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Work of Operators in the Eyes of a Regulator

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Speaker's background as regulator

Retired from the post of STUK's Director General in February this year.

Worked in nuclear regulation for 38 years – last 15 years of that as chief regulator in Finland.

- 1981-82, for 14 months with the U.S.NRC
- 1987-89, for two years with the IAEA

Many international duties, among them

- 1999-2007, Chairman of CNRA, Committee for Nuclear Regulatory Activities (one of the standing OECD/NEA Committees)
- 2009-2011, Chairman of WENRA, Western European Nuclear Regulators' Association.

Outline

- General expectations of regulators on operators attitudes and conduct
- Observations on how these expectations were met before Fukushima accident
- Observations after the accident in Fukushima

Principle of continuous improvement (1)

Convention on Nuclear Safety (CNS) sets clear obligations to operators

The CNS, adopted in 1994, is the one and only document that has legal power in the nuclear safety area in all countries with operating NPPs.

Article 9 : “Each Contracting Party shall ensure that prime responsibility for the safety of a nuclear installation rests with the holder of the relevant license and shall take the appropriate steps to ensure that each such license holder meets its responsibility.”

Article 10 requires policies that give due priority to nuclear safety.

Article 19 emphasizes the importance of analyzing the operating experiences and requires that the results obtained and the conclusions drawn are acted upon.

Principle of continuous improvement (2)

In the regional level, the European Union Directive issued in 2009 has been ratified to the legislation of all EU countries – consistent with the CNS.

Article 6, Licence holders: “Member States shall ensure that the national framework in place requires license holders, under the supervision of the competent regulatory authority, to regularly assess and verify, and continuously improve, as far as reasonably achievable, the nuclear safety of their nuclear installations in a systematic and verifiable manner.”

Confirms what the European heads of the national nuclear safety authorities, members of WENRA, agreed already in 2005: “*we commit ourselves to a continuous improvement of nuclear safety in our respective countries”.*

Principle of continuous improvement (3)

Emphasis on the importance of continuous improvement of both NPP safety and regulatory effectiveness was not equally evident in countries outside Europe.

However, after the accident in Fukushima the idea of continuous improvement seems to be recognized more globally.

My conclusion from the recent international discussions among the regulators:

No complacency is accepted and no operator should claim that it has achieved such an adequate level of safety , which does not require efforts for its enhancement.

High level of safety is a cornerstone for profitable nuclear power generation (1)

In many countries there are nuclear power plants that have demonstrated excellent operating results.

These plants have the following attributes of successful operation:

- **competitive production costs,**
- **power available when it is needed,**
- **no harmful impact to the environment,**
- **low worker doses,**
- **infrequent abnormal events, no significant production losses,**
- **small accident risk, also perceived like that by the general public.**

High level of safety is a cornerstone for profitable nuclear power generation (2)

Healthy cost structure of a successful plant covers not only direct operating, maintenance, fuel and waste management costs.

Adequate funds have to be allocated in annual budgets also to

- regular equipment modernization,
- backfits for enhancing safety,
- ensuring adequate knowledge and skills of the staff, and
- safety research maintaining and improving knowledge base.

High level of safety is a cornerstone for profitable nuclear power generation (3)

Financing of all long term cost is achievable without endangering the competitiveness when the operator has established a positive feedback loop:

- **steadily high capacity factor permits adequate investments in the safe and reliable operation.**

As experiences at many plants have shown, striving towards good performance is in the long term always better than short term savings achieved by cutting maintenance and operating costs.

High level of safety is a cornerstone for profitable nuclear power generation (4)

Good management practices are necessary for safe and profitable production. These should include:

- motivating each individual to responsible work with self-imposed quality goals and professional pride,
- thorough planning and detailed scheduling of outages, supported by pre-exercised conduct of the most demanding works,
- continuous and determined development of work methods, procedures and staff qualifications, and
- maintaining wide technical knowledge and skills within the operating organization.

Safety Culture needs to show up in daily life (1)

The plants with high safety culture have following characteristics:

- The arrangements and measures by the operators reflect their recognition of ultimate responsibility for safety.
- Strive for excellence, rather than just fulfilment of regulatory rules, is self-evident.
- The operators set their own performance standards for activities they find most important to ensure reliable and thus safe operations.
- Strive for excellence means also that the operator has a steady investment program that is aimed to
 - keep the material condition of the facility at least at the same level it used to be after the first start-up,
 - improve reliability and safety

Safety Culture needs to show up in daily life (2)

Safety and quality must have higher priority than costs and schedule. This message from the operator's management has to be very clear and transmitted to all levels of the organisation and also to all contractor organizations working for the operator.

Management's acts and decisions have to be consistent with the message.

The critical moments demonstrating real management attitude are situations when

- some problem endangering safety has appeared and a decision has to be made on whether to continue production or to shutdown without delay and fix the problem.
- new lessons on risks have been learned from the operating experience or research: are some actions needed to evaluate the risks at own plant and to possibly take corrective actions?

Regulators have noted major differences in investments to safety (1)

International peer reviews have given an opportunity to compare both regulatory policies and the policies of operators in different countries.

The IAEA has arranged

- OSART missions to NPPs since 1982
- IRRS missions to assessed work of national regulators since the end of 1990's

In this year, there was an extensive European peer review as part of targeted safety re-assessments (“stress tests”) that were conducted in the aftermath of Fukushima accident.

I have attended a number of those reviews and have noted major differences between the countries and the NPP's.

Regulators have noted major differences in investments to safety (2)

As I stated above, the policy in Europe promoted by WENRA and now also required by the European Nuclear Safety Directive is to continuously improve nuclear safety.

However, a consistent implementation of that policy has not yet been commonly achieved at the plant level in all European Countries.

Regulators have noted major differences in investments to safety (3)

Some European operators have been pro-active in enhancing the safety of their NPPs already since 1980's. As a basis for safety enhancement some operators have used their own living PSA's that always provide a "top ten" list of risks that could be eliminated or made less significant.

Other operators have been more in a reactive mode and have taken actions only when some major events have been reported worldwide and have generally led to corrective measures.

The recent report on the European "stress tests" pointed out areas, where some operators have conducted major backfits of the plants, while others have not seriously addressed the same safety issues.

The accident in Fukushima has now influenced the attitudes and policies of operators, and I expect to see a more harmonized approach in the entire Europe.

Regulators have noted major differences in investments to safety (4)

In Russia, the shortcomings in safety systems of the operating facilities were recognized already after the accident in Chernobyl, and this prompted planning of large upgrade programs at all plants.

Planning of the Russian safety upgrade programs was supported by the IAEA that organized in the early 1990's several design review missions to Russian plants.

After these missions, the results were combined and a set of IAEA reports often called "issue books" were written separately for each type of plant as a joint effort between the Russian and international experts.

Regulators have noted major differences in investments to safety (5)

The IAEA “issue books” gave practical guidance for safety upgrades at the VVER and RBMK type plants in different countries.

The implementation of the safety upgrades in Russia took place at the end of 1990’s when the economic situation at NPPs had significantly improved and the necessary investments could be financed.

The spirit of continuous improvement has prevailed until these days at Russian NPPs, as I have seen on safety evaluation missions that I have conducted together with my Finnish colleagues and the Russian regulators to the NPPs close to our common border.

Regulators have noted major differences in investments to safety (6)

As concerns the situation in the USA, the policy question on whether to require maintaining or continuously upgrading the safety has been discussed for years between regulators in connection with the OECD/NEA co-operation.

In the report of the IRRS mission that in October 2010 reviewed the U.S.NRC regulation of the operating reactors, the Executive Summary stated the common view of the international team : *“The NRC has a strong drive for continuous improvement in its own performance and has well achieved its goals. Industry performance has also shown improvements as demonstrated by improved operational performance and reductions in risk profiles. However, there are indications that licensees have not been as proactive in making voluntary measures to upgrade systems, structures, and components with improved technology as operators in many foreign countries to enhance safety.”*

In my exit meeting speech in the role of IRRS team leader I asked : “What could be the NRC’s leverage to encourage proactive measures by licensees?”

Regulators have noted major differences in investments to safety (7)

Concerning Japan, it was noted already before the Fukushima accident on the IAEA missions that the Japanese have built and operated the plants very much following the U.S. model.

For the seismic hazards there was a solid regulatory basis in the USA at the time when the first Japanese plants were built, and consequently also the Japanese plants have a robust seismic design with large safety margins.

On the other hand, the risks addressed in designing the U.S. plants did not emphasize the site specific risk factors such as tsunamis that were much more serious in Japan.

Also during the operating stage, it seems that the Japanese operators have not made plant modifications that would go beyond the modest changes that have been made in the USA at similar plants.

Fukushima seems to have changed the attitudes of operators (1)

The accident of Fukushima was a heavy blow on all of us who work in the field of nuclear power.

However, it was encouraging that the political decision makers and the general public in most countries did not lose their trust on our promise on safety.

It is also assuring to see that many operators throughout the world have clearly expressed their will to make their plants even safer than they are today.

Fukushima seems to have changed the attitudes of operators (2)

Safety reassessments, similar to European “stress tests”, have been conducted in all countries with operating NPP’s and many ideas have been generated on means to enhance safety.

The innovative thinking of many operators has shown that we have not yet exhausted all means to make nuclear power safer, and even with reasonable costs.

In this process there has been no need to wait for regulatory requirements because the operators know best their facilities and are in the best position to look at potential areas where improvements could be made.

Fukushima seems to have changed the attitudes of operators (3)

The European wide “stress tests” were completed in April

- country specific reports on peer reviews are publicly available on the website www.ensreg.eu
- these reports provide a variety of examples from the initiatives taken by the European operators.

Some of the measures are already in the implementation phase

- many safety enhancement projects were actually initiated before the accident in Fukushima.

Although many actions are adapted to specific plants, the country specific peer review reports give a good overview of the general trends and also concrete ideas for consideration at each plant.

Fukushima seems to have changed the attitudes of operators (4)

Operators in other countries have started more or less similar safety upgrades as those in Europe but in this presentation I cannot go through all of the good examples.

However, I want to highlight here the ambitious work conducted by the Japanese industry and operators in a joint project coordinated by Japan Nuclear Technology Institute (JANTI). The final report issued April 3rd is on website www.gengikyo.jp/english/ , and it demonstrates well the very responsible attitude of the Japanese industry and operators.

Fukushima seems to have changed the attitudes of operators (5)

JANTI project started with evaluation of the course of accident at all four destroyed units.

Based on the accident evaluation they made a systematic fault tree analysis on what went wrong and where the course of accident had been possible to turn if proper systems, resources, or emergency plans would have been available.

Next they identified subject areas for careful engineering examination. Not surprisingly, these were

- Preparation for earthquake and tsunami (natural hazards)
- Preparation of power sources
- Responsiveness to heat sink loss
- Countermeasures against hydrogen
- Preparation for emergency events

Fukushima seems to have changed the attitudes of operators (5)

From each of the subject areas the JANTI study group examined in detail five to ten subjects and elaborated potential countermeasures on how the respective failures could have been avoided.

These prospective countermeasures went beyond regulatory requirements, and gave a good “shopping list” for analysis, development and possibly implementation.

- there is now sound basis for Japanese operators to consider potential safety upgrades

The study addressed even a potential combination of events that have not happened but would be conceivable: a major fire connected with flood, earthquake, or tsunami.

Regulators can warmly support ideas of WANO's Post-Fukushima Commission (1)

As I noted above, after Chernobyl accident an extensive international review of all Soviet designed NPP's was conducted, and a systematic safety enhancement program was based on its results.

We should recognize that a similar program would be equally important for all other NPPs as well.

Regulators can warmly support ideas of WANO's Post-Fukushima Commission (2)

I have understood that the scope of WANO programs is now suggested be expanded, and it would in the future review also the features and facilities for accident response and mitigation, as well as implementation of design safety fundamentals.

This is an important and good move that I can warmly support.

Conclusion

The Fukushima accident has once again shown the major hazards involved in the use of nuclear power. However, the determined response by the operators and the nuclear industry have raised confidence that safety can be ensured even in connection with very violent and unexpected behavior of the nature.

The operators have learned important lessons and are now much better prepared to unexpected events than before the accident.