GREENPEACE Fact-Sheets

EPR – European Pressurised Reactor

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The European Pressurised Reactor (EPR) is a new reactor design developed by the French company AREVA in co-operation with the German firm Siemens. Comprising 1,600 MW of power generation in a single unit, the EPR is intended to be the world's largest reactor. The EPR is being promoted as a nuclear power plant which is mature, safer, cheaper and more reliable than any other. The nuclear industry is presenting it as the only example of an advanced "third generation" reactor; a flagship of the nuclear 'renaissance'. Promotional materials promise, for example:

> *"The EPR is the direct descendant of the well proven N4 and KONVOI reactors, guaranteeing a fully mastered technology. As a result, risks linked to design, licensing, construction and operation of the EPR are minimized, providing a unique certainty to EPR customers."* [1]

Contrary to these promises, however, serious doubts have been raised based both on consideration of the EPR's blueprints and practical experience at the two sites where EPRs are under construction, in Finland (Olkiluto 3) and France (Flamanville 3). Reality has revealed the incompetence of the nuclear industry as illustrated by weaknesses in design, problems during construction phases and soaring costs.

A summary of the problems and the lessons learned in four areas:

- safety
- waste
- costs
- no solution to climate change

Safety

The EPR is a pressurised water reactor which in many ways differs little from the majority of existing "second generation" reactors. Its concept is based on developments dating from the 1970s. It includes some additional improvements but attempts to make the reactor more competitive also have their downsides.

- **Large volumes of radioactivity.** The EPR is the largest reactor ever built with a core that contains the largest quantity of radioactive elements of any reactor. It addition, for reasons of economy, it is designed to burn fuel longer. However, this seriously increases amounts of radioactivity and dangerous nuclear isotopes. Furthermore, the mixed-oxide (MOX) fuel for the EPR is a mix of uranium and plutonium, which also results in a higher content of hazardous materials. The scale of contamination and impacts could be vast in the event of a serious accident releasing large quantities of radioactivity to the environment. A study conducted in 2007 by Large Associates, a British nuclear engineering consulting company, showed that this kind of accident occurring in France could require the evacuation of hundreds of thousands of people, would involve the serious contamination of many thousands of square kilometres and may produce thousands of human fatalities. [2]

[1] Framatome ANP: EPR; brochure, March 2005

[2] *Assessments of the Radiological Consequences of Releases from Proposed EPR/PWR Nuclear Power Plants in France*, Large Associates, February 2007

- **Terrorism.** Having been designed prior to 2001, the EPR does not reflect the changed security situation following the 9/11 attacks in the United States. While it has robust containment, pathways and vulnerabilities have been identified that could lead to radioactivity bypassing the containment under certain scenarios. [3] The ability of the containment to withstand the impact of a large aircraft was placed in doubt in leaked French official documents in 2003. Also, one of the reasons for delays and complications with EPR construction in France has been the need to reinforce the containment because the original design did not meet required safety criteria.

- **Weaknesses in construction.** Apart from problems with the EPR design blueprint, there is growing evidence from construction sites in Finland and France showing the inability of the nuclear industry to ensure proper construction. Problems include:
  - Concrete base: In Finland, the concrete base slab on which the power plant is positioned was poorly built. The concrete of the reactor's base slab is more porous than allowed, making the structure more vulnerable to chemically-reactive substances. This can lead to long-term deterioration of the reactor containment building. The concrete has a high water content, which could, under certain accident conditions, lead to rapid formation of cracks. Also at the EPR construction site, in France, inspectors recently found that concrete has been poured incorrectly, the concrete base slab for the reactor has developed cracks and steel reinforcing bars have been wrongly arranged. The poor composition of the concrete may lead to cracking and faster deterioration in sea air conditions. In both cases, problems have emerged because of mistakes and weaknesses or absence of quality control.
  - Containment. The inner steel containment liner - a crucial safety device – has suffered from a number of problems during construction in Finland. It was manufactured by a Polish company that had no previous experience of nuclear projects. Safety standards were breached in welding and dozens of holes were cut in the wrong places. The bottom of the liner is deformed and was damaged during storage. Sub-standard quality of the liner can lead to greater releases of radioactivity in the case of an accident. Similarly, in France, the containment liner has been welded by a company without the required certification and one-quarter of the welds are deficient.
  - Poor cooling pipes. The components of the primary cooling circuit at the Finnish reactor were found to have too large and irregular a grain size. The problem was caused by the subcontractor's attempt to save time and to reduce costs. All eight pipes have been recast but it is unclear whether the new methods have resolved the problem or led to new ones. Failure of the primary coolant circuit can initiate a severe nuclear accident.
  - Other problems were detected in Finland. The Finnish nuclear safety authority STUK detected 1,500 safety and quality problems in the EPR project. Some of them are illustrated in the graphic which summarises problems as of October 2007.

- **Rush and incompetence.** Problems with the EPR project in Finland can be attributed to a combination of a tight time schedule and considerable cost pressure. Similar circumstances are likely to apply to other future nuclear projects. The unrealistic price and construction timetable of Olkiluoto 3 have been a strong incentive for AREVA NP (a daughter company of AREVA, formerly known as Framatome ANP) to cut costs and to refuse to perform time-consuming corrections when problems arise. [4] According to articles published in *Nucleonics Week*, AREVA's attempts to reduce costs led the company to select cheap, incompetent subcontractors and overlook safety-related problems. In addition, nuclear safety training was not provided to workers. [5] Also, because of fast-track licensing Olkiluoto 3 subcontractors have used outdated blueprints and Finnish authorities have been at times unable to supervise work as they have not had the necessary design

[3] *Démarche de dimensionnement des ouvrages epr vis-à-vis du risque lié aux chutes d'avions civils*, DGSNR/SD2/033-2003

[4] *Management of safety requirements in subcontracting during the Olkiluoto 3 nuclear power plant construction phase*, Investigation report 1/06, STUK (Finland's Radiation and Nuclear Safety Authority), 10 July 2006, 18

[5] Ibid., at 23

documents. New reactor designs are inherently harder to build and control because of their larger size and fuel burn-up which places high demands on construction. But the stagnation of nuclear construction over the last decade or so has resulted in a shortage of competent personnel and companies. [6]

- **Waste.** AREVA claims that one of the advantages of the EPR is that it would produce less waste than other reactors. But the EPR does not solve the nuclear waste problem. While the promise is that the volume of waste produced will be reduced by 15 percent, this is only done by playing with numbers. The waste that is produced will be more dangerous because it will be more radioactive. With regard to radioactivity, the EPR will not be a step forward: improved fuel combustion rates simply lead to more dangerous waste. In addition, by being able to function with 100 percent MOX fuel (a mixture of uranium and plutonium oxides) the EPR will be a major link in the nuclear reprocessing system, which is highly contaminating.

<u>Costs and economics</u>

The EPR reactor has been promoted as a technology that makes nuclear energy cheaper and more competitive. When the decision was made to build an EPR in Finland, in 2002, the government promised that it would cost Euro 2.5 billion and take only four years to build. The final contract, three years later, put the price at Euro 3.2 billion and construction time was set at 4.5 years. Since construction began, less than three years ago, a variety of technical problems have led to a two-year delay, extending the construction period to at least 6.5 years. The estimated additional cost is Euro 1.5 billion, raising the current price tag to Euro 4.7 billion, almost double the initial estimate. More problems, delays and cost overruns are likely to occur before the project is completed.

The construction contract was signed as a fixed-price and turnkey delivery arrangement from AREVA and Siemens. Extra costs will most likely be borne by the two companies. Nonetheless, AREVA is seeking to claim some of the additional costs from the investor, the Finnish utility TVO.

Financing for the Finnish EPR has benefitted from State support in the shape of a Euro 570 million loan guarantee provided by the French export agency COFACE. The low interest rates offered by French and German State-controlled banks may be in violation of EU legislation and are the subject of a pending complaint with the European Commission and the European Court.

<u>Nuclear power is irrelevant for combating climate change</u>

From the Greenpeace briefing, *"Nuclear Power – Undermining Action on Climate Change"* (2008) [7]:

> "Nuclear power could at best make only a negligible contribution to CO2 reduction; even then many years after massive cuts are needed and only by depriving real climate solutions of funding.
>
> "Currently 439 commercial nuclear reactors supply around 15 percent of global electricity providing only 6.5 percent of overall energy consumption. Even if today's current installed nuclear capacity was doubled it would lead to reductions in global greenhouse gas emissions of less than five percent and would require one new large reactor to come online every two weeks until 2030. An impossible task: even in countries with established nuclear programmes, planning, licensing and connecting a new reactor to the grid typically takes more than a decade."

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[6] Greenpeace Finland's briefing on Olkiluoto 3, March 2008. http://www.greenpeace.org/international/press/reports/fact-sheet-olkiluoto-3

[7] *Nuclear Power – Undermining Action on Climate Change,* Greenpeace International, March 2008. http://www.greenpeace.org/international/press/reports/nuclear-power-undermining-ac

Regarding experience with the Finnish EPR, the briefing states:

> “The International Energy Agency (IEA) warned against the risk of relying on the new reactor for emission cuts, saying in 2004 that any delays would inhibit Finland’s ability to meet its greenhouse gas reduction targets under the Kyoto Protocol. That risk has become a reality.
>
> “In August 2007, after 27 months of construction, the project was officially declared to be between 24 and 30 months behind schedule and at least Euro 1,500 million (US$2,230 million) over budget. Unlikely to be operational before 2011, OL3 will not be ready in time to contribute to Finland’s Kyoto target.“

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