STUK

RIC 2005, March 8-10

OBSERVATIONS ON PERFORMANCE IN USE OF OPERATING EXPERIENCE

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In the international co-operation, much effort is spent to report and discuss operating events.

However, the events keep recurring worldwide and there are very long delays in implementing the obviously needed corrective measures

- this indicates that the information is not utilized as it should.

Reporting on operating experience is not meaningful, if the recipients are not using the given information to enhance nuclear safety by

- **improving plant hardware,**
- **improving staff competences and management of operations, or**
- **improving safety assessment and regulation**

Importance of OEF is nowadays generally recognized and even strongly emphasized in strategic plans of international and national organizations working on nuclear safety.

However, in the daily work of operating and regulatory organizations 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 organizations, do dot provide good means for promptly addressing identified safety deficiencies.

A worldwide observation is that operating experience feedback (OEF) needs to be much improved

In the international arena,

- the focus of existing networks (IRS, etc.) should move from event reporting towards a synthesis of the given information and to combining it with other available knowledge on the respective topic, e.g. insights from risk studies and other research
- It is also important to provide information on corrective actions taken both in the reporting country and in other countries

At the national level, responsible organizations in each country must

- ensure that reports transmitted through international networks for this purpose are read
- analyse and understand in depth what has been reported:
  - what did we learn ?
  - are the lessons valid for our situation - in view of technical, human, or management issues ?
- initiate a timely response:
  - analyse thoroughly the own situation - what if ?
  - are there potential safety deficiencies that need to be addressed to keep risks at acceptable level ?
  - remove the safety deficiencies as relevant

Most important for maintaining safety is the OEF process within the operating organizations: they have prime responsibility for nuclear safety

The regulators must have a parallel process that ensures

- implementation, adequacy, and proper function of the OEF process in each operating organization
- bringing relevant events to the attention of operators
- independent assessment of continued meeting of licensing conditions, also in light of the new information

In Finland, the regulations provide adequate guidance for implementing systematic OEF, and the organizations have established necessary structures for it.

However, also in our case it must be admitted that OEF work has too often given way to more urgent tasks that have strict deadlines. This is a continuous problem in management and supervision of work, although many good results have been achieved in responding lessons learned, as mentioned in the following.

The way to improve the situation could be dedication of experts for fixed terms in OEF tasks, and avoiding assignment of any other duties to them during these periods.

Finnish requirements on OEF are based on Government decision (1991/395) which is a mandatory rule. Its § 27, Operating experience and safety research, says:

"Operating experience from nuclear power plants as well as results of safety research shall be systematically followed and assessed. For further safety enhancement, actions shall be taken which can be regarded as justified considering operating experience and the results of safety research as well as the advancement of science and technology."

More detailed requirements are given in three regulatory guides:

- YVL 1.5, Reporting on NPP operation to STUK
- YVL 1.9, Quality assurance during operation of NPP's
- YVL 1.11 Nuclear power plant operating experience feedback

Each licensee has established its own OEF process, being thus in compliance with the regulatory requirements.

STUK reviews the function and results of each OEF process as part of its periodical inspection program for operating NPP's:

- inspection "Operating activities" is conducted every three years
- inspection "Safety management" is conducted every second year.

Both licensees in Finland have a group for co-ordinating the OEF:

- groups meet about once a month
- group has about 10 experts representing different fields of nuclear technology
- inputs are received from own plant, from other Finnish facilities, from plants of the same vendor, through WANO (5-10 events per year), through IRS (50-100 events per year), etc.
- total number of events discussed annually is about 200
- about 5-10 recommendations are given annually to the plant manager, most of them lead to changes in plant design or operation

STUK has established also its own process for utilizing the international OEF

- the process is providing review and response to the IRS reports received through the IAEA and NEA networks
- responsibilities are assigned for
  - management and co-ordination of the process
  - preliminary review of each report and writing a short summary on relevance
  - detailed review (if necessary)
  - actions: making requests to licensees, asking for analysis and corrective measures at plants (if necessary)
    - annually 2-5 reports lead to actions
- performance of the process is followed by internal indicators

All IRS reports are transmitted also to the licensees.

Most of the corrective measures at Finnish NPP's have been small improvements in

- operating practices and procedures,
- inspections and testing of equipment,
- additional analysis, and
- staff training, including simulator training

In addition, foreign operating experience has prompted some major plant modifications.

Lessons from in-house experience are evaluated within the operating organizations by similar methodology and by the same groups as the external experience.

Besides the abnormal events, it is most important to recognize

- potential common cause failures (CCF)
- premature aging
- recurring failures

This is done by a systematic evaluation of failure notifications and feedback information from the work order system.

At the Finnish NPP's, potential CCF's have been identified from experiences in connection with harsh weather conditions (snow, freezing) and fires in electrical systems.

- new insights have led to increased physical separation and diversity within safety relevant systems

Premature aging has led to replacement of all redundant equipment of a certain type with new equipment of improved design: pumps, valves, cables, etc.

Most common reasons for recurring events have been too slow progress in completing corrective actions and lack of understanding the actual cause of the event.

Among the foreign events that have initiated a process leading to major plant modifications at Finnish NPP's are the following:

- TMI
- Several large turbine building fires (Greifswald, Armenia, Vandellos, Chernobyl)
- Large primary to secondary circuit leak (three leaks opened in short intervals, each equiv. to more than 10 SG tubes) at Rovno NPP
- ECC recirculation filter blockage at Barsebäck NPP

Actions taken after TMI included both accident preventing and accident mitigating measures.

Accident preventing measures were similar to those taken at US plants:

- backfitting of design: improved CR instrumentation including SPDS, reactor coolant system vents, etc.
- improved analytical methods used for developing emergency operations and respective guidelines for operators

For severe accident mitigation, a strategy was developed at each plant to protect containment integrity against all potential threats.

For instance, the most extensive changes at one plant included following:

- high pressure meltdown - reliable high capacity pressure relief system
- molten core - passive external cooling of the RPV (core retained in the RPV)
- slow containment pressurization - fully independent external containment spray providing steam condensation on inner wall (large steel containment with wall thickness of 20 mm)
- hydrogen burn - first glow plugs to initiate slow burn, later on catalytic recombiners
- containment penetration leaks - improved sealing with high temperature resistant material
- dedicated I&C and control room for severe accident management

Corrective actions implemented at one plant for protection against fires included

- construction of new fire walls in the turbine building, and improving fire resistance of existing walls and doors
- provision of fast acting automatic spray systems to suppress turbine and transformer fires
- provision of additional routes for electrical power supply to safety systems
- installation of an additional 2-redundant auxiliary feed water system in a new building, with independent power supply, water storage, and feedwater lines.

Large primary to secondary system leak was addressed by

- designing improved boundary between primary and secondary circuits, thus eliminating potential leak that occurred at Rovno
- designing improved systems that give enough time for cooling to cold shutdown (before exhausting ECC water), even in case of large primary to secondary leak: major increase of water volume stored in ECCS (new tanks) and fast depressurization of primary circuit

Risk of ECCS recirculation clogging was addressed by designing new filters to the containment sumps

- total free flow area through the filters is about 100 m^2 (1100 sq-ft)
- in case of clogging, the filters can be efficiently cleaned using back flushing with nitrogen gas

Conclusions

- Recurring events do take place worldwide
- More emphasis is needed on the efficient utilization of event reports (IRS, WANO, other networks)
  - higher priority on OEF activities (fixed term dedication of experts?)
  - thorough analysis of events
  - timely corrective actions
- Licensees responsibility has to be emphasized
- Regulators role is to oversee licensees activities and to perform own analyses to verify licensees activities and to develop regulations
- International organizations should change focus from event reporting towards evaluating general relevance of lessons learned and promoting corrective measures worldwide

References

More information on OEF in Finland and the respective regulations is available at

- STUK's website www.stuk.fi
- Seija Suksi: Methods and Practices used in incident analysis in the Finnish nuclear power industry, Journal of Hazardous Materials 111 (2004) 73-79: (www.elsevier.com/locate/jhazmat)