

FIRST GENERATION VVER 440

What is the “reasonable” price?

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“What at first was a proper concern for safety has become a near pathological anxiety ...

...the media...and the political disinformers who sought to discredit the nuclear industry as potential enemies, have been so successful at frightening the public that it is now impossible in many nations to propose a new nuclear power plant”

Sir James Lovelock

**Preface to the book
“Environmentalists for
Nuclear Energy”
by Bruno Comby**



International Nuclear Concerns

Before TMI: Focus on peaceful use

- Secrecy at the implementation of nuclear programmes - a necessity for strategic, political and commercial reasons
- IAEA set up in 1957 as independent intergovernmental organization within the UN system
- EURATOM established by one of the Treaties of Rome in 1958 to form a common market for the development of the peaceful uses of atomic energy
- OECD created NEA department
- IAEA started issuing in 1974 basic standards and guides for the design and operation of NPPs

International Nuclear Concerns

Focus on safety

- TMI accident in 1978 showed that
 - severe accidents can occur through multiple minor faults and human error
 - The defense-in-depth concept requires containment structures to be provided
 - Man is an essential element of safety
- INPO was established in 1979 gathering all the US utilities with NPPs in operation or under construction
- OECD NEA set up a system for collection, analysis and circulation among members of information on particularly significant incidents affecting the nuclear installation of the countries concerned
- This system was extended by the IAEA to all countries using nuclear power. IAEA offered services more directly focused on the plants themselves, OSARTs and ASSETs

International Nuclear Concerns

Focus on Soviet design plants' safety

- April 1986 : Chernobyl proved that a severe nuclear accident is more than a hypothesis and revealed insufficiency of safety culture. It caused a raise of acute public anxiety about the NPP safety forming an active anti-nuclear opinion worldwide
- In September 1986, a safety conference was held in Vienna aiming to study the causes of the Chernobyl catastrophe and to establish early warning and emergency assistance agreements
- In 1989, the first expert assessment of VVER took place on the East German plants. While it was found feasible to upgrade them up to the western standards at acceptable cost, they were abandoned by political decision
- In 1989, WANO was formed to maximize safety and reliability of NPP operation. One of the first objectives was for operating staff from every nuclear power plant in the former Soviet Union to visit plants in the West for technical exchange, and for the personnel from the West to visit every plant in the former SU. This was accomplished in the first two years

Focus on Soviet design plants safety

IAEA Approach

- The IAEA responded in 1990 with an extrabudgetary program to evaluate the first generation VVER-440/V230 reactors aiming at identifying design and operational weaknesses, and to prioritize safety improvement measures
- The program was expanded in 1992 to deal with VVER-440 Model V213, VVER-1000, and RBMK nuclear power plants in operation and under construction
- The IAEA reached international consensus on the major safety issues for all Soviet reactor types, ranked according to urgency and significance with respect to the defense-in-depth concept:
 - VVER 440 /V230, 97 safety issues
 - VVER 440 Model V213, 87 issues
 - VVER-1000, 84 issues
 - Third-generation RBMK, 58 issues
- Subsequent assistance is related to generic issues for each reactor type, plant-specific issues and training. The IAEA's technical co-operation projects have created linkages with the European Commission, EBRD, the OECD Nuclear Energy Agency and WANO to upgrade the safety of Soviet-designed reactors

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G7 Approach

- By 1992, a considerable amount of work was already done to improve the safety of Soviet-designed nuclear reactors by the countries concerned, sometimes in cooperation with Western experts, based on the IAEA assessments of safety problems for different types of reactors. The EU and a number of bilateral donors were providing technical assistance to improve operational safety, and were cooperating with the nuclear safety authorities.
- At the Munich summit 1992, an economic declaration is adopted “Working together for growth and safer world” offering support to the CEE and CIS countries operating Soviet design reactors within the framework of a multilateral programme of action.
- The programme of action comprised immediate measures:
 - operational safety improvements
 - near term technical improvements to plants based on safety assessments
 - enhancing regulatory regimes.
- In addition, the programme of action was to create the basis for longer term safety improvements by the examination of:
 - the scope for replacing **less safe plants** by the development of alternative energy sources and the more efficient use of energy
 - the potential for upgrading plants of more recent design.

Focus on Soviet design plants' safety

G7 Approach

- A new multilateral mechanism was set up in 1993 by EBRD to receive contributions by donor countries for financing the immediate operational safety and technical improvements not covered by bilateral programmes.
- Agreements sought with the countries concerned on time-tables for the shutdown of the less safe reactors as part of agreed strategies for their power sub-sectors
- First projects related to VVER-440/230 and RBMK
 - Kozloduy NPP (four VVER-440/230) ECU 24 mln
 - Ignalina NPP (two RBMK) ECU 35 mln
 - Leningrad NPP (four RBMK) ECU 30 mln
 - Kola and Novovoronezh NPP (four VVER-440/230) ECU 45.9 mln
 - Chernobyl NPP (four RBMK) ECU 118 mln
- Results by 1999
 - The agreed strategies for the power subsectors not implemented due to failure to fulfill measures committed by both parties
 - Units of more advanced design not yet modernized
 - Reconsideration requested of the closure agreements for the early design units, upgraded by national investments complemented by NSA grants and other financial assistance

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EU Approach

- Declaring nuclear safety as one of primary concerns, at the beginning of the 1990s EU decides to be a major contributor to the international efforts supporting the safety enhancement of soviet-design reactors. The member states charge the EC with this responsibility
 - PHARE NSP is focused on on-site assistance and operational safety, design safety, regulatory authorities and their TSO, waste management and off-site emergency preparedness
 - TACIS NSP priorities additionally include control of nuclear materials, conversion of nuclear military scientists, Chernobyl closure and sarcophagus
 - These priorities reflect the G7 strategy adopted in 1992 and, in the case of design and operational safety of reactors, the risk classification established by the IAEA
 - For the period 1991-1998, the EC has had available EUR 838 mln under these programmes, including EUR 181 mln under PHARE and EUR 657 mln under TACIS
 - Agenda 2000 adoption and accession negotiations changed the political context of the PHARE NS Programme

Focus on Soviet design plants' safety

EU Approach

- In the context of EU enlargement, nuclear safety in CEE countries becomes a major part of the accession process. In 1997 Agenda 2000, the EC called for the candidate countries operating reactors classified as unupgradable at a reasonable price to internationally accepted safety levels, to close them at earliest practicable dates fulfilling the NSA agreements
 - This requirement further reflected in the Accession Partnerships signed with Lithuania, Bulgaria and Slovakia
 - Opening of accession negotiations conditioned by decision on definitive closure dates, Understandings on closure dates signed including financial support commitments
 - International decommissioning support funds established administered by EBRD and framework agreements signed
 - Process initiated of Safety assessment against “ safety requirements and good practices applied within the EU for similar installations”, in 1999 implemented by WENRA and continued by AQG/WPNS of the Council in 2000 – 2004
 - EU Acquis in nuclear safety and RAW & SNF Management proposed by the EC in 2000, rejected by a blocking minority of member-states in 2004

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Results

- There was no NPP on the West closed or new-build terminated as a result of Chernobyl
- The availability of secure supply of affordable electricity and environmental concerns are the main factors of the recent decisions for a nuclear new-build in some member-states
- All Chernobyl RBMK reactors have been shut down by 2000
- In East Germany, the VVER plants were shut down/construction ceased by political decision after reunification. Poland terminated the construction of four VVER units in 1990.
- Soviet-design plants and regulatory regimes in CEE countries have been upgraded in compliance with the IAEA requirements through substantial national investments supplemented by significant financial support of the international community
- Unsolved remains the definition issue of western or EU safety standards, and whether the western practices are the only sensible benchmark
- Nevertheless, under political imperatives, two VVER units were closed and premature closure dates were agreed for the first generation soviet design plants operated in Bulgaria, Lithuania and Slovakia, based on a judgement of "unupgradability at a reasonable price" against the "western safety standards"

Focus on Soviet design plants' safety

First generation VVER – is the price “reasonable”?

“If what are considered as shortcomings were rapidly identified by the experts from Western Europe, the benefit of their characteristics was only included later in their assessments”

Jacques Libmann, “Elements of Nuclear Safety”, 1996

- By now the total reactor operation experience is about 350 reactor-years and demonstrates reliability and safety
- Within the last 20 years no nuclear and radiation-related incidents and accidents have occurred
- The safety-related system element damages and failures experienced did not impair the safety
- No occurrence of safety system element failures resulting in loss of safety function
- At reactor shutdowns and load rejections the reactor control and protection system operability was comprehensive and ensured safe bringing of reactors into subcritical state or to the required load

The Utmost Imperative

“The Greens have so frightened their supporters that a change of mind would be almost impossible...

Sometime in the coming century the catastrophe may happen and then we'll look back and see what a vast disservice our politicians had done... as to order the closure of the working nuclear power plants...”

Sir James Lovelock

*“We need nuclear power, says the man who inspired the Greens”
Daily Telegraph, 15 August 2001*

