



## Risk and environmental impact assessments for the decommissioning of radioisotope thermoelectric generators (RTGs) in Northwest Russia

**All 180 RTGs in Northwest Russia have now been removed and secured as a consequence of Norwegian-Russian cooperation and funding from Norway. The removal and safe disposal of RTGs and their replacement with solar panel technology in Northwest Russia is a priority area under the Norwegian Nuclear Action Plan. Norwegian cooperation and funding requires Risk and Environmental Impact Assessments during the planning phase. The role of the Norwegian Radiation Protection Authority (NRPA) is to perform a review and quality assurance of such assessments.**



*Removal of an RTG from its original placement in Northwest Russia (Photo: County Governor of Finnmark).*

### Lighthouses powered by RTGs

An RTG is a radioisotope device which transforms thermal energy from the decay of radioactive material into electricity. In Russia, RTGs are used in areas with harsh climatic conditions to supply power for unmanned automatic navigational aids, inter alia lighthouses. These are located on remote parts of the coast and the like. Russian RTGs utilise large radioactive sources containing strontium-90 (Sr-90), which forms the Radioisotope Heat Source (RHS). More than 1000 RTGs were manufactured in the former USSR. About 60 % of these have subsequently been removed

In 2005, a Memorandum of Understanding was signed by the Norwegian Ministry of Foreign Affairs and the Federal Atomic Energy Agency of

the Russian Federation. This provided the basis for the provision of funds by the Norwegian Ministry of Foreign Affairs for the dismantling of all RTGs in lighthouses in the counties of Murmansk, Arkhangelsk and the Nenets Autonomous Area (including Novaya Zemliya), and their replacement by solar panels or other alternative power supplies. Now, all 180 RTGs in these areas have been removed and secured. The project manager from the Norwegian side was the County Governor of Finnmark and from the Russian side, the Murmansk Regional Administration.

### Security and radiological hazard

The limited physical protection around the RTGs and lack of maintenance and control make them easily accessible for intruders. RTGs are

categorized by the International Atomic Energy Agency (IAEA) as radioactive sources with highest amounts of radioactivity and therefore highest risk. The primary risk to health and the environment associated with RTGs is radiation exposure from an RHS following the removal or destruction of the outer casing and shielding.



*An RTG in Northwest Russia (Photo: County Governor of Finnmark).*

This potential risk has been exacerbated in recent years by insufficient regulation and control of RTGs. Due to its half-life of 29.1 years and the high levels of radioactivity involved, the Sr-90 fuel pellet can pose a radiological hazard for many decades.

### **Decommissioning of RTGs**

In general, a number of distinct steps can be identified in the decommissioning process:

- ◆ Inspection of RTGs in-situ, to determine status.
- ◆ Removal of RTGs from their operational locations and transport to a temporary storage point.
- ◆ Transfer from the temporary store to a dismantling facility.
- ◆ Extraction and packaging of the RHSs.
- ◆ Onward transport of packaged RHSs.
- ◆ Processing of RHSs for extended storage prior to disposal.

### **Risk and Environmental Impact Assessments**

The Norwegian governments focus on Risk- and Environmental Impact Assessments for nuclear safety projects in Russia provides for systematic

review of potential consequences for the environment, health and safety. In this work NRPA has cooperated with Russian regulatory bodies to develop new regulatory framework focusing the regulatory requirements and regulations.

The robust nature of the RTG unit and its low potential for significant releases of activity to the environment under normal conditions has been demonstrated. Potential accident scenarios have been identified and countermeasures introduced to reduce risks and mitigate hazards. Handling of damaged or partially dismantled units has been considered and provisions made on a case by case basis. The scope and depth of information provided by the relevant Russian bodies has evolved and progressed during the scope of this project.

The objectives for performing and reviewing Risk and Environmental Impact Assessments are to:

- Improve the safety and security of radioactive sources and waste.
- Reduce potential environmental radioactive contamination.
- Ensure that activities are carried out in accordance with international recommendations and Russian laws.

For further details, see Strålevernrapport 2009:13.

### **Conclusions**

Unsecured RTGs pose a radiation risk to human and environment due to the extremely high activity level. The Norwegian-Russian RTG decommissioning project in Northwest-Russia involved the removal of 180 RTGs and replacement with solar panels.

As a result of experience gained throughout the decommissioning project, a reduction in the risks has been achieved. Close dialog with the Russian regulatory- and supervisory authorities has been essential which has resulted in the development of new regulatory basis and inspection work. The feedback from NRPA throughout the reviewing process of the risk and environmental impact assessments aimed to reduce the risks in the decommissioning project. There were no accidents during the decommissioning project.