Nuclear Free Local Authorities
briefing

**Date:** 28th February 2011 **No.81**

**Subject:** **Floating nuclear reactors and submerged nuclear facilities – joint KIMO / NFLA / Greenpeace International report to the OSPAR Commission**

1. **Introduction**

This briefing provides member authorities with additional background information to a joint report of the local authority marine pollution group KIMO International and Greenpeace International in association with the NFLA. The report, attached as Appendix 1 below, has been tabled for the OSPAR Intergovernmental Marine Pollution Commission's Radioactive Substances Committee meeting of the 21st – 24th February.

The NFLA Secretary would like to express his thanks to the KIMO International Secretary, John Mouat and Rene Parmetier, an independent energy consultant linked to Greenpeace International, in the production of this briefing.

The briefing provides some additional information on two developments – small 'floating' nuclear reactors being developed by the Russian nuclear company Rosatom, and underwater nuclear facilities being developed by the French nuclear company DCNS.

2. **Floating nuclear reactors**

Floating nuclear reactors are not a new idea. In the 1970s, the United States built the 10 megawatt 'Sturgis' reactor and located it on the Panama Canal during the Vietnam War. It was in operation from 1967 – 1976. The Soviet Union military also considered building small 10 megawatt reactors in the 1980s but abandoned the project in the initial stages (1).

The project has been resurrected by the Russian state nuclear utility company, Rosatom, and a launch ceremony was held on June 30th 2010, at the Baltic Shipyard in St Petersburg of the hull of a floating nuclear power plant. This was deemed for use in the Kamchatka region off the far east of Russia. It is likely it could be fully operational by early 2012.

3. **Construction**

According to Alexander Nikitin, Director of the Environmental Rights Centre for the Bellona Foundation (an independent environmental NGO with its headquarters in Norway), the floating reactor (2) consists of two small nuclear reactors, two steam turbines, coastal equipment for transmitting produced electric and thermal energy to an external grid for demand allocation.



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The reactor is hosted on a flat bottomed, flush deck, non self propelled vessel with multi-layered bulkheads. It is a complex floating construction of some 140 metres – 30 metres wide and 40 metres high. It potentially could be used in any part of the world, including the Arctic Sea, the Baltic Sea and the North East Atlantic.

## 4. Dangers of this type of reactor

Whilst being a source of heat and electrical energy the obvious dangers of such a plant are the concentration of nuclear materials and radioactive waste in geographically isolated areas. The Kamchatka Peninsula is an earthquake-prone area and the potential for devastating tsunamis in the Far East remain a realistic scenario.

As Nikitin comments, the technology being developed by Rosatom, compared to international standards, may be outdated and technically deficient. There are also real concerns about the risks of refuelling such reactors using highly enriched uranium in remote areas, as would be required around every three years. Other issues that may arise are the risks of transporting such fuels large distances, the initial fuelling of the reactors at static dockyards (the Mayor of St Petersburg banned such practices in the 1990s) and the physical and heavily energetic process required to start up a reactor. Rosatom are marketing the floating reactors as a relatively cheap energy solution, but costs have tripled from $150 million in 2001 to $550 million by 2010 – a similar issue to all new nuclear reactor building projects. It is unclear who the customers for such reactors would be, and they would only become a profitable project if there was a large amount of customers seeking to buy them (3).

There also has to be real concern over a terrorist attack or piracy attack of such a reactor, as well as the alarming possibility of increasing nuclear proliferation. As seeking to acquire nuclear materials to develop a ‘dirty’ bomb is considered one of the biggest risks in the UK Government’s National Security Strategy (4), the existence of floating reactors which may have much lower levels of security than fixed nuclear sites is a highly alarming issue of concern. KIMO, NFLA and Greenpeace International are raising their concerns at the OSPAR Commission’s Radioactive Substances Committee to seek the member states to publicly raise concerns with such reactors to the Russian Government. The paper attached in Appendix 1 summarises the joint concerns of the three organisations.

## 5. Submerged nuclear facilities

An equally alarming concept being developed by the French state owned submarine-building and nuclear engineering firm DNCS (Naval Defence Company), in collaboration with Areva, is that of submerged nuclear facilities.

In January 2011, DCNS announced plans to conduct a validation study on its designs for a small sub-sea power plant for supplying coastal regions with electricity (5). It is anticipated that the ‘Flexblue’ plant would sit on the seabed at a depth of 60m – 100m a few kilometres out to sea, with a maximum operational capacity of around 50MW – 250MW (compare this to Sizewell B which produces annually around 1200MW).

DCNS claim that their design would be resistant to tsunamis, earthquakes and floods. It is also claimed, that, by being underwater, it much less susceptible to a terrorist attack. The plant would contain a small nuclear reactor, a steam turbine-alternator set, and electrical plant and associated electrical equipment. Power cables would take the generated electricity back to the mainland. Ballast tanks would help to raise the plant for installation or maintenance.

Like nuclear powered submarines, the reactor design would have fuel cladding, a reactor vessel and a hull. This would prevent contact between nuclear materials and the marine environment. DCNS also argue that underwater nuclear facilities would provide a natural means of cooling the reactor with the only substances released being cooled seawater.

DCNS are seeking to conduct a technical and licensing design certification with the nuclear regulator CEA in association with Areva and EDF. 2016 is seen as the target date for the completion of this process.

## 6. Dangers of such facilities

The costs and necessity of building such facilities could be prohibitively expensive and the French state may simply not have the resources to build them in the short term. The other obvious issue remains the key security risks from transporting such facilities off-shore and the real problems in achieving an effective emergency response to an underwater facility. The effects on the marine environment in the event of a major leak or accident could be catastrophic.

In the case of both reactor designs a rigorous safety review is required and even then, public disquiet on the safety of such facilities is unlikely to go away. As the KIMO / NFLA / Greenpeace International report below outlines, the effects on the marine environment by a safety breach is wide-ranging and alarming.

## 7. Further action

The report outlined below as Appendix 1 was been formally tabled for discussion to the OSPAR Commission's Radioactive Substances Committee (RSC) by KIMO and Greenpeace International and was presented to it by the NFLA. The three organisations formally asked for a ban of such facilities in the OSPAR maritime region. National government delegations are being lobbied to formally support this report and allow for full discussion in the meeting. The meeting determined that the issue should remain in its work programme and further information requested of the Russian and French Governments.

Further actions, since an immediate ban is not forthcoming, will be considered by the three organisations. KIMO has already passed a formal motion opposing development of such facilities, which was fully endorsed and supported by the NFLA Steering Committee in its January 2011 meeting. Regulators and national governments will be contacted in the event that a ban is not forthcoming, and further lobbying of the OSPAR RSC will also continue.

## 8. References


(1) Alexander Litkinin, Bellona Organisation – 'Does Russia Need Floating Nuclear Power Plants?' http://www.bellona.org/articles/articles_2011/Russia_need_FNPPs
(2) Ibid.
(3) Ibid.
(4) UK Government – 'A Strong Britain in an Age of Uncertainty: The National Security Strategy.' http://www.direct.gov.uk/prod_consum_dg/groups/dg_digitalassets/@dg/@en/docuemnts/digitalasset/dg_191639.pdf
(5) The Engineer Website, 27th January 2011 – 'French company proposed offshore nuclear power.' See http://www.theengineer.co.uk/video/french-company-proposes-offshore-nuclear-power/1007070.article

**Appendix 1**

## Paper to OSPAR RSC - Concerns on Floating and Submerged Nuclear Power Plants

**Submitted by KIMO International and Greenpeace International, and presented by NFLA**

Recent developments in nuclear energy technology are concerning for the integrity of the marine environment in the OSPAR region. Recent activities in Russia and France are seeking to develop technologies that would move nuclear energy production plants from their conventional, established land-based locations to offshore marine environments greatly increasing risks from the nuclear energy industry. These developments have serious implications for the OSPAR region, and KIMO and Greenpeace International seek to highlight the issues to the RSC.

### Background

1 Russia is in the final stages of constructing the first vessel in a new fleet being built to generate nuclear power in the Arctic Ocean. Work has been underway since contracts were drawn up in 2006 and the first floating nuclear power station (FNPS) is due for completion in early 2012.

2 The first $400M vessel is part of a planned eight-strong fleet to be located off Russia's northern coastline to supply energy to onshore consumers. Each FNPS is estimated to be capable of producing enough heat and electricity for 45,000 homes and will be capable of remaining at sea for up to 12 years.

3 Rather than being spent nuclear material in transport that poses the risk of catastrophic impacts, these are functioning nuclear reactors whose presence is intended to be long-term. In the event that an accident did occur the scale of impacts could be vast.

4 The first vessel, the Academician Lomonosov is to be completed in the Port of St Petersburg and floated through the Baltic Sea and via the North Sea to the city of Murmansk for nuclear fuelling before being transported along the entire northern coast of Russia and through the Barents Sea to the remote Kamchatka peninsula to provide power. Criticisms of this plan highlight that current energy supply in the Kamchatka region already outstrips demand, and the lack of adequate infrastructure is a current issue, raising questions over the choice of location for the vessel, probably to be in close proximity for marketing to the booming Asian economy.

5 Should expansion of the fleet occur in the Arctic Ocean, considerable risks will be imposed on the OSPAR region. The transpolar ocean current moves south from the Arctic into the OSPAR region past the east coast of Greenland, if a nuclear accident involving an Arctic-based FNPS was to occur it is clear that the OSPAR region would be at significant risk of pollution. Moreover the Port of St Petersburg, where the first of the FNPS is currently undergoing construction works, may be used by the vessels for maintenance and refueling, thus resulting in nuclear reactors being transported by sea through OSPAR region.

6 The rate of accidents on-board nuclear vessels is a clear justification for being concerned about the development of FNPS. The reactors are based on the KLT-40 naval propulsion reactors that are used in Russian icebreakers, and are similar to those used in Russian submarines, which have had 14 accidents involving the release of radiation.

7 Along with risks of the operation of this fleet of vessels, KIMO and Greenpeace International are also gravely concerned about the potential for them being produced for sale on the open market. If successful, these vessels may end up being exported to other nations throughout the world, with greater uncertainty and increased risk to marine environments, including the OSPAR region.

8 Parallel to these alarming developments in Russia, the French state-owned DCNS (Naval Defence Company) has commissioned work to investigate the potential of small and medium sub sea nuclear power generators to supply electricity to maritime nations.

9 The nuclear energy firm Areva has launched a study into the scope for producing 100MW-scale FlexBlue[1] nuclear reactors that would be submerged at depths of up to 100m on the sea floor. The 100-metre-long cylinders would be transported by special ship to their destination, a few kilometers offshore, be submerged and linked up to the shore by cable.

10 The firms involved in the study promote the concept as being less at risk of terrorist intervention given their sub sea location, reinforced by sensors and under-sea fencing capable of informing surface and onshore security of any risks or threats. They also suggest that since the installations are not mobile, they pose significantly fewer risks than those associated with nuclear submarines.

11 These small-scale installations aim to target the market for maritime nations seeking electricity supply of up to 50 to 250MW. The proposed technology does not require any onshore infrastructure other than to link up the onshore to the energy generated offshore.

**Risks, Security and Emissions**

12 The very fact that these types of systems are being considered is concerning. In the case of a catastrophic accident where the core was exposed to seawater the result would be a thermal explosion that would hugely increase the amount of radiation emitted both to the marine environment and atmosphere.

13 Both systems would be transported by sea to their destination, raising considerable safety issues about terrorism, piracy and accidents. This was recently highlighted with the hijacking of the Arctic Sea, which was boarded and taken over by masked men posing as Swedish Police, in the Baltic, in 2009.

14 Floating nuclear power plants would be refuelled at sea every three years with highly enriched fuel, which, apart from being a major proliferation risk, also increases the possibility of an accident. Then every 12 years the whole plant would need to be transported back to port, currently St Petersburg, for removal of radioactive waste. Tsunami or large storm events would also pose a threat to the plants whether in situ or whilst being transport especially in harsh environments like the Arctic.

15 Submerged plants would be at risk from fishing vessels and the anchors of larger vessels as well as terrorism despite the undersea fencing. In the case of an accident the DCNF states the reactor would flood with seawater potentially leading to emissions to the marine environment. Patrick Boissier, the President of DCNS, the engineering firm developing the project was quoted in *Le Figaro*[2]*,* stating, "Water is a natural barrier to radiation".

**Action requested**

16 Given the increased risks to the marine environment from the operation, transport and refuelling of these types of nuclear reactors RSC is requested to consider a ban on their use within the OSPAR Maritime region.

[1] http://en.dcnsgroup.com/presse/dcns-va-realiser-avec-areva-le-cea-et-edf-les-etudes-de-validation-de-son-concept-innovant-flexblue-2/
[2] http://marches.lefigaro.fr/news/societes.html?OFFSET=1&ID_NEWS=174740069&