of an event this may form the basis for the dissemination of an alert to other operators.

> **For more significant events a fact finding meeting may be used to establish facts that are then fed into the investigation. The fact finding is carried out as soon as practical after the incident and has an aim to generate a time line and identify additional information that is required. It is not used to determine causes or actions.**

Step 3 - Investigation Report

Comprehensive reporting after screening and investigation.

For low level events and near misses the process is often sufficiently completed with the information collected for initial reporting. Due to availability and time constraints (the event occurs during night shift, urgent notification to authorities, etc.), a succinct immediate notification may be needed to be issued, before collection of information is organised and screening takes place. In practice, the level of detail of the report depends on the seriousness of the event, from an initial notification and prompt report to a comprehensive report in accordance with the progress of the collection of information. The reporting plant procedure should stipulate the sequence and the time limits for reporting events, the format for the type of reports and the related administrative arrangements for its distribution and dissemination. As a general rule the events should be reported as quickly as possible after discovery or recognition of the event/condition, for example, notifying in less than one hour, prompt reporting mostly within 24 hours.

The content of the comprehensive report should include sufficient technical details, and whenever appropriate, human factor data for an understanding of the event, i.e. sufficient enough without the need for additional information. The report template should specify mandatory information requirements. The content of the report needs to be commensurate with the importance of the event and the language used should clearly identify if the event is a problem that needs to be corrected or as an item to be improved upon. Report authors should bear in mind the need for the report to be understood by people at other locations so local terminology and abbreviations should be avoided and acronyms explained.

Whilst Licensees/Authorisees are obliged to report specific incidents to statutory bodies, the form of report used may not necessarily serve to assist with dissemination of OE to other operators. Consideration should be given to using a different presentation or format to share the OE among other organisations. In many cases the content is expanded including not only descriptive and compliance information but also other practical information, such as flow diagrams, layout sketches of the affected areas and organisation practices to manage the event.

Content of a high level and a significant event report

Before a comprehensive report is submitted, a prompt initial report with the basic information and description may be needed as soon as possible, to inform the Regulator within the required timescale or to be sent to the screening process for the purpose of defining the level of analysis, selection and further OE communication. These reports may need to be updated with additional developing information for reasons such as:

- Further degradation in the level of safety of the plant.

- Major changes in the perception of the significance of the event as a result of additional evaluation.

- Discovery of new information.

- The need to correct factual errors.

The prompt initial report can then be developed into a comprehensive report, within specified timelines, including the results of the analysis and actions and being updated with further root cause investigations and complementary actions.

The comprehensive report should include the following:

- Basic information

- Narrative description

- Safety assessment (consequences and implications)

- Graphic information to better understand the event (if necessary)

- Causal analysis

- Recommendations and corrective actions taken and/or planned

- Learning identified

Use of OE (Embedment into Organisational Processes)

The vast amount of OE information available to utilities once screened, may be funnelled into various processes - some by virtue of targeted trending programmes by system or department, some by ensuring the process 'pulls' OE into it, for example, making it mandatory for relevant OE to be sought and reviewed before progression to the next stage is authorised. The following should be considered:

- Daily operations meeting - OE agenda item. Ensuring that OE requests are an agenda item in key meetings such as a daily production / operations meeting provides the opportunity for OE to be requested when emerging issues arise. The OE can then be used as part of the data review and any decision making process

- Operational Decision Making - making OE requests and review a formal requirement of the process

- Engineering Plant Health reviews - OE data for each plant area to be analysed

- Mandatory review of OE as part of the plant modifications process

- OE review prior to endorsing and adding a risk to the Risk Register (Business Risk)

- OE review as part of project gating process (review of available learning prior to obtaining funding and collation of all learning during project prior to the close-out). Incorporate reporting as a positive when formulating success criteria.

- Review of relevant OE inclusion in the Contract inaugural meetings

- Selection of OE inserted into training packages and induction training - making the training specific to an organisation and personal experience. Case studies / simulator scenarios created based on real events.

> **OE flags placed on the project plans means a note on each applicable activity on a project plan where there is some learning to be disseminated - for example the 'flag' may be a reference number to an event and the project lead or whoever is setting the group to work that day can use the reference to obtain the relevant flyer for the pre job brief.**

- SQEP / Authorisation process - training packages for operational areas could include grab packs (collection of focussed OE for a given subject, purpose or area) of OE in each area / system. Knowledge of the key OE for each area as a formal requirement in interview to gain SQEP / Authorisation status.

- Outage preparation and execution. Available experience on Outage planning should be reviewed prior to the start of the Outage and reviewed in readiness assessments. Grab packs for project areas can be created and OE flags placed on the project plans

- OE information attached to work packs where relevant

- OE input into Pre Job Briefs and captured in Post Job Briefs

- Ad hoc requests for OE

A number of different methods for communicating the right information to the right work groups at the right point in time can be deployed, some examples are given below:

Publications

- Posters - however, beware of 'poster-blindness'. A small number of well-placed posters, updated regularly can be a useful communication tool. Too many posters, infrequently updated are liable to become part of the wall paper and their effectiveness vastly reduced
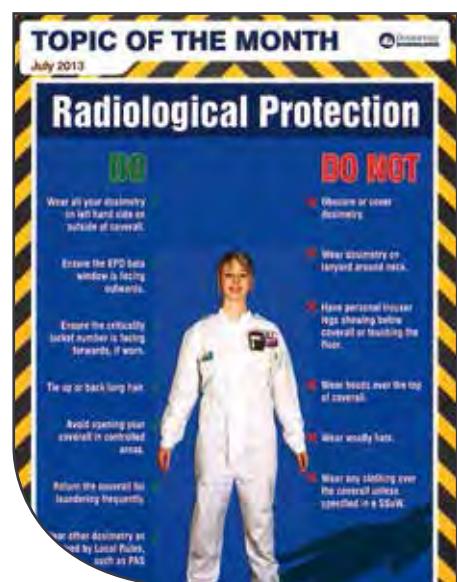
- Colour coded alert flyers - e.g. Red (for action), Amber (for attention), Green (for Information) - again to be updated frequently

- Just In Time (JIT) briefs / booklets - containing brief summaries of the events with emphasis on the concise learning points

- Grab packs - packs containing topic-specific OE, ideally compiled by the working teams or OE Communicators (e.g. fuel disposal, feed pump maintenance etc.)

- Newsletters - communicating succinct learning points from a range of latest events

- OE noticeboards sharing relevant material for the work area (owned and populated by workers)

- Worker created OE bulletins (sharing local knowledge) - e.g. maintenance specific bulletins, promulgating 'local knowledge' - especially useful to share historical knowledge with apprentices and new craftsmen

- Good practices - to understand the learning behind what makes it a good practice, these reports should contain enough detail to allow others to emulate/ replicate the success

- Use of OE in pre job briefs and capturing relevant OE in post job briefs

- Publicising successful use of OE (how using OE prevented an event)

- Regulator communications including production of INF1s and Follow Up Reports

- Key themes - 'Messages of the Day/Week'

Interactive Programmes

- The establishment and maintenance of an OE Communicator programme

- Learning workshops with specific topics / groups

- Pre & post job briefs (emphasis on capturing relevant lessons in post job briefs)

- OE on the agenda in shift handovers / daily operations meetings / general meetings where relevant

- Coaching in OE process / reporting / investigation methodology

- Encouraging the workforce to conduct their own OE searches (database interrogation)

Post Job Brief - Capture feedback from attendees on improvements for next time, Capture any actions taken to improve briefing, procedures, or plant. Any Equipment problems? Unexpected, confusing plant response? Procedure problems? Human performance issues? Actions for Improvement.

Campaigns

- A targeted set of activities to raise awareness of and educate people about specific hazards or failure mechanisms

- Behaviour related campaigns aimed at influencing how personnel act in the work place

An example of a behavioural challenge is where one operator challenged the workforce to go for at least 60 days without breaching certain criteria. At the end of the challenge a donation is made to charity or a small prize given to the entire workforce.

Corrective Actions

Effective arrangements for the management of corrective actions are an essential component of any OE system. Without such arrangements, the learning from industry and internal events will not be used to bring about changes in the organisation. Corrective actions arise from several sources, including: internal events, external events, investigations, industry-wide learning, inspections and reviews (internal and external) and trending of event information. In deriving the actions, every effort should be made to ensure that the actions are SMART and that they are placed with the agreement of the actionee. In the interests of clarity, it is beneficial if the person specifying the action can also stipulate clear acceptance criteria for the closure of the action.

In an attempt to ensure that actions are SMART, some organisations choose to strongly discourage the use of the word "consider" when setting actions. Having placed the actions, with the agreement of the recipient, an effective action tracking and accountability system is required, in order to ensure that actions are completed in a timely manner. This action tracking system is generally part of the integrated OE system, in order that actions can be easily linked to their source.

Review

At a fundamental level the effectiveness of OE could be assessed with one measure - instances of repeat events. However if any element of OE is failing, be it event reporting, investigation, analysis, or dissemination of learning then it will contribute to an increased likelihood of a repeat event and so it is necessary to apply more detailed analysis to the process of OE in order to help locate any shortcomings. The use of Safety Performance Indicators (SPI) is an effective way of assessing the effectiveness of each of these elements as is periodic monitoring and audit.

Typical SPIs

- Number of events that are investigated in accordance with established process.

- Extent of events where the investigators managed to find real root cause(s).

- Amount of time needed for implementation of recommendations resulting from investigations.

- Correlation of trend analyses and statistics to improvements made, based on determination and elimination of root and contributing causes.

- Number of appearances of same root cause.

Typical audit/monitoring questions

- Is there a process for investigation and analysis of events, with the following key features?

  - Identification of roles and responsibilities of those involved in the investigations (ensuring that appropriate experts and staff are involved, including employees concerned in the event);

  - Criteria for determining which events should be subject to investigation, and at what level;

  - Criteria for appointing investigating teams when relevant (with impartial members);

  - Criteria for when external resources should be called in;

  - Procedures for carrying out the investigation (including how to gather evidence from witnesses, documentation, technical reviews and other sources);

  - Procedures for; analysing evidence, determining and analysing root causes, together with contributing causes and for developing conclusions and recommendations.

- Is there a system for follow-up of event investigations in order to eliminate identified shortcomings?

- Is there a system for monitoring the timeliness of investigation reports?

- Is the analysis of the event supplemented by a potential problem analysis of similar situations in other parts of the organisation?

Activities Indicators

- Is there a procedure for taking corrective actions as the result of events? Does this procedure address:

  - Identification of roles and responsibilities for action;

  - When, what, and how to take action;

  - The need to consider technical and managerial actions.

- Is there a system for follow-up of incident investigations and related recommendations and actions? Does this procedure address:

  - Identification of roles and responsibilities for taking and closing out actions

  - Time for implementation/ deadlines

  - Documented follow-up to determine whether recommendations have been followed, what action has been taken and the reasons for such action.

- Is there a procedure for preparing statistical reports and trend analyses to identify common or systemic problems (such as weaknesses in training, procedures, maintenance or inadequate source of technology)?

- Is there a procedure for taking corrective actions as a result of trending?

- Is there a system for analysis of reported events, addressing e.g.

  - Type of events involved

  - Why numbers are going up or down.

- Is there an efficient and effective system for disseminating the results of event investigations, statistical reports and trend analyses? Is the information effectively disseminated:

  - Inside the organisation to all concerned;

  - To other companies within the industry;

  - To stakeholders outside the organisation (including, e.g. public authorities, media, neighbours, the public).

Assessing OE Use - Self Assessment

The overall effectiveness of how well the organisation uses OE should be reviewed periodically and routinely as part of the response to their own events.

Personnel within the organisation should frequently monitor how effectively they have used OE information to improve organisational performance. Effectiveness reviews provide feedback to senior management on performance and corrective actions to resolve weaknesses. These reviews are not solely intended to be evaluations of compliance with the various administrative requirements; they should also focus on how effective the use of OE has been to prevent or reduce the severity and the recurrence rate of events and how well personnel across the organisation have internalised lessons from OE.

These reviews should include a representative sample of recent OE information from all sources, which personnel within the organisation then analyse regularly. The organisations procedures, training documentation, action item tracking logs or databases, and interviews are also used when effectiveness reviews are conducted. Other techniques that may be useful include the following:

- Interview personnel to determine their awareness of lessons learned from organisations or industry OE that apply to their jobs

- Monitor events across the organisation for similarities to previous industry and local experience. Determine if the lessons learned from the industry experience were internalised and, if not, what weakness precluded that from occurring

- Review several recent design changes and organisational modifications; and determine if OE, including equipment failure information, was considered

- Review recent event investigations within the organisation, and determine if industry experience was considered to help identify potential causal factors and possible corrective actions

- Review corrective actions from past internal and industry events, and confirm they are still effective. For example, training material and the organisations procedures are reviewed to determine if revisions may have unintentionally deleted or changed information that had been added as corrective actions. Interview operations, engineering, and maintenance personnel to determine their awareness of revised expectations and practices

- Review how effectively the components of an OE system (as illustrated on page 10) are implemented

Objective measures of performance, such as the number of OE documents waiting for review and the number of overdue action items associated with OE documents, are assessed. Broader subjective measures that could also be monitored are the thoroughness of root cause analyses and how effectively applicable information from previous industry and internal event experience was identified.

An overall review of all aspects of OE use is conducted periodically (for example, every two years). However, the frequency for this effectiveness review is based on management's assessment of how well OE is being used and on the results of feedback from line managers and external reviewers.

Personnel familiar with the organisation event investigation methodology conduct the effectiveness reviews. Personnel from other organisations or utilities could assist in the reviews on a reciprocal basis. Several organisations have found this practice valuable, as outside personnel often provide additional perspectives and see potential problems that the local staff sometimes overlooks.

The organisation's management should discuss problems and deficiencies identified in the overall administration and use of OE. Identified weaknesses are assessed to determine their underlying causes and effects on overall programme performance, and corrective actions are recommended.

The recommended actions to address identified weaknesses should be prioritised and tracked to completion. Identify strengths and communicate them to personnel across the organisation, demonstrating how effective use of OE enhances the organisations performance.

The effectiveness of Peer Review should also be considered whether from within the organisation or by requesting external reviews and Peer Assists including those accessible via WANO.

Training

OE is an organisation wide function and not the sole responsibility of a single department. The OE department or team, where in existence, should be responsible for facilitating the processes of OE, providing a point of contact for guidance, support and information; the provision of specialist analytical techniques and the collating and interpretation of trending information. OE training is therefore applicable to all. The level and specific requirements of OE training will, however, differ according to role, responsibility and area of expertise. It should be recognised that all personnel at a location, including short term contractors, should be suitably trained so as to understand the prevailing safety culture and their duty to identify and report areas for improvement and the occurrence of any safety related events and near misses.

A training needs analysis should be undertaken to identify the specific items of training required to ensure an effective OE process. This will include:

- Use of the OE system,

- Event investigation

- Trending

Whilst there are some proprietary OE related training packages available, the suitability of such packages will depend on the specifics of the OE system in use within the organisation/facility.

Conclusions

The information in this Guide to Good Practice has been drawn from the collective experience of a significant number of OE practitioners across a range of nuclear installations. It is not the intention to provide a 'model' OE process to be adopted by all who aspire to have the best possible OE arrangements; rather it provides a guide to good practice in each of the elements of an OE process, which can be adopted to suit the needs of individual organisations.

It is intended that this Guide will be updated as other relevant good practices are identified.

It should be recognised that adoption of the good practices identified in this guide will not in themselves lead to an effective OE process. For the practices identified in this guide to be fully effective, a healthy and positive safety and reporting culture is essential. Without this, the reporting of events, which is the basis of an effective OE process, will be ineffective and hence the achievement of an effective OE process will be unattainable.

Glossary

AC	Authorisation Condition
IAEA	International Atomic Energy Authority
IRS	(IAEA) International Reporting System
INPO	Institute of Nuclear Power Operations
LC	Licence Condition
LfE	Learning from Experience
OE	Operating Experience
OELG	Operating and Experience Learning Group
ONR	Office for Nuclear Regulation
SAP	Safety Assessment Principle
SDF	Safety Directors Forum
SMART	Specific, Measurable, Achievable, Realistic, Timel-Bound
SQEP	Suitably Qualified and Experienced Person
WANO	World Association of Nuclear Operators

Appendix A - Reporting Ratios Example

Graph displaying that for the greater number of minor events and near-misses reported, the number of significant events reduces (taken from Wylfa Power Station historical data).