Systematisation of the use of experience feedback from NPP's in the regulatory field

A. Vandewalle

Association Vinçotte Nuclear Rue Walcourt 148 Walcourtstraat B-1070 Brussels

Abstract:

Operating experience activities are important to maintain and to improve nuclear safety for Nuclear Power plant installations. Although with somewhat other objectives, the same kind of activities has to be performed by the regulatory organisations to support their functions, responsibilities and missions, without duplications and wastage of resources. International cooperation to share experience gained from events is also essential in this improvement process and each regulatory organisation should participate to this fundamental support to nuclear safety.

1 INTRODUCTION

Operating experience feedback based on events is usually considered as important in the improvement process of the Licensee organisations. Is it useful to perform similar kind of activities by the regulatory organisation? Is it not a wastage of resources by duplicating the activities performed elsewhere?

Although with other purposes and objectives, experience feedback activities performed by the regulatory organisation can be very beneficial to the improvement of overall safety of the Nuclear Power Plants. It can also improve the efficiency and the effectiveness of the regulatory organisations.

Operating experience feedback outcomes can be very useful not only to assess the performance of the NPP organisation but also to support different processes inside the regulatory organisations.

2 IMPORTANCE OF EXPERIENCE FEEDBACK

To maintain and improve the safety for Nuclear Power Plants, an operational experience system should be in place so that:

- no safety related event remains undetected;
- corrections are made to prevent the recurrence of safety related events.

Effective operating experience feedback leads to improve the design and/or the operation of the installation.
This relies on the concept that an accident of any severity would most probably has been marked by precursor events, and to this extent would have been predictable and, therefore, avoidable. Feedback of experience also increases knowledge of the operating characteristics of equipment and performance trends, and provides data for quantitative and qualitative safety analysis.

Event investigating and reporting contributes thus to improvements in nuclear safety and has the following objectives:

- to identify and assess events and conditions that are precursors to significant degradation and have the potential to cause accidents that could lead to radioactive releases;
- to identify events that are important to safety and their associated safety concerns and root causes, and to determine corrective actions to be taken to address the safety concerns;
- to discover emerging trends or patterns of potential safety significance;
- to assess what could have happened;
- to assess the generic applicability of events;
- to prevent recurrence of similar events.

The Licensee should maintain an effective system for collection and analysis of operational experience. He should disseminate safety significant information in a timely manner among its own staff and to other relevant organisations. The causes of all safety significant events should be determined and analysed. Events that may be regarded as precursors of accidents should also be identified and actions should be taken to prevent any recurrence. Each operating organisation should learn from the experience of other organisations.

The concept of defence in depth (DID) is applied to the design of Nuclear Power Plants in order to avoid as much as possible the occurrence of incidents or accidents. If they occur, DID aims at limiting their potential consequences and preventing any evolution to more serious conditions. DID consists in a hierarchical deployment of different levels of equipments and procedures in order to maintain the effectiveness of physical barriers placed between radioactive materials and workers, the public or the environment. This strategy is applied in normal operation, in incidents and, for some barriers, in accidents at the plant. DID is implemented through design and operation to provide a graded protection against a wide variety of transients, incidents and accidents. Equipment failures and human errors within the plant as well as events initiated outside the plant are considered generally in this approach.

Events can be indicators of a weakness in, or a failure of one or more of the DID barriers. In many cases events may also indicate lack of adequate supervision or deficiencies in the safety management of the nuclear installation.

Events have to be taken as opportunities for learning and an effective experience feedback system is necessary to handle this learning opportunity and to transform it into the continuous improvement of the safety of a NPP.

3 THE REGULATORY ORGANISATION AND THE EXPERIENCE FEEDBACK SYSTEM

3.1 Role of the regulator and responsibility of the Licensee

The role of the regulatory body[1] is reminded in appendix. In a few words, the regulator should be able to deliver authorizations, perform regulatory reviews and assessments, perform inspections and enforcements and establish safety principles, criteria regulations and guides.

[1] In this document, as it may differ from country to country, the regulatory body is to be understood as the regulatory organisation itself or the group of organisations (e.g. regulatory body and technical support organisation) that fulfil the role.

The Licensee has the responsibility for the safe operation of the nuclear power plant. The management of the plant shall ensure that the plant is operated in a safe manner and in accordance with all legal and regulatory requirements.

3.2 Why should the regulator perform experience feedback activities

As it will be explained further on, the experience feedback process by the Regulator has multiple facets. Some of these activities are directly related to its regulatory missions, some others are supporting these missions.

3.2.1 Fulfilment of RB mission -The verification of the operating experience feedback process by the Licensee

According to its responsibilities, the Licensee seems to be the only one that has to take care of events and to handle them with an effective experience feedback process. However, the regulator, as mentioned in the IAEA safety standard GS-R-1 has to verify that operating experience is appropriately analysed and that lessons to be learned are disseminated.

The objectives of the operational experience process of the regulator have to be consistent with its fundamental mission, i.e. the surveillance of the effectiveness of the nuclear safety management and radioprotection programs of the licensees.

As already mentioned above, an effective experience feedback process is an important component of the safety management program of the Licensee. The operational experience process by the Regulator should thus consist of the evaluation, in an independent way, of the effectiveness of these licensee programs and should initiate regulatory action whenever this is judged necessary.

Regulatory activities in this area can be delineated as following:

- To verify that the licensees are able to avoid recurrence of events with actual or potential safety impact, e.g.:
    - existence of adequate collection mechanisms and appropriate gradation of safety importance of events;
    - use of adequate analysis methods;
    - appropriateness of depth and extent of the performed analysis;
    - adequateness of proposed corrective measures with appropriate coverage of technical, human and organisational deficiencies;
    - adequate reporting and diffusion of analysis results;
    - respect of reasonable delays to perform these activities.
- To verify that licensees adequately review and apply lessons learned from significant events and near misses in similar Belgian plants.
- To initiate independent in-depth investigations of a small selection of events whenever this is felt necessary.

3.2.2 Fulfilment of RB mission – Assessment of safe operation by the Licensee: inspections

The principal objectives of regulatory inspections are to provide a high level of assurance that all activities performed by the Licensee during operation have been executed safely and meet the safety objectives and licence conditions. Regulatory inspection is performed to make an independent check on the operator and the state of the facility, and to provide a high level of confidence that operators are in compliance with the safety objectives prescribed or approved by the regulatory body.

The operational experience process of the regulator is supporting the inspection activities by:

- Identifying and analysing deficiencies in safety related processes or management programs of the licensees. This can be performed by a periodic review of events. Events reported by the utility and those internally reported by the Regulator through the inspection reports (the latter include low level events which are not always reportable) should be considered. The focus should be on the recurrence of causal factors, which affect the effectiveness of processes or management programs.
- Obtaining a global picture of the safety status of the plants, based on the assessment of events reported within a given time frame.

3.2.3 Support of RB missions

The operating feedback process can also prove to be beneficial in supporting other processes or activities within the Regulatory organisation, such as:

- Regulations and Licensing conditions
- Safety assessments
- Emergency planning and preparedness
- Training and knowledge management
- Research and development
- Reporting on events to national and international organisations

In these areas, the collection and analysis of events from the domestic NPPs should be supplemented by the assessment of events occurring in other countries.

3.2.3.1 Regulations and Licensing conditions

The Regulatory Body has the obligation to establish, promote or adopt regulations and guides. He has to define the licensing conditions to be applied to the authorization that are delivered. The modification to existing regulations as well as the establishment of new regulation can benefit from the outcome of the experience feedback process. The experience feedback process can also be very useful to identify shortcomings or gaps in the regulatory mix. Specific requirements (such as IE bulletins or Generic Letters in the USA) can also be set up by the regulator according to experience feedback outcomes.
The events related to the operation at reduced primary system inventory for PWR NPPs are typical examples of events that deserve attention from the regulator. In some countries, the operation at reduced primary system inventory with fuel elements in the reactor has been forbidden according to the experience feedback.

3.2.3.2 Safety assessments

Experience feedback should be taken into account when performing safety assessments of modifications to the NPPs or of new plants. The information gained by the process is useful to focus the attention of the assessment expert to safety significant aspects.
The events related to the strainer clogging issue are typical examples of information from the experience feedback process that has to be taken into account in the assessment process.

3.2.3.3 Emergency planning and preparedness

To fulfil its obligation related to emergency planning and preparedness, the regulator should collect and analyse events related to this area. The response to emergency situations and the lessons learnt from nuclear disasters as well as from emergency planning exercices is part of the continuous improvement proces that the regulator should apply.

3.2.3.4 Training and knowledge management

Although it is neither desirable nor affordable in terms of resources for the regulator to analyse every event, the independent analysis of some selected domestic and international events can be a motivating tool to maintain knowledge of assessment experts and inspectors. The same kind of activity can also be performed by newcomers in order to give them the opportunity to learn the specific features of the NPPs and can be more effective than purely ex cathedra lectures.

3.2.3.5 Research and development

The outcome from the experience feedback activities should be taken into account in the research and development program of regulatory organisation. The analysis of events could identify areas where development efforts are needed and it can also be used to improve the operating experience process itself.

A typical example of the latter is the development of methods to better analyse the human factors during events.

3.3 Collection of data on events - National and International experience feedback systems

It is quite easy for the regulatory organisation to collect information from events occuring in its own country. Reporting requirements set to the licensees and outcomes from inspections activities are the common sources of information that can be used to feed up the experience feedback system.

The situation is different for events occuring in other countries. Although some regulatory organisations such as the US Nuclear Regulatory Commission are totally open to the public, it can be very different from country to country. The information from foreigners Licensees is even more difficult to obtain by the regulatory organisations.

For this purpose[2], the OCDE/NEA and the IAEA decided to establish the Incident Reporting System (IRS). The IRS is established as a simple and efficient system to exchange important lessons learned from operating experience gained in nuclear power plants. The main objective of the IRS is to assure proper feedback on events of safety significance on a worldwide basis to help prevent occurrence or recurrence of serious incidents or accidents.

The IRS is a system based on the voluntary commitment of the participating countries which obviously benefit from the exchange of information. The IRS relies upon the participating countries which are responsible for selecting events to be reported to the IRS.

As there are differences in design, construction, and operation of NPPs, IRS has to provide sufficient details to highlight the relevance of the event to the recipient. Therefore, an IRS

[2] The following text has been partly extracted from the IRS Guidelines.

report should provide detailed technical and human factors information on event causes, safety significance, lessons learned, and corrective actions.

IRS reports are generally classified as “Restricted” in order to encourage open and timely exchange of information between the international regulatory organisations. The restriction applied to the distribution of IRS reports is justified by the detailed technical character of the information which is provided by participating countries for official use by the international nuclear community. IRS reports are intended for representatives of regulatory bodies and technical support organisations, operating organisations, manufacturers and researchers of the nuclear industry. The system is designed for specialists of the nuclear community as a source of detailed information on analysis and lessons learned from the events.

The efficiency of IRS rests on the voluntary commitment of the participating countries to feed back appropriate information on significant events and depends on the quality of the event selection and of the information exchanged among countries. Therefore, the primary role of participating countries is to ensure that all events with important lessons in terms of safety to be learned by the international community are effectively reported in a timely manner. The efficiency of the IRS also largely depends on its use.

4 CONCLUSIONS

The operating experience feedback system is of prime importance for the Licensees in order to give them the ability to maintain and improve the safety of the Nuclear Power Plants. The performance of this kind of activity is however not limited to the Licensees. Regulatory organisations have to closely look to the events in order to be able to perform their surveillance mission appropriately. The outcome of the operating experience feedback process is also very important to support the activities the regulatory organisations have to perform in areas such as: regulations and licensing conditions, safety assessments, research and development, emergency planning and preparedness. Operating feedback is also essential in maintaining and improving the competence of regulatory personnel.

Reporting on events to national and international organisations is an important mission the regulatory organisation has to perform in order to adequately share the experience with domestic and international organisations. In the latter area, the IRS plays an important role and sufficient resources should be devote to support this activity.

Appendix 1 – Extracts from the IAEA safety standard GS-R-1

Responsibilities and functions of the Regulatory Body

In order to fulfil its statutory obligations, the regulatory body:

1. shall establish, promote or adopt regulations and guides upon which its regulatory actions are based;
2. shall review and assess submissions on safety from the operators both prior to authorization and periodically during operation as required;
3. shall provide for issuing, amending, suspending or revoking authorizations, subject to any necessary conditions, that are clear and unambiguous and which shall specify (unless elsewhere specified):
   3.1. the facilities, activities or inventories of sources covered by the authorization;
   3.2. the requirements for notifying the regulatory body of any modifications to safety related aspects;
   3.3. the obligations of the operator in respect of its facility, equipment, radiation source(s) and personnel;
   3.4. any limits on operation and use (such as dose or discharge limits, action levels or limits on the duration of the authorization);
   3.5. conditioning criteria for radioactive waste processing for existing or foreseen waste management facilities;
   3.6. any additional separate authorizations that the operator is required to obtain from the regulatory body;
   3.7. the requirements for incident reporting;
   3.8. the reports that the operator is required to make to the regulatory body;
   3.9. the records that the operator is required to retain and the time periods for which they must be retained; and
   3.10. the emergency preparedness arrangements.
4. shall carry out regulatory inspections;
5. shall ensure that corrective actions are taken if unsafe or potentially unsafe conditions are detected; and
6. shall take the necessary enforcement action in the event of violations of safety requirements.

Activities to be performed by the Regulatory Body

In order to fulfil its main responsibilities, the regulatory body:

1. shall establish a process for dealing with applications, such as applications for the issuing of an authorization, accepting a notification or the granting of an exemption, or for removal from regulatory control;
2. shall establish a process for changing conditions of authorization;
3. shall provide guidance to the operator on developing and presenting safety assessments or any other required safety related information;
4. shall ensure that proprietary information is protected;
5. shall provide an explanation of the reasons for the rejection of a submission;
6. shall communicate with, and provide information to, other competent governmental bodies, international organisations and the public;
7. shall ensure that operating experience is appropriately analysed and that lessons to be learned are disseminated;
8. shall ensure that appropriate records relating to the safety of facilities and activities are retained and retrievable;
9. shall ensure that its regulatory principles and criteria are adequate and valid, and shall take into consideration internationally endorsed standards and recommendations;

10. shall establish and inform the operator of any requirements for systematic safety reassessment or periodic safety review;
11. shall advise the government on matters related to the safety of facilities and activities;
12. shall confirm the competence of personnel responsible for the safe operation of the facility or activity; and
13. shall confirm that safety is managed adequately by the operator.