

The Future of Nuclear Power in Central and Eastern Europe

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Considerations Concerning Safety and Risk Avoidance of Existing NPPs

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Nuclear fleet

- 442 nuclear power reactors in operation worldwide now – the total number at plateau during recent decade
- 28 units under construction now – almost constant during recent decade
- The net electrical capacity about 370 GW – increased by some 10 GW during recent decade, mainly due to upgrading of existing plants
- 16% of the total electricity generation worldwide – decrease from 17%
- 134 power reactors 9 countries in Western Europe and 23 power reactors in 9 countries in Central and Eastern Europe now – total number is decreasing
- Eight countries with 40% or more of total electricity generation - Belgium, Bulgaria, France, Lithuania, Slovak Republic, Sweden, Switzerland and Ukraine - all in Europe
- Asian countries (Japan, China, Korea, India and Pakistan) - the centre of expansion of nuclear industry: 16 of the 27 reactors under construction at the end of 2005, and for 24 of the last 34 reactors connected to the grid.

Design safety

During recent years most of first generation reactors finally shutdown in Germany, UK, Bulgaria, Spain, Sweden, Lithuania and Japan (2 in 2005, 5 in 2004, 4 in 2003). After 2010 no such reactors operated in Europe.

One Generation III reactor (EPR) under construction at Olkiluoto site in Finland, one EPR unit planned for Flamanville site in France. Four Generation III units in operation in Japan; all are ABWRs.

During recent decade many PWRs in Europe upgraded with filtered venting systems and hydrogen burning systems and some upgraded with supplemental "bunkered" systems. Most of the European BWRs also upgraded with filtered venting systems or with supplemental "bunkered" systems.

Outcome:

- improved design safety features of European nuclear fleet;
- probability of severe accidents and early radioactivity release from European nuclear power reactors decreased.

Operational safety and recent incidents

23 Level 3 and 1 Level 4 events occurred in nuclear power reactors worldwide since the introduction of INES in 1991.

Operational safety performance not improved during recent years. Concerns expressed regarding complacency and negligence in the industry.

A number of serious incidents occurred over the past few years, including:

- **Data falsification at Tokyo Electric Power Co. , Japan, 1991-2004.** All 17 BWRs shut down for more than one year for safety checks
- **Reactor pressure vessel head corrosion at Davis-Besse (US), 1990-2002.** About 15 x 12,5 x 17,5 cm hole through in the main material.
- **Ex-core fuel damage in Paks Unit 3, Hungary, April 2003.** 30 FA damaged, unit shutdown 17 months, cleaning operations started 3,5 years after.
- **ATWS waiting to happen at Kozloduy NPP unit 6, Bulgaria, 2005-2006.** 22 of total 61 CCRA's inoperable with driving mechanisms. Number of CCRA's enable to scram unknown.
- **Loss of offsite power and failure of 2 from 4 emergency trains in Forsmark 1, Sweden, July 2006.** Forsmark 1&2 and Oskarshamn 1&2 temporarily shut down for safety checks.

Quality of designers and suppliers

During recent years concerns expressed regarding the quality of nuclear designers and suppliers. Examples of poor quality include:

- **Delivery by Atomstroyexport, Russia to Tianwan-1 (China) of SG with damaged tubes; Delay in licensing and commissioning, more than 700 tubes plugged before start-up.**
- **Design, fabrication and supply by Framatome ANP to Paks NPP of fuel cleaning system with insufficient safety features.**
- **Design, fabrication and supply by Westinghouse to Temelin NPP of FAs, that are bending and twisting, causing problems with CCRAs insertion. Tens of CCRAs unable to touch down, in June 2006 two CCRA came to a halt above the bottom of reactor core, unit 1 shutdown about 4 months before the planned outage**
- **Design and delivery by Atomstroyexport, Russia to Kozloduy unit 5 a set of CCRAs drive mechanisms, not properly tested after implementing changes in the design. After several months of operation - fixation of drive mechanism and inoperability of CCRAs. CCRAs of this design delivered and installed to Tianwan unit 1 and Kalinin 3.**

Independence of Nuclear Regulatory Bodies

Independence = effective separation between the functions of NRB and those of any other organization promoting or utilizing nuclear energy, sufficient financial and human resources and technical capabilities.

- Most of Heads and senior managers and experts of NRB came from nuclear industry, NPPs or TSOs. Limited number of experts from universities, almost no experts from NGOs.
- In many countries the state administration manages and regulates the nuclear industry that could lead to conflict of interests and could possibly limit the independence of Nuclear Regulatory Body.
- University professors and independent experts usually participate in advisory councils, which have very limited influence on the decision making process.
- Participation of NGOs and opponents to nuclear power is excluded.

This practice could result in limited independence of Nuclear Regulatory Bodies from the nuclear industry and possibly leads to conflicts of interest, decisions in favor of nuclear industry, lack of transparency and unbalanced information to the public.

International cooperation and risk communications

Convention on Nuclear Safety and Joint Convention – the most important international conventions in the field of Nuclear and Waste Safety.

- Conventions are incentive in nature, no control and sanction, but based on common interest to achieve higher levels of safety.
- National reports are prepared by NRB, other bodies and Operators only.
- Not all National reports are publicly available.
- Only states – members to the Conventions could formulate questions to National Reports and participate in the peer review process.
- During the meetings groups of experts, who belong to the closed nuclear community, report to each other, then the participants change the role.
- Meetings are closed to of other countries, independent experts, NGOs and media, which results in lack of quality and criticism.

International cooperation and risk communications are dominated by pronuclear organizations. However insufficient openness and transparency results in lack of public confidence.

Public opinion

- **December 2005 - new 18-country opinion survey conducted by Globescan Inc., sponsored by the IAEA.** Six in ten citizens (62 %) believe existing nuclear reactors should continue, yet six in ten (59 %) do not favour new NPPs being built. Support for new constructions about 25 % in France, 22 % in Germany, 33 % in Great Britain, 22 % in Russia and 19 % in Hungary. Support for existing plants, no new, about 50 % in France, 47 % in Germany, 37 % in Great Britain, 41 % in Russia and 55 % in Hungary. Stressing the climate benefits of nuclear power positively influences one in ten to be more supportive of expanding its role, but there is still a general reluctance to build more NPPs. A majority of 54 percent across all countries surveyed believe the risk of nuclear terrorism to be high.
- **January 2006 - last survey conducted by Eurobarometer, the public opinion analysis sector of the EC.** More than 29 000 people in 25 EU states and acceding and candidate countries. “Almost half of all EU citizens (48 %) believe that their national government should focus on developing the use of solar power followed by promoting advanced research for new energy technologies (41 %) and developing the use of wind power (31 %)”. Support for prioritizing nuclear energy development by national governments varied in the nations surveyed, from a high of 27 % in Finland to a low of 2 % in Cyprus and Greece. Such support was found to be 8 % in France, 17 % in Germany, and 18 % in the UK.

Public opinion (continuation)

- **January 2006 - new poll, conducted by Credoc, a French government-supported opinion research centre.** French public opinion remains divided on nuclear power, with 50% judging that having three-quarters of the country's electricity provided by reactors has more advantages than disadvantages. Thirty-six percent said it presented more disadvantages, and 14% percent had no opinion. But 59% of those polled saw a high risk of a severe accident in a French reactor and 52 % said they do not agree that nuclear waste is properly stored in France.

Summarizing, at a time when the nuclear power option is being vigorously pursued in the fast developing countries of Asia and being reconsidered in some European states and the USA, the findings raise questions as to whether the nuclear industry and politicians have sufficiently raised public confidence in the safety and efficiency of the nuclear power option.

Lessons learned or to be learned

Biennial general meeting of the WANO held in Berlin, October 2003

- WANO Chairman Hajimu Maeda: *“a terrible disease threatens nuclear operating organizations from within... It begins with loss of motivation to learn from others...overconfidence...(and) negligence in cultivating a safety culture due to severe pressure to reduce costs following the deregulation of the power market... Those troubles, if ignored, are like a terrible disease that originates within the organization... and can, if not detected, lead to a major accident” that will destroy the whole organization...We must avoid the pitfalls of self-satisfaction which threaten us”*.
- Bruno Lescoeur, executive vice president, generation & trading, of EdF: **“Even a minor accident could be a disaster, because it could question the acceptability of nuclear energy in France, and perhaps in the world.”**
- Armen Abagyan, Rosenergoatom said lack of attention to operational events - he cited events in Russia, France, and the U.S., *”may lead to a new burst of antinuclear opposition and adversely affect both Russian and the world nuclear industry.”*

Lessons learned or to be learned (Continuation)

American Nuclear Society meeting in New Orleans in November 2003

- **IAEA Director General Mohamed El Baradei** in a video presentation: "*We cannot afford another accident*". El Baradei said there is still a lot of work that needs to be done in the area of safety, particularly in the area of applying safety standards and safety culture uniformly across the industry.

All abovementioned assessments are valid today. Recent incidents again showed shortcomings in the design and quality of the systems and components, safety documentation, and safety culture. Complacency, overconfidence, self-satisfaction and negligence demonstrated in a number of incidents, threaten the whole nuclear industry.