

OPERATING EXPERIENCE FEEDBACK OF A NUCLEAR FACILITY

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With regard to new nuclear facilities, this Guide shall apply as of 1 December 2013 until further notice. With regard to operating nuclear facilities and those under construction, this Guide shall be enforced through a separate decision to be taken by STUK. This Guide replaces Guides YVL 1.11 and YVL 1.12.

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Authorisation

According to Section 7 r of the Nuclear Energy Act (990/1987), *the Radiation and Nuclear Safety Authority (STUK) shall specify detailed safety requirements for the implementation of the safety level in accordance with the Nuclear Energy Act.*

Rules for application

The publication of a YVL Guide shall not, as such, alter any previous decisions made by STUK. After having heard the parties concerned STUK will issue a separate decision as to how a new or revised YVL Guide is to be applied to operating nuclear facilities or those under construction, and to licensees' operational activities. The Guide shall apply as it stands to new nuclear facilities and to other use of nuclear energy.

When considering how the new safety requirements presented in the YVL Guides shall be applied to the operating nuclear facilities, or to those under construction, STUK will take due account of the principles laid down in Section 7 a of the Nuclear Energy Act (990/1987): *The safety of nuclear energy use shall be maintained at as high a level as practically possible. For the further development of safety, measures shall be implemented that can be considered justified considering operating experience, safety research and advances in science and technology.*

According to Section 7 r(3) of the Nuclear Energy Act, *the safety requirements of the Radiation and Nuclear Safety Authority (STUK) are binding on the licensee, while preserving the licensee's right to propose an alternative procedure or solution to that provided for in the regulations. If the licensee can convincingly demonstrate that the proposed procedure or solution will implement safety standards in accordance with this Act, the Radiation and Nuclear Safety Authority (STUK) may approve a procedure or solution by which the safety level set forth is achieved.*

1 Introduction

101. According to Section 24 of Government Decree 717/2013, operating experience feedback and safety research results shall be monitored and assessed in order to enhance safety. Safety-significant operational events shall be investigated for the purpose of identifying the immediate and underlying causes as well as defining and implementing the corrective and preventive actions. According to Section 29 of the Decree, systematic procedures shall be in place for identifying and correcting deviations significant in terms of safety.

102. One necessary prerequisite for the safe and reliable operation of nuclear facilities is that lessons are learnt from the experience accumulated during the course of the construction and operation of both own and other facilities. In the present Guide, this activity is generally referred to as operating experience feedback. The purpose of this activity is to prevent accidents and other events adverse to safety by identifying and eliminating circumstances leading to failures, flaws and non-conformities, and by underlining sound procedures proven at both own and other facilities.

103. Operating experience feedback covers all significant flaws, observations and good practices in terms of the design, construction, technical implementation, operation and decommissioning of nuclear facilities, and the management systems covering the said stages. Furthermore, operating experience feedback encompasses the experiences gained from the activities of key suppliers and contractors. Additionally, effective use is to be made of the operating experiences accumulated at other nuclear facilities in Finland and abroad. The requirements pertaining to the safety of disposal of nuclear waste are set out in Sections 18 and 20 of Government Decree 736/2008.

104. To make efficient use of construction and operating experience, the licensee shall identify, analyse, investigate and report events related to the construction and operation of nuclear facilities. Operational events here refer to such developments, failures, flaws and problems that are of relevance in terms of nuclear or radiation safety.

105. With the help of reports and other records, the construction and operation of, the operational events occurring at, and the modifications made to the facility may also be assessed and analysed afterwards. It is of great importance to safety what lessons are learnt from the events and how this is done, and how the personnel is encouraged to raise any needs for developing the procedures detected in the internal activities and those of others.

106. According to Section 63(9) of the Nuclear Energy Act (990/1987), STUK may *investigate an abnormal event or procedure observed in the use of nuclear energy that is, or may be, of significant importance to the safe use of nuclear energy; those performing the investigation may also hear individuals other than those employed by the licensee who are involved in the matter or otherwise have knowledge of it.*

107. The requirements pertaining to emergency arrangements and plans at nuclear power plants are set out in Government Decree 716/2013.

2 Scope

201. This Guide sets forth the criteria and requirements for operating experience feedback, in particular in respect of the utilisation of the experiences gained from the construction and operation of nuclear facilities. The requirements specified in this Guide apply to nuclear facilities throughout their entire lifecycle. While this Guide primarily addresses operating nuclear power plants, it shall also be applied to other nuclear facilities with due regard to their special features. With regard to nuclear facilities under construction, this Guide shall be applied with due account taken of the requirements of Guide YVL A.5. Guide YVL D.2 shall be applied to events related to transports.

202. This Guide provides a description of the licensee's responsibilities regarding the classification, analysis and investigation of the events, and the measures taken in response to such events.

203. This Guide specifies the feedback notifications and reports required by STUK on operational events taking place at nuclear facilities,

including the requirements for the submission of such reports to STUK.

204. This Guide provides a description of the responsibilities for determining the INES (International Nuclear and Radiological Event Scale) rating, i.e. the severity rating of nuclear facility and radiation events in Finland.

205. This Guide details the requirements pertaining to the reporting of events at Finnish nuclear facilities to other facilities and authorities through international reporting systems such as the IRS system maintained by the IAEA and OECD/NEA.

3 Organising operating experience feedback

301. The licensee is required to ensure that operating experience feedback has appropriate objectives, structured procedures, adequate resources and the full support of the top management.

302. The licensee shall put in place documented procedures to help to systematically identify, select for further processing, investigate and save operating experiences.

303. The licensee's organisation is required to assess plant design, its own operations and safety culture in the light of such operating experience.

304. All the tasks and responsibilities related to operating experience feedback must be clearly defined and duly documented.

305. The licensee shall ensure that the procedures applied in operating experience feedback yield results and help all relevant parties to learn from such experience.

306. The licensee shall designate the individuals responsible for operating experience feedback procedures and the investigation of events and ensure that they are provided with adequate training, sufficient time and other resources for carrying out the activities while receiving the full support of the line organisation. They are tasked

to implement the procedures of operating experience feedback, issue recommendations for actions to be taken and forward all observations relevant to safety to the responsible manager. All significant findings and trends shall be reported to the licensee's top management.

307. Where appropriate, the licensee shall maintain liaison with the organisations involved in the design and construction of the nuclear facility (manufacturer, research organisation, designer). The objective is to exchange operating experience feedback and secure advice in case of equipment failures and abnormal events.

4 Events at other nuclear facilities

401. Events at other nuclear facilities shall be processed in accordance with the general requirements specified in section 3 and the requirements for continuous improvement specified in section 6.

402. The licensee shall systematically evaluate information on operational events at other nuclear facilities made available through various channels by making use of the relevant international reporting systems. In case of highly significant events, such evaluation shall be carried out without delay.

403. When events at other nuclear facilities is screened for closer study, due consideration shall be given to the following:

- general applicability to the facility, organisation and operating environment;
- are there similar installations, systems or structures at the facility;
- are there similar procedures in place at the facility that could give rise to a similar event;
- any prior events of a similar type at the own facility.

404. A summary shall be made of each assessment in which similar events and the probability for the occurrence of a similar event at the own facility are presented.

405. The necessary actions complete with deadlines and responsibilities shall be determined based on a detailed analysis of the sequence of events. The implementation of the actions shall be duly monitored.

5 Event analysis and investigation

5.1 Identifying and selecting events for further processing

501. The licensee shall require all of its personnel and subcontractors to report any operational events and encourage them to draw attention to any shortcomings related to plant safety.

502. The licensee shall select for further processing and classify events significant to plant safety and the operations of the organisations involved, and specify the applicable selection and classification criteria to this end. Any need for investigation and reporting shall be determined after classification.

503. In order to ensure the availability of adequate expertise and that the organisation is able to draw the required lessons, the following resources shall be made available for the analysis and investigation of operational events:

- representation by the various organisational units;
- competence in the methods of investigation;
- technical expertise;
- expertise related to human and organisational performance.

504. The events shall be analysed or investigated in accordance with their significance. While an analysis is enough for a majority of events, the most significant events shall be duly investigated.

505. The event classification criteria shall at least include the following:

- the actual or potential nuclear or radiation safety significance of the event;
- the recurrence of the event or the potential for such recurrence;
- the frequency of the flaw, problem or phenomenon detected;

- the substantial benefits in terms of lessons learnt and the dissemination of experimental knowledge yielded by the investigation of the event.

506. All events shall be analysed or investigated on a time scale consistent with the safety significance of the event concerned. The analysis or investigation shall at least address the following:

- the sequence of events, situation control and non-conformities relative to normal operation;
- a safety assessment and potential safety significance;
- the circumstances contributing to the event;
- the recurrence of similar events or frequency of similar causes;
- corrective and preventive actions.

5.2 Investigation of events

507. The licensee shall have in place:

- structured investigation procedures that also cover factors related to human and organisational performance as well as the review of the management system;
- selection procedures for determining the appropriate method of investigation for the event concerned.

508. An analysis of root causes is required when the event involves circumstances that have, or may have, significant implications for plant safety. The analysis of root causes may identify structural problems in the activities of the organisation so as to provide indications for the determination of direct causes, for example. Possible examples of such indications include complex cause-effect relationships, communications problems, or vaguely defined responsibilities.

509. The licensee shall appoint an investigation team to carry out the analysis of the root causes. The team shall perform its work under the direction of the responsible manager or other party independent of the event. Broad-based expertise shall be represented in the investigation team. The head of the investigation team shall possess competence in investigation and analysis methodology and have experience from actual investigations. The investigation team shall be given

an adequate induction to their duties before the commencement of the investigation.

510. The licensee shall provide the individuals participating in the investigation of events with adequate powers and resources.

511. Circumstances may be uncovered during the investigation that call for a re-assessment of the event's safety significance. If so, the investigation and related measures shall be re-defined.

5.3 Corrective and preventive actions and their effectiveness

512. In order to prevent the recurrence of the event and to improve the level of safety where necessary, the licensee shall take corrective and preventive actions in response to the findings of the investigation. Such actions may include technical modifications at the plant, its structures, components and systems; changes to operations and operating instructions, surveillance or inspection activities; and changes in the organisation and in the training provided to personnel.

513. A traceable link shall exist between the uncovered root causes and detected flaws on the one hand and the corrective and preventive actions on the other.

514. The licensee shall determine and document the timetable and responsibilities for corrective and preventive actions.

515. The licensee shall prioritise the actions primarily in terms of their safety significance, and also in terms of feasibility and effectiveness.

516. The licensee shall maintain an up-to-date database on operational events that are currently being analysed and on those that have been closed. Similarly, records shall be kept of the progress and implementation of corrective and preventive actions.

517. The licensee shall monitor the progress achieved in the implementation of the decisions made regarding the corrective and preventive actions. Any changes in implementation shall be

processed in the same way as the decisions on the corrective and preventive actions originally made.

6 Utilization of operating experience data

6.1 Generic investigation and trend analysis

601. The licensee shall store the data relevant to operating experience accumulated on plant operation and operational events. The data shall be organised, documented and stored in such a way that it can be easily retrieved, searched, screened and assessed.

602. The licensee shall carry out a generic investigation of multiple events when similarities can be seen with regard to their underlying technical causes, organisational or human factors, or other recurrence of problems.

603. The licensee shall carry out trend analyses and prepare a range of summaries in order to identify weaknesses and movements in trends at the facility by making use of data significant in terms of operating experience feedback, such as maintenance and non-conformity data and other databases.

6.2 Continuous improvement

604. The licensee shall ensure that the operating experience data is duly disseminated to the different organisational functions involved.

605. In the training programmes of individuals holding positions important for safety, due consideration shall be given to internal operating experience and to the operating experience received from other facilities insofar as deemed relevant to their own facility.

606. The licensee shall annually evaluate the efficiency of the operating experience feedback process and any need for improvement. When doing so, the licensee shall:

- evaluate the attainment of the objectives set for operating experience feedback process, the adequacy of the resources allocated and the efficiency of the procedures applied;

- identify trends or the recurrence of developments essential to safety on the basis of the occurred events;
- determine whether the preventive and corrective actions have been correctly prioritised and completed by the set date, and how effective they are in terms of preventing a recurrence of the events;
- identify the reasons why any actions have not been completed correctly and by the set date, and determine the additional actions required;
- prepare a list of the events addressed in connection with events at other nuclear facilities, including related preventive actions and their current status.

607. The licensee shall evaluate the effectiveness of the operating experience feedback process in terms of pre-defined performance criteria as part of its self-assessment programme.

608. A peer review group shall review the operating experience feedback process at least once between periodic safety assessments.

7 Notification of events and reporting

7.1 Prompt notification of events

701. The licensee shall promptly notify STUK of any events affecting the nuclear or radiation safety of a nuclear facility by calling STUK's 24h emergency number and include such events in the next daily report. Even events that do not directly affect nuclear or radiation safety but may be anticipated to arouse public interest shall be notified following the same procedure. The 24h emergency number and its back-up numbers and other more detailed reporting instructions are issued to the licensees separately.

7.2 Preliminary operational event report and INES scale

702. The licensee shall, without delay, make a preliminary assessment of the safety significance of the event in order to determine whether the plant has performed as planned, and to decide whether any immediate further actions are re-

quired to ensure the safety of the plant, people and the environment.

703. The licensee shall have pre-defined procedures in place for the preparation of an immediate safety assessment as well as access to experts for this purpose.

704. The licensee shall use the immediate safety assessment to determine whether the event is of such safety significance that a preliminary operational event report to STUK providing a description of the event, an evaluation of its safety significance and the licensee's proposal for the appropriate INES rating is called for. The report shall be submitted to STUK for information by e-mail or fax as quickly as possible with due regard to the safety significance of the event. Events of Level 2 or higher on the INES scale shall be reported no later than eight hours from the occurrence of the event.

705. The licensee shall have in place structured procedures and designated responsible individuals for the determination of the INES rating. Determination of the INES rating is also part of the duties of the emergency organisation.

706. Events shall be rated in accordance with the latest edition of the IAEA's INES User's Manual. If the licensee operating a nuclear facility finds it advisable to revise the INES scale because of findings made in the course of subsequent analyses and evaluations, STUK shall be notified of the new proposed INES rating.

7.3 Operational event report

707. A list of the events to be reported is provided in Annex A. The operational event reports listed under items A01 through A07 shall be submitted to STUK for approval and the operational event reports listed under item A08 for information.

708. The operational event report shall be submitted to STUK within two months of the detection of the event.

709. The analysis of root causes shall be submitted for information within four months of the detection of the reportable event. Generic inves-

tigations shall be submitted for information upon completion in accordance with the timetable defined by the licensee.

710. The content of the operational event reports to be submitted to STUK are presented in Annex B. The report shall address the issues to the level of accuracy consistent with what is essential about the event being reported.

711. Operational events that do not trigger the reporting threshold shall be addressed internally in order to improve the licensee's own operations.

7.4 Other reporting

712. The licensee shall submit a follow-up report for information if any changes have taken place in the information presented in the report, or if STUK finds this necessary in order to monitor corrective and preventive actions.

713. The licensee shall submit a summary report as defined in requirement 606 to STUK for information by 1 March of the following year, describing what use has been made of the internal and external operating experience during the preceding calendar year.

8 Regulatory oversight by the Radiation and Nuclear Safety Authority

801. STUK oversees the licensee's performance in implementing the operating experience feedback programme as part of its inspection activities. Such oversight includes a review of the operating instructions and reports submitted to STUK, and the follow-up on the actions taken in response to such reports. STUK reviews the procedures applied in the operating experience feedback process and its effectiveness based on reports and on-site inspections.

802. Based on the notifications of events and preliminary reporting, STUK evaluates the safety significance of the operational events, the need for any changes to operations and communications directed at parties outside STUK. STUK determines the preliminary INES scale of the event either based on the licensee's evaluation or independently. STUK determines the final INES scale of the event when reviewing the report on the event. STUK oversees the licensee's performance in the determination of the INES scale, both in connection with the events as they occur and as a part of its inspection activities.

803. STUK evaluates the investigation of events carried out by the licensee based on the operational event reports. STUK uses the reports to arrive at an independent evaluation of the adequacy of the investigation and the corrective and preventive actions taken. When the events occur, STUK may carry out investigations and inspections or conduct interviews in order to obtain additional information.

804. STUK will appoint its own investigation team to look into non-conformities or procedures that are, or may be, of major importance to the safe use of nuclear energy. Such investigations are carried out especially when STUK finds an independent investigation necessary due to the nature of the event.

805. STUK reports on events significant to nuclear and radiation safety in accordance with the relevant international treaties and principles.

806. STUK reports important events or experiences that it expects to be of use to the regulatory authorities of other countries through the international reporting system maintained by the IAEA and OECD/NEA.

807. STUK disseminates information about the events by means of publications, web pages and various kinds of announcements.

Definitions

Preventive action

Preventive action shall refer to a measure intended to eliminate the cause of a potential deviation or other undesirable situation.

INES scale

INES scale (International Nuclear and Radiological Event Scale) shall refer to the IAEA's international classification scale of nuclear facility events and radiological events used to estimate and illustrate the radiation and nuclear safety significance of events when communicating on them. The INES scale is not applied to events which have no influence on radiation or nuclear safety.

IRS system

IRS system (Joint IAEA/NEA International Reporting System for Operating Experience) shall refer to the operating experience reporting system maintained by the IAEA and in use in its member states. The system is used to report events and experiences related to operation and decommissioning, the causes of which and lessons learned have significance on a global scale.

Correction

Correction shall refer to an action that is performed in order to eliminate observed detected nonconformity.

Corrective action

Corrective action shall refer to an action intended to eliminate a nonconformity or other undesirable situation.

Operational event

Operational event shall refer to a failure, flaw or non-conformity in safety functions, systems, components, structures or an organisation's activities that has a bearing on radiation safety or nuclear safety. Operational events also include emergencies and disturbances as well as events compromising radiation safety. Operational events also include events taking place during the construction phase.

Contributory factors

Contributory factors shall refer to events or conditions that, together with the other causes, increase the probability of an accident but will not cause the event alone.

Root causes

Root causes shall refer to factors that explain the occurrence of direct causes. They indicate the suitable corrective action to be taken in order to avoid similar events. Root causes are those causes related to activities that can be identified and corrected with reasonable effort. In order for a cause to be considered a root cause, it must fulfil one of the following three conditions: the issue is replicable; the issue would not have occurred had this cause not existed; and the issue will not occur due to this cause if a correction is made.

Event analysis

Event analysis shall refer to the identification of faults and the factors resulting in faults.

Event investigation

Event investigation shall refer to investigating the progress, causes and consequences of an event, identifying the factors resulting in the event, and estimating the measures required to prevent the occurrence of similar events. Systematic and documented methods must be used in the investigation.

Generic investigation

Generic investigation shall refer to an analysis or investigation using information concerning several similar events.

Trend analysis

Trend analysis shall refer to the procedures to identify degradation or undesired developments by means of analysing events or failures that have occurred.

Operational Limits and Conditions (OLC)

The Operational Limits and Conditions (OLC) set out the technical and administrative requirements for ensuring the plant's operation in compliance with the design bases and safety analyses; the requirements for ensuring the

operability of systems, structures and components important to safety; and the limitations that must be observed in the event of component failure.

External events

External events shall refer to exceptional situations or incidents occurring in the vicinity of a nuclear power plant that could have a detrimental effect on the safety or operation of the plant.

Peer review group

Peer review group shall refer to a team of experts from other facilities who perform an inspection.

Direct causes

Direct causes shall refer to immediate events or conditions that cause an event.

References

1. Nuclear Energy Act (990/1987).
2. Government Decree on the Safety of Nuclear Power Plants (717/2013).
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4. Safety of Nuclear Power Plant Design, IAEA Safety Standards Series No. SSR-2/1. Vienna, 2012.
5. A System for the Feedback of Experience from Events in Nuclear Installations. Safety Guide IAEA Safety Standards Series No. NS-G-2.11. Vienna, 2006.
6. Improving the International System for Operating Experience Feedback INSAG-23. A Report By The International Nuclear Safety Group. Vienna, 2006.
7. WENRA Reactor Safety Reference Levels J: System for Investigation of Events and Operational Experience Feedback. January 2008.
8. The Use of International Operating Experience Feedback for Improving Nuclear Safety. Committee on Nuclear Activities (CNRA), OECD Nuclear Energy Agency. NEA/CNRA/R (2008)3. January 2008.
9. Current Status of the National Operating Experience Feedback Programs. Committee on Nuclear Activities (CNRA), OECD Nuclear Energy Agency. Nuclear regulation. NEA/CNRA/R (2009)2. February 2009.
10. INES The International Nuclear and Radiological Event Scale. User's Manual. IAEA and OECD/NEA. Vienna, 2009.

Annex A Reporting instructions

The reportable events are as follows:

A01. Emergency situations

- An emergency standby, site emergency or general emergency has been declared at a nuclear facility (Guide YVL C.5).

A02. Events related to radiation safety

- Uncontrolled radioactive leak inside the plant resulting in substantially increased air or surface contamination or radiation dose rates in the spaces involved.
- The radiation dose incurred by any individual may have exceeded the dose limit (Guide YVL C.2).
- Radioactive releases into the environment have exceeded the limit requiring corrective actions (Guide YVL C.3).

A03. Special situations related to the Operational Limits and Conditions (OLC)

- The plant has been deliberately or accidentally operated in non-compliance of the OLC.

A04. Events related to safety functions as well as failures of and damage to systems, structures and components

- An automatic protection system function fails to be triggered even though a parameter exceeds the protection limit defined in the OLC, or a protection function fails to be completed as designed.
- An increase is detected in the radioactivity of the reactor coolant suggesting a failure of several fuel rods or significant damage to a single fuel rod; or an exceptional leak in or degradation of the primary circuit; or degradation of the containment to the extent that it no longer meets the requirements specified for tightness or strength.
- A malfunction or significantly defective performance of a safety valve or pressure relief valve is detected in the primary or secondary circuit.
- The emergency core cooling system or isolation of the containment is actuated during an

actual event. The isolation of some process systems that routinely occur after a reactor scram is not deemed to constitute such isolation of the containment.

A05. Events endangering safety functions

- A failure, operational error or deficiency; an incorrect process, automation or electrical connection; an incorrect instruction or other reason potentially preventing the performance of a safety function is detected.
- A common cause failure or recurrent defects or malfunctions in an important safety function-related component type, system, structure or function are detected.
- A liquid or gas leak, fire or explosion at the plant gives rise to circumstances that endanger or may endanger the performance of any safety function.
- A departure of more than 1% from the estimated value of the reactor multiplication factor in a stationary state, or the possibility of unplanned criticality inside or outside the reactor is detected.

A06. Weaknesses in safety management or assessment

- A problem or flaw with significant or potentially significant safety implications is detected in the management system or in the compliance with safety regulations.

A07. External events

- An atypical natural phenomenon or other external event affecting the plant gives rise to a situation compromising safety.
- Off-site power is lost, which results in it being necessary to supply the plant's AC systems from on-site electrical power supply units.

A08. Other events

- A significant flaw is found in the design bases, design, implementation or inspection procedure during a construction or modification project.
- Reactor scram, turbine trip and other transients resulting in a forced reduction of more than 5% in the reactor or gross electric power.
- Significant operational occurrences, failures and changes in the performance of the plant

unit or its systems, or their operation or operating conditions.

- An automatic protection function related to plant safety is triggered when it should not.
- A fuel rod assembly is damaged during handling, or may have been damaged or subjected to the risk of damage as a result of some other event.
- An error is detected in an accident analysis, analysis method or some other basis for the OLC and there is reason to believe that the operation of the plant under certain circumstances is not as safe as previously assessed or foreseen in the design bases.
- A fire, explosion or other accident involving a general risk occurs on the plant site without, however, directly compromising the plant's nuclear and radiation safety.

however, directly compromising the plant's nuclear and radiation safety.

- A threat to the plant's security arrangements or an attempt at deliberate damage to the plant is detected or a significant flaw is found in nuclear security (Guide YVL A.11). When such events are reported, due consideration shall be given to the secrecy provisions set forth in the applicable laws (Section 78 of the Nuclear Energy Act and Section 24 of the Act on the Openness of Government Activities).
- Other events related to radiation or nuclear safety which the licensee determines to be reportable to the authorities, or on which a report is required by STUK.

Annex B Requirements concerning the content of the reports to be submitted to STUK

The reports shall address the following issues. Analyses of root causes may be subject to other requirements specified for the procedures to be used. If so, the operational event report may omit sections that will subsequently be addressed in the root cause analysis.

B01. *Event description.* A description shall be provided of the circumstances in which the event is detected, including the sequence of events complete with preceding and subsequent measures. The sequence of events shall describe the last normal condition preceding the event and the immediate correction subsequent to the event. Activities of the organisation involved in the event: an evaluation shall be made of the procedures, instructions and responsibilities as well as their applicability.

B02. *Safety assessment.* The performance of the systems involved in the event and their implications for the assurance of safety functions shall be evaluated. The safety assessment shall establish the safety significance of the event and potential consequences in the various operating conditions. A probabilistic risk assessment (PRA) or other risk analysis shall be prepared of the event if applicable. The accuracy of the system design and design documents, including the FSAR, OLC and classification document, shall be evaluated.

B03. *Causes and contributory causes of the event.* The report shall address direct causes and contributory factors. The analysis of the causes shall identify the issues related to the organisation's activities such as management; staff action; assumptions and skills; co-operation and communications; adequacy of resources; the management of external actors and change management; organisational *modi operandi* and decision making. Additionally, it is necessary to identify the factors in the organisation's safety culture that contributed to the sequence of events.

B04. *Recurrence or frequency of causes.* The frequency of the phenomenon or problem at the facility and the incidence and significance of the causes and factors contributing to the event elsewhere at the plant shall be investigated. The report shall address the recurrence of similar events or events resulting from similar causes and the corrective and preventive actions taken in response to such events.

B05. *Corrective and preventive actions taken to avoid the recurrence of similar events.* An implementation plan shall be prepared for corrective and preventive actions complete with an advance evaluation of the feasibility and effectiveness of such actions. The actions shall be presented in highly concrete terms, the related responsibilities shall be defined and deadlines established for implementation. All actions shall be traceable to identified causes.

B06. *Lessons learnt and measures taken to improve performance.* Lessons learnt and measures taken to improve performance shall be identified in the course of the investigation. One aspect of the lessons learnt is the development of the safety culture and dissemination of information. The investigation of an individual event may give an opportunity to improve performance at a more general level or disseminate good practices.

B07. *Simulation of the sequence of events.* A description of the sequence of events shall be provided in a graphic format. This means that the individual stages before and after the event are presented in a logical sequence. The diagram shall present the cause-and-effect relationships leading up to the events and the contributory factors at the various levels of the organisation.

B08. *Diagrams and images.* Graphic presentations depicting the process performance (e.g. pressure levels, temperatures, flow rates), images and drawings, diagrams, print-outs, parameter changes, test results or other failure data recorded during the event shall be attached to the report.