DISPOSAL OF RADIOISOTOPE THERMOELECTRIC GENERATORS; PROBLEMS, AND HOW TO SOLVE THEM

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1. The work carried out at "VNIITFA" in 2007

The following work for disposal of RTGs was carried out at "VNIITFA" in 2007:

USA

- For the money allocated by the US we completed the work on developing of the database of all the RTGs located on the territory of the Russian Federation. 21 RTGs were tested in the Far East and in Kamchatka. Besides, the US coordinated the work financed by the Canadian side on decommissioning of 10 RTGs from the Tiksi Bay, as well as installation of 9 alternative power sources in the Strait of Yugorsky Schar.

Canada

- in accordance with the Executive Agreement with the Ministry of Foreign Affairs and International Trade of Canada 17 transportation containers for transporting RHSes were fabricated, as well as 16 sets of secure containers for transporting RTGs. The above equipment is currently being used to transport RTGs and RHSes for disposal.

Norway

- removal of RTGs from the coast of the Barents Sea continued with the technical assistance of Norway. Totally 21 RTGs were removed and disassembled due to the money of Norway. Currently there are no RTGs on the Kola Peninsula.

Russia

- for the money of the Russian Federation the work was carried out to eliminate radiation accident with the RTG at Navarin lighthouse, as well as 3 RTGs from the Baltic region were disposed of with a certain preliminary work. Inspection of 10 RTGs was carried out in Yakutia (Peleduy).

2. Work planned at "VNIITFA" in 2008

The following work for disposal of RTGs is planned at "VNIITFA" in 2008:

USA

- it is planned that 24 RHSes located at "VNIITFA" will be sent for disposal, and 20 RTGs from the mouth of Yenissei will be disposed of for the money of the US.

Norway

- 30 RTGs from Novaya Zemlya, Barents and White Seas, as well as 16 RTGs from the Nenets AR are planned to be disposed of for the money of Norway.

Russia

- 8 RTGs from the Baltic region, as well as 10 RTGs from the Nenets AR are planned to be disposed of for the money of the Russian Federation. It is also planned to have an inspection and start the work to dispose of the "drowned" RTG at Cape Maria.

Totally it is planned to deliver 84 RTGs for disassembly to "VNIITFA" in 2008.

3. Disassembly of RTGs.

RTGs are disassembled at “VNIITFA” is the specialized protective cell for approximately 10 years. Extensive experience has been gained during these years in the issues related to radiation safety, accounting and control of radioactive materials, as well as physical protection when working with RTGs. For the whole period of carrying out the work there has been not a single radiation accident, as well as abnormal situations with radioactive materials. The work is carried out by the trained and certified highly qualified personnel. Disassembly of RTGs is carried out on the basis of technical requirements developed for each type of RTGs.

4. Problem with the damaged RTGs.

We have run into a number of difficulties recently when disassembling RTGs.

- First, there are situations when it is impossible to extract RHS. We believe that it is related to internal mechanical damages of RTGs, as well as with long-term thermal loads of RTGs, design operation term of which is expired.
- Second, sometimes we find external contamination of RHSes when disassembling RTGs. This is specific of the medium-temperature RTGs of “Gorn” and “Gong” types. We believe that this is due to long-term thermal loads, as well as with the specifics of the design material of capsule containing RHS fuel composition.
- Third, there are cases when tightness of the RTG uranium protection is lost. In this case intensive oxidation of depleted uranium starts, thus leading to worsening of its protective functions, and as a result – to significant increase of the radiation levels.

It is important to state that recently we started having more and more of the damaged RTGs. Geography of their location is from the Baltic region to the Far East. In accordance with our statistics approximately 7-8% of the decommissioned RTGs can be evaluated as the damaged. For today there are already approximately 25 pieces.

5. Proposals for disposal of the damaged RTGs.

Currently we are completing developing of the design documentation for fabrication of the can-containers that we plan for disposal of both RHSes and whole RTGs. After fabrication of these can-containers it will become possible for us to partially solve the problem of the above damaged RTGs located at “VNIITFA”. In the future, when certain decisions are made, it will become possible to transport damaged RTGs in the above can-containers from the sites of their temporary storage. As we accumulate some number of the damaged RTGs we will be able to deliver them for disposal inside these can-containers at PA “Mayak” in small batches (approximately 10 pieces). There exists already preliminary agreement with PA “Mayak”.

6. Proposals for repair and commissioning of the second hot cell

Some time ago RTGs were disassembled at “VNIITFA” in two hot cells. Still after a certain activity not related to RTGs one of the hot cells became contaminated, and the work was stopped there.

We propose the work to decontaminate the hot cell, replace manipulators, and lining elements. Operation of two cells would allow uninterruptible work even in case operation in one of the cells is to be stopped for some time, it would also allow disassembling of more RTGs. We believe it will be economically beneficial.

7. Proposals for disposal of RTGs located at the temporary storage sites.

We have established the following order of the RTG disassembly at “VNIITFA” recently. As the work on RTG disassembly is linked to beginning of the navigation period, i.e. it starts only in July. To organize more intensive work in the first half of the year it would be possible for us to

receive RTGs that are currently located at the temporary storage sites. Therefore, the work would be more uniformly distributed within a year, and we could additionally disassemble of up to 50 RTGs per year.

8. Problem of the RHS lifetime.

In accordance with the existing certificates lifetime of RHS is limited. For РИТ -90 – it is 35 years, for РИТу – 90 – 25 years. Lifetime of low temperature RTGs is 35, and of medium temperature – 25 years, respectively. Therefore, after completion of the design lifetime RHSes are either to be transferred into the category of radioactive wastes, or from the category of closed sources – into the category of open. This will lead to revision of all the existing schemes for disposal of RTGs.

It is necessary to mention that the casing of RTG, which plays the role of the container for storing RHS was not designed for storing radioactive wastes. It is important to note that RTG itself is not a perfect structure for long-term storage of RHSes, as it contains elements of limited stability – sealing, compounds, semi-conducting battery, etc. Degradation of these elements sufficiently worsens conditions for storing RHSes.

We believe that it is important to pay attention to the age of RTGs and, in the first place, to select the "oldest" ones for disposal. This is to be started as soon as possible, because the number of RHSes to be transferred into the category of radioactive wastes will increase drastically in the near future.

9. Analysis of the cost of work.

We would like to discuss costs for disposal of RTGs. Cost of disassembly and disposal of the damaged RTG in the can-container is several times higher than of the standard one. The cost of disposal of RTGs with the damaged radiation shielding (as the RTG from Navarin Cape) increases several tens of times. In this case we do not account for expenses related with the storage of such containers, as we do not have any technologies now for long-term storage of large-size containers with RTGs. It was shown that the probability of the increase of the cost for disposal is growing along with the age of RTGs. This is directly connected with internal and external impacts onto RTGs, as well as with the RTG storage conditions in both operation locations, and in the temporary storage sites. If the work on disposal of RTG from Navarin Cape started in 2000, the cost of it would have been lower by one order of magnitude.

One more time we would like to mention, how important the time factor is for decommissioning of RTGs. We believe we should not wait till an RTG comes to a damaged state, and will become a threat for environmental and radiation safety. One should not forget that dose rates for the personnel participating in disposal of the damaged RTGs increase greatly, thus leading to the drastic increase of the cost of the work to be done.