
Needs for international Operating Experience Feedback - View of Finland

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Abstract: Nuclear power plant (NPP) operational safety performance has significantly improved worldwide. This has partly been achieved by utilising operating experience feedback (OEF) and implementing latest achievements of science and technology in improvements. Operators and regulators are most effectively learning from their own experience, but the growing importance of a strong international Operating Experience Feedback (IOEF) system must be recognized. Over the next decade we expect that nuclear power plants may be built in many countries with no previous nuclear power experience or with the limited experience from only one or a few nuclear plants. In these cases, national feedback systems will clearly not be sufficient because of the absence of an extensive data base of experience. As a result, the international system must fill an important need. Similarly, because of the extended operation of NPPs in various countries beyond their initially declared design life, there is now an increased need to ensure that experience with aging systems is widely shared so that all may learn of problems and intervene, as necessary, in a timely fashion. Operating experience feedback is an essential part of systematic Periodic Safety Reviews (PSR) in determination of Reference Licensing Basis (RLB) and in establishing safety improvement measures. While continued strong safety performance by operators is encouraging, a concern on insufficient learning from experience remains. By relatively minor measures the utilisations and efficiency of current international systems and networks for OEF could be improved.

1 BACKGROUND

Operating experience feedback can provide a very important mechanism for ensuring safety. Worldwide steady improvement in operational safety indicators seems to be a sign of reasonably well functioning operating experience feedback (OEF) processes within each country. Plant operators and regulators are evidently learning from their own experience. However, the number of nuclear power plants (NPPs) in any single country is only a fraction of the global nuclear fleet, and for many countries the majority of operating experience is available from foreign NPP's. Therefore an OEF process cannot yield full benefit unless it includes worldwide operating experience.

The current exchange of international operating experience is based only on a few mechanisms that try to fulfil users' needs. Systems with worldwide coverage are the Incident Reporting System (IRS) managed by the International Atomic Energy Agency (IAEA) and the Nuclear Energy Agency of the Organisation for Economic Cooperation and Development (OECD/NEA), and a same type of system for operators which is managed by the World Association of Nuclear Operators (WANO). In addition, information on experience is provided regularly in networks among nuclear reactor owners groups and in meetings between regulators. Less known are various multinational database systems, and these still have a limited coverage among the countries using nuclear power.

Additional useful tools for mutual learning are the peer review missions organized by the

IAEA and WANO and the reports written for the Review Meetings of the International Convention on Nuclear Safety (CNS).

The effectiveness of currently available international reporting systems has recently been seriously questioned. For instance, the NEA Working Group on Operating Experience (WGOE) has noted: *“Almost all the recent significant events reported at the international meetings have occurred earlier in one form or another. Counteractions are usually well known, but information does not always seem to reach end users or corrective action programs are not always rigorously applied”* [1].

Consequently, there is an acute need to improve the opportunities and ways in which we share international operating experience, both positive and negative, and to use it more effectively for reducing or eliminating risks.

In this paper the Finnish policy and approach for utilising OEF is clarified. For a country with a small nuclear power programme the international OEF (IOEF) is an important source of reference information. Thus the international part of OEF is addressed. Some deficiencies in utilising IOEF and also in the efficiency of international networks have been met. From these starting points which are based on the needs and experiences by the Finnish regulatory body few thoughts and ideas on tools and methods on improving current systems are provided.

2 REQUIREMENTS

2.1 National OEF systems

Importance of OEF is nowadays generally recognised and even strongly emphasised in strategic plans of national and international organisations working on nuclear safety. However, in the daily work of operating and regulatory organisations it seems to be a low priority task. Allocation of dedicated resources to OEF is often inadequate, and it is difficult to motivate people to prioritize OEF if they have other urgent duties. Another concern is that legal and institutional arrangements, especially in large organisations, do not provide good means for promptly addressing identified safety deficiencies.

On national level countries maintain efficient national processes for management and utilisation of operational experience of their own and from foreign plants. Although many differences exist between countries e.g. in legislative framework, regulatory requirements and resources, it is surprising to notice how similar are the national reporting requirements and requirements for utilising operating experience.

Fundamental principle within nuclear industry is that the licensees have the prime responsibility for safely operating the plants. Likewise, the collection of information on OE is the responsibility of the licensee and they must have established processes to systematically follow and analyse OE of their own and from foreign NPPs. The regulatory challenge is to assure that OEF is used effectively to promote safety. Regulatory bodies must have parallel process to review the results, and to ensure proper function of licensees OEF processes, and to ensure that the relevant events have been brought to the attention of operators.

IAEA Safety Guide NS-G-2.11 provides guidance for the establishment of an operational experience feedback system for managing operational experience on national basis [2]. The guide can be applied also for international OEF systems when applicable [3].

2.2 General requirement on international OEF

The requirement for a functioning international OEF system is established as a clear international obligation. Article 19 of the Convention on Nuclear Safety requires that *“incidents significant to safety are reported in a timely manner by the holder of the relevant licence to the regulatory body and that programmes to collect and analyse operating experience are established, the results obtained and the conclusions drawn are acted upon and that existing mechanisms are used to share important experience with international bodies and with other operating organizations and regulatory bodies.”*

By signing the international Convention on Nuclear Safety, each contracting party has committed to take the appropriate steps to establish arrangements and processes for IOEF. All contracting parties have indicated in the review meetings that they have such programmes in place, and these programmes have indeed been valuable in sharing experiences. Nevertheless, the observations on recurring events give a reason to believe that safety benefits could be achieved by enhancing the efforts in the area of OEF for nuclear facilities.

2.3 Finnish requirements on OEF and safety enhancement

In the Finnish legislation are given the general requirements for utilisation of OE and for safety enhancement. The regulation and regulatory guides provide adequate guidance for operators for their processes for OEF and for implementing improvements at their plants. The operating organisations have established necessary structures according to the requirements.

Requirements for licensees relating to analysis of incidents and operating experience are presented in the legislation and specifically in “the Decisions of Government on the General Regulations for the Safety of Nuclear Power Plants”. According to the requirements operating experience from nuclear power plants shall be systematically followed and assessed. For further safety enhancement, actions shall be taken which can be regarded as justified considering operating experience and results of safety research as well as the advancement of science and technology. More detailed requirements for the review of operational events are presented in relevant YVL guides¹, developed by STUK.

2.3.1 Regulatory Guides provide technical guidance

STUK’s regulatory guides, called YVL Guides, give detailed guidance for operators in their processes and in specific technical issues, and correspondingly for STUK how to review and assess licensees’ documentation and practices.

YVL Guides are systematically updated. Updates address the most recent safety concerns and knowledge in safety issues. They are applied as such to new NPPs. To operating plants they are applied as separately decided. Implementation decision is made for each guide, based on assessment and application done by the licensee and reviewed and approved by STUK. Detailed requirements for OEF are given in three regulatory guides.

Procedures and plant arrangements in place applicable to systematic analysis of operational

¹ By virtue of the Nuclear energy Act and Governmental Resolutions, STUK issues detailed regulations that apply to the safe use of nuclear energy and physical protection, emergency preparedness and safeguards.

events, clarification of root causes, and carrying out of corrective actions are presented in the quality assurance programme of licensees. The programme also presents requirements and procedures applicable to the assessment of operational events abroad and initiation of potential actions. Requirements for the organisation to establish adequate resources to carry out these mentioned activities are presented in the Guide YVL 1.9, "Quality assurance during operation of nuclear power plants".

In addition, Guide YVL 1.11, "Nuclear power plant operational experience feedback", sets forth the criteria and requirements for nuclear power plant operational experience feedback. It requires that a licensee examines all operational events which have safety significance, using a sophisticated root cause analysis method if an event's root causes are not evident. The report on the root cause analysis is submitted to STUK for information.

Requirements for reporting events and for contents of the plant operational event reports are presented in the Guide YVL 1.5, "Reporting nuclear power plant operation to the Radiation and Nuclear Safety Authority". Amongst the other, this guide establishes the reporting and notification processes to be followed by the utilities for events that have to be reported at a regular time intervals and events for which a prompt reporting is needed.

Event reports are prepared on events and issues which need to be reported in detail after the event has occurred and certain criteria have been met. These event reports can be divided into three categories: special report, operational disturbance report and other incident report. A special report will be submitted to STUK for approval within one month of an incident. Reports include the following detailed data as applicable: event description, safety assessment, causes of the incident, and measures to avoid recurrence.

The Governmental decision, which is a mandatory rule, also indicates that OE has to be understood in a wider scale: It's not only operating events but also results of safety research, which shall be considered when assessing needs for safety improvements. The statement contains the Finnish policy and approach for continuous improvement. Operating experience and results of safety research are important references to be considered as detecting actions for further enhancements, and latest achievements of science and technology have to be considered when implementing improvements.

2.4 STUK's expectations on lifetime management

STUK's policy for continuous improvement contains the following expectations for plants' lifetime management: It is not enough to maintain the safety and reliability at the same level as at first start-up. Safety and reliability need to be improved over the entire lifetime. It is implemented by replacing unreliable equipment with better ones. Modernization and upgrading are to be implemented by the advanced technology when applicable. New safety features have to be assessed and implemented as needed to meet the upgraded safety requirements.

General expectation on lifetime management is that the licensees maintain the safety and reliability of the operation of the NPP by paying attention to safety culture, taking care of competence of personnel, ensuring good material conditions with proper maintenance strategy, by testing and in-service-inspections, through operating experiences, by replacing unreliable equipment, and paying attention to current state of plant documentation and updating documents, if needed.

STUK's expectation is also that licensees follow the principle of continuous safety improvements and meet the upgraded safety requirements. This necessitate collecting and analysing systematically plant operating information using systematic analysing methods to

find real root causes. Technical failures or errors can be easily observed as well as immediate human failures. Deviations and events need to be investigated more deeply to find the contributing management related causes or latent organisational errors. In analyses should be utilised in addition to deterministic safety analyses also PSA, when applicable. The results of these analyses should lead to corrective actions resulting plant modernization, improvements in procedures and training.

3 NATIONAL VERSUS INTERNATIONAL OEF

There seems to be a worldwide steady improvement in operational safety indicators: operators and regulators are learning from their own experience. However, the majority of OE is available from foreign NPP's. It is most important for all countries, but especially for those with only a few NPP's, to benefit from the international OEF. Anyway, when discussing problems in utilising IOEF the same problems are revealing in all organisations: countries have minor recourses for that, and countries are doing overlapping work with their limited resources. Results of review and assessment of international OE remain most often only regulators' or operators' property on the national level as well as the actions which have been required from the operators, not even to speak about preventive actions implemented in advance to prevent corresponding event (good practices).

We have to share important international experience. Writing reports on operating events is one part of OEF but not only part of it. Closing the loop need information on corrective actions and their implementation. When thinking about and making the decision on reporting, or not, of any event, observation or deficiency, it is important to assess: are there some important lessons to be learnt also by other countries? It is impossible and even useless to report all events or observations to other countries. Criteria and objectives have to be clearly agreed and kept in mind. The most important criteria for reporting is; if there is a direct coupling to risk reduction and enhancement of nuclear safety. Objective of reporting must be to eliminate the disclosed risks without any delay, not just write reports on experience.

3.1 Operating experience of interest

Reporting operating events is not enough, it would be of benefit to report also other experience, like:

- Equipment failures or human errors that have not resulted in a plant transient but would have the potential to cause a serious incident or degradation of safety function in other circumstances,
- Unexpected observations such as design weaknesses, degraded equipment or aging effects that could lead to failures,
- Identification of previously overlooked external hazards,
- Management issues such as degraded safety culture, high human error rates, or inadequate control of contractors,
- New information, such as research results or new safety analyses that show a previously unknown weakness,
- Event in a non-nuclear facility which could be relevant also in NPPs, and
- Good practices that have a potential to assist other plants in making safety upgrades.

It is difficult and seems not feasible to provide in advance comprehensive reporting criteria for events. Most important criterion for reporting and evaluating an event should be the

significance of lessons that can be learned from it to eliminate risk factors and to improve safety. Some low level or near miss events could provide as valuable lessons as safety significant events, thus safety significance of an event should not be the only criterion. An “event” could be also an unexpected observation or understanding of a risk factor not considered earlier. The basis for reporting an event worldwide should be a professional judgement on whether the information calls for assessing the existence of similar risk factors elsewhere and might require corrective measures.

4 IOEF PROCESS AT STUK

4.1 IRS processes at STUK

STUK is the national co-ordinator of IRS reports in Finland. In total 52 STUK experts have access to the IAEA/NEA webbased international reporting system. The processes to review, assess and prepare IRS reports are described in the Quality Manual of Nuclear Reactor Regulation department. STUK’s international OEF group has 9 rotating experts in different technical disciplines who are responsible for assessment of reports assigned to them. STUK’s IRS co-ordinator, international OEF manager and the publication secretary who maintains STUK’s IOEF database are permanent members of the group chaired by the deputy director of Nuclear Reactor Regulation (NRR) department.

STUK’s international OEF group and experts review and assess the IRS-reports disseminated through the IAEA (process chart, figure 1). Also other, not urgent, information or reports received directly from foreign regulators or operators, are reviewed and assessed by the group. As needed, the group makes suggestions to the line organization of NRR department for expert review. Based on the expert memos, the group assesses whether there is a need for regulatory or licensee measures on the basis of lessons learned. As needed, the group proposes requests to be made to the licensees on their actions.

The group oversees the utilization of international OE by operators through specific inspection of periodic inspection programme (PIP) for operating NPPs. Inspection is focused on the licensees international OEF process. Inspection is performed at least twice a year. OEF activities at the plants are reviewed also as part of the process -oriented inspection “Operation” of PIP. This inspection is focused on the licensees internal OEF process and is performed as part of wider inspection once on 4-5 years.

Group prepares also the IRS-reports on events at the Finnish NPPs (process chart, figure 2). Selection of events at the Finnish NPPs to be reported to the IRS following: Safety Management Office and national IRS-coordinator compile a list of operational events proposed to be reported. Nuclear Reactor Regulation departmental meeting reviews monthly the operational events list. The meeting decides events to be reported, the reporting platform (IRS-report, STUK’s quarterly report, STK’s annual report) and nominates responsible experts for preparing the reports.

Events to be reported to the IRS are selected according to the following general principles applying IAEA/NEA Incident Reporting System (IRS) Reporting guidelines [4]:

- The event itself is serious or important in terms of safety due to an actual or potential significant reduction in the plant’s defence in depth.
- The event reveals important lessons learned that will help the international nuclear community to prevent its recurrence as a safety significant event under aggravated

conditions or to avoid the occurrence of a serious or important event in terms of safety.

- The event is a repetition of a similar event previously reported to the IRS, but highlights new important lessons learned for the international community.

The main reporting categories are:

- Unanticipated releases of radioactive material or exposure to radiation
- Degradation of barriers and safety related systems (assure primary coolant inventory and core cooling)
- Deficiencies in design, construction, operation (including maintenance and surveillance), quality assurance or safety evaluation
- Generic problems of safety interest
- Consequential actions
- Events of potential safety significance
- Effects of unusual external events of either man-made or natural origin.

The nominated STUK expert prepares IRS report based on the utility's event report and information from the regulatory oversight of STUK. IRS coordinator submits the draft IRS report for review and comments to the Deputy Director, Head of Office and other experts of STUK's NRR department. IRS coordinator submits the draft IRS report to the utility in question for review and comments. Comments and corrections received from the utilities are reviewed by the expert responsible for the report writing and the report text is modified accordingly. IRS coordinator submits the final report for clearance (supervisor of the responsible expert, Head of Safety Management Office, Director of NRR). IRS coordinator inserts the report to the WBIRS after the approval of the report. Objective for the reporting schedule is to prepare the report as much as possible within three months after the event.

4.2 Bilateral and multilateral cooperation

Cooperation between regulatory authorities has been found to be a very effective and fast way to exchange experiences between countries. Regular meetings are also creating personal contacts with foreign colleagues which are lowering the threshold to contact in a case there is need for information exchange. Countries are usually exchanging their experiences in meetings that are held twice a year. Finland and Russia have bilateral cooperation where operational experiences of Kola, LAES and Loviisa NPP are reported twice a year. Safety Management Office personnel has regular meetings with the Swedish regulatory body, SKI, exchanging information and experience on events at Olkiluoto NPP and Swedish NPPs.

WWER-Forum's working groups are also found very effective to exchange experiences and to benchmark practices in each countries. Cooperation should not be limited to any specific area of supervision but it should cover all issues related to nuclear and radiation safety of NPPs.

5 OBSERVATIONS ON IRS SYSTEM

The IRS system gives very little information on possible initiatives or corrective actions taken based on lessons learned from foreign experience. We do not know to what extent, if at all, the operators or regulators have used the information provided in a specific IRS report to enhance the safety of their plants. Very discouraging is to note that although some operators and regulators have reported important measures they have taken as a response to foreign

experience, others have not recognized the relevance of the same information.

This kind of examples can sometimes be recognized in meetings: not the same plant type, not same kind of systems, not same components, etc.

All information that could be useful for reducing risks is not reported to the IRS. Very few reports are written on other issues but incidents, although often the incidents are preceded by degraded performance of organisation or there might have been observations of weakening trend in performance of components in periodic tests, indicating generic issues in performance. Many reports do not give adequate information for true understanding of the key issues and for considering the relevance of lessons in other countries

Some reports are “censored” for to minimize potential political or other problems in the reporting country: mentioning of the manufacturer or type of the component might have censored even though this kind of information could be essential for the operator or regulator receiving IRS report and assessing its relevance.

Collection of feedback from IRS users is not organized:

- what analysis was made in other countries
- what would be recommended safety enhancing measures
- what was actually done to enhance safety (follow up of the implementation of corrective actions is not reported).

5.1 Improvement needs in the IRS system

Reporting criteria must be clarified in a revised IRS guideline. The main criteria for issuing an IRS report should be the generic significance of the disclosed safety deficiency and the corrective actions taken to remove that deficiency. We should report experiences that have led to significant corrective measures in hardware or safety management, or raised concerns that require new safety research.

An IRS report on events should focus on lessons learned and actions taken:

- describe the event only as needed to understand the safety concerns and the causes of the event
- focus on root causes and especially point out possible weaknesses and failures in safety management
- describe the actions that the reporting organization has taken to avoid recurrence of similar events, or to correct more widely the technical or management deficiencies revealed by the event
- make recommendations on issues the reporting organization considers worth review and assessment in organizations receiving the report.

Based on STUK’s needs and experiences in utilising international OEF and IRS reports few thoughts and ideas on improving IRS systems have come up. Improved system for the use of IRS reports complemented with steps to improve the quality of reports, to ensure the dissemination of recommendations based on analyses and to distribute feedback to all IRS users is proposed (process chart, figure 3).

5.1.1 Quality control

Quality control should be provided by readers of the reports – they should request the reporting organization to clarify or improve the report if information is not understood. The readers have a right to expect that:

- the event descriptions, safety assessments and root-cause analyses of the reported events are accurate enough and permit adequate understanding of the events, the lessons learned, and the corrective actions
- the corrective actions are presented in such a manner that they allow readers to assess the need for similar measures at their NPPs.

It would be helpful if there would be a dedicated organization to collect and combine the need for report improvement, and make a joint request to the original author on behalf of all readers.

5.1.2 Analyses

Analysis should be added to the OEF process. There should be an agreed mechanism on the reader side to screen out reports that raise a need for thorough analysis of the reported issue and its generic relevance. Analysis task should be assigned to a proper organization. Recommendations should be provided on the basis of analysis and distributed to all IRS users.

5.1.3 Feedback

Feedback should be added to the OEF process. The recipients of each original report (e.g., regulators of every participating country) should provide information on the safety enhancing measures that were eventually taken by them after analyzing the insights from the report. “Good practices” should be reported by those recipients of the report who already had means in place to eliminate similar concerns.

All feedback information should be collected and summarized; summaries of the response by recipients to the original report should be distributed through the same system as the original report.

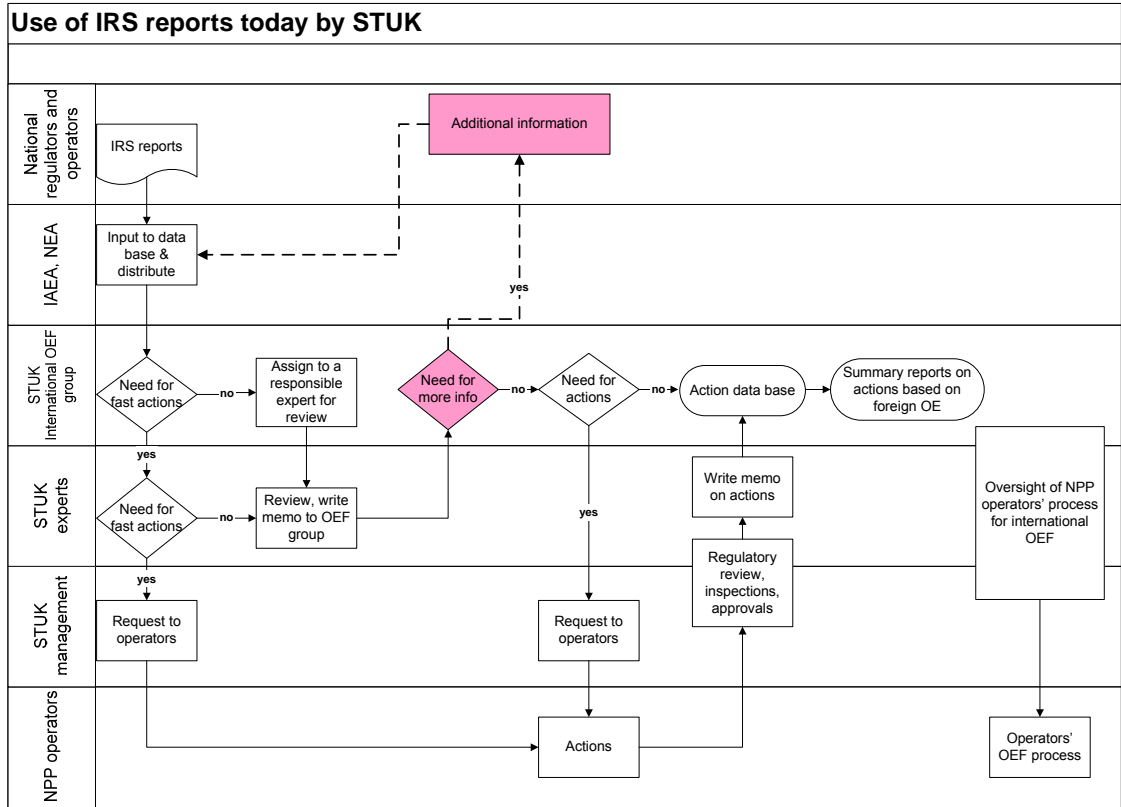


Figure 1. Use of IRS reports by STUK

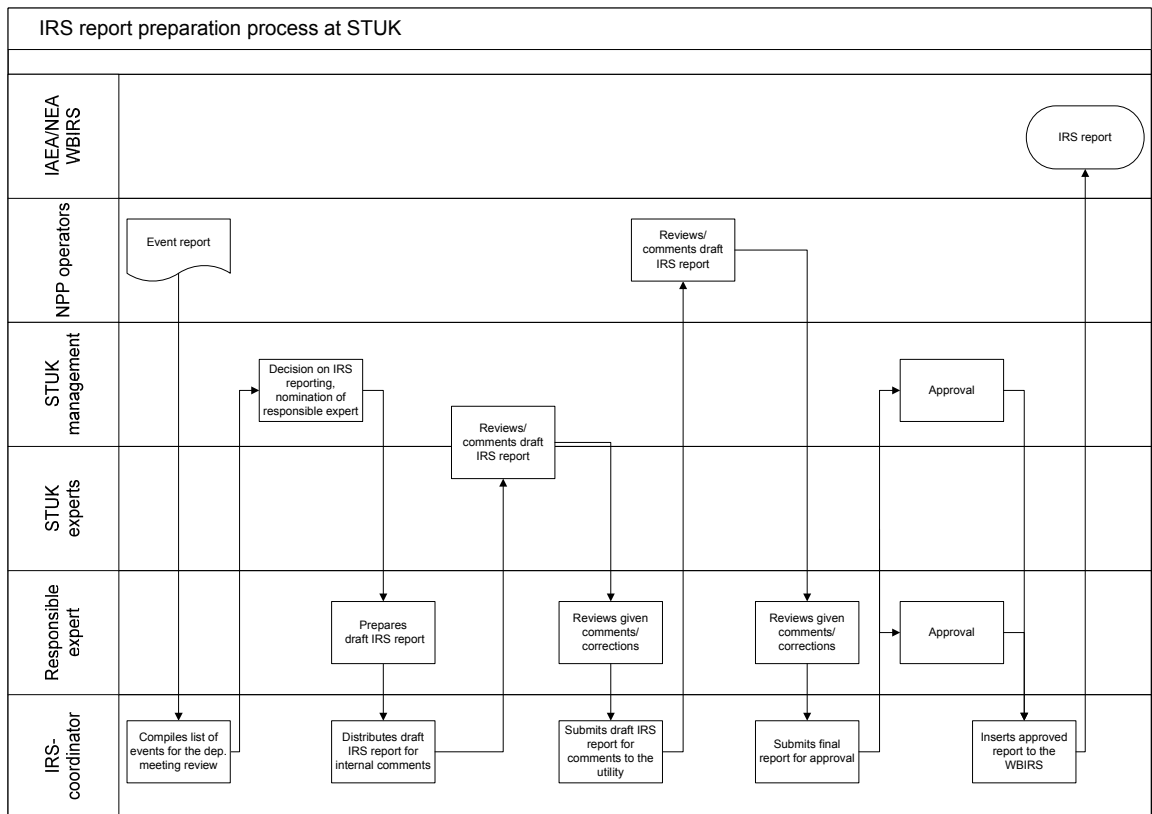


Figure 2. IRS report preparation process at STUK

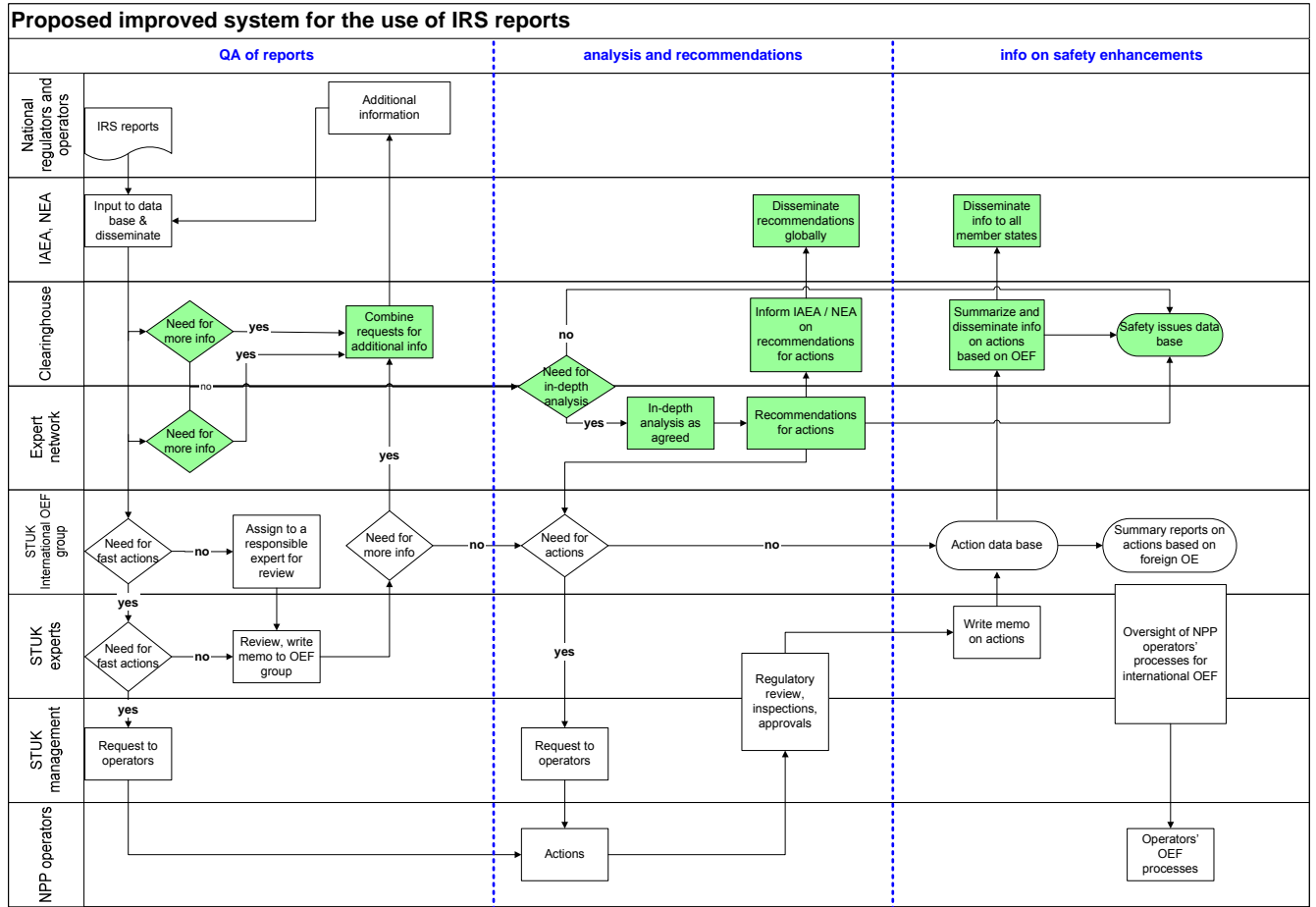


Figure 3. Proposed improved system for the use of IRS reports

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