



## Spent nuclear fuel removed from Andreeva Bay

Fifty kilometers from the Norwegian border at Andreeva Bay in Russia lies what is considered to be the largest and most dangerous collection of spent nuclear fuel in the world. In June, removal of the fuel commences. This will take a minimum of five to six years.



*The spent nuclear fuel will be put in transport and storage containers that comply with international standards. (Photo: SevRAO).*

The spent nuclear fuel is at a former Russian military base at Andreeva Bay. The military base was used for refueling of nuclear submarines and the handling and storage of solid and liquid radioactive waste. After operation of the base ceased in the 1980's, little maintenance was performed and parts of the base are very contaminated. The radioactive waste and spent nuclear fuel from approximately 100 submarine reactors and an accident at the base can have serious consequences. Norwegian authorities started concrete projects with Russia already in 1997 to improve conditions. A number of other European countries have contributed to the establishment of conditions necessary for removal of the waste. Russia is responsible for the removal of the nuclear fuel which will commence in June 2017 and is estimated to take five to six years.

The spent nuclear fuel will be transported to Mayak in Russia, 150 km from Yekaterinburg, for treatment and long-term storage. It will be transported with Russia's special ships, Serebrianka and Rossita, to Murmansk where it will then be transported further in special rail carriages. The transfer of the spent nuclear fuel to the new containers is viewed as very complex and represents many safety challenges.

### Dangerous transport

Norwegian authorities have taken the initiative in development of a consequence analysis for potential accidents during handling of the spent nuclear fuel. This information will contribute to necessary precautions to avoid accidents. The analysis was performed by the Russian operators at Andreeva Bay. The County Governor of Finnmark

was leader of the project. The consequence analysis takes account of:

- Earthquakes, floods, hurricanes, lightning strikes, etc.
- Explosions and shockwaves
- Power outages
- Fire
- Falls involving waste or equipment
- Equipment falling on the roof of the storage
- Storage and handling incidents
- Criticalities and chain reactions
- Airplane crashes
- Human errors

The report indicates that the radiological consequences outside of the Andreeva Bay facility as a result of a potential accident with the spent nuclear fuel are generally low.

### Close collaboration

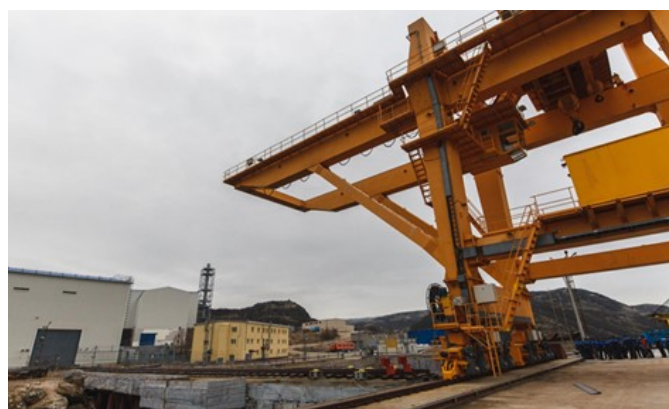
The wider health and environmental risks posed by the spent nuclear fuel were one of the reasons for Norway's engagement. The fuel has been secured and its safe removal has been among the Norwegian Governments highest priorities within the Norwegian Nuclear Action Plan. There has been close collaboration between the regulatory authorities in Norway and Russia in areas such as emergency preparedness and regulatory aspects.

The County Governor of Finnmark has led the infrastructural projects together with the county administrators in Murmansk and the Russian entity responsible for the clean-up. Financial resources for the project have come from the Nuclear Action Plan. Other contributors have been the United Kingdom, Italy, Sweden, the European Commission and the Northern Dimensions Environmental Development Fund, which is administered by the European Bank for Reconstruction and Development (EBRD).

### Measures financed by Norway:

- Physical security and alarm systems
- Road, water, waste, power and structural facilities necessary for the safe removal of the fuel
- Quay for transport

- Geological investigations and mapping of contamination at the facility
- Radiation shielding of the storage tank contributing to radiation safety for the workers
- Training of personnel involved in removal of the fuel
- Emergency exercises
- Equipment and facilities for the preparation of the transport
- Environmental monitoring
- Development of new guidelines, regulations and inspection routines



Andreeva Bay facility (Photo: SevRAO)

### Safer conditions

There are 22000 fuel elements from nuclear submarines and icebreakers at the facility, these are stored in three tanks which were not designed or constructed for storage of this type of waste. In addition there are approx. 18000 m<sup>3</sup> of solid radioactive waste and approx. 3400 m<sup>3</sup> liquid radioactive waste at the facility.

Conditions at the facility are, today, significantly better and safer than earlier. The risk of radioactive material falling out of regulatory control has been significantly reduced. Conditions for the safest and most secure handling of the transport have been established. The extensive measures implemented by Norwegian, international and, not least, Russian partners have led to this establishment.