Recovery of Orphan Radioactive Sources in Georgia (Lessons Learnt)

Prof. G. Nabakhtiani, L. Chelidze
Nuclear and Radiation Safety Service of Georgian Ministry of Environment Protection and Natural Resources - 6, Gulua st. Tbilisi-0114, Georgia
E-mail: ngiorgi2000@yahoo.com

1. Introduction

Georgia had serious problems with s.c. orphan radioactive sources. There were found and recovered 293 of such sources. The number of people was overexposed. The lethal events are also fixed. Among the found orphan sources the most important are s.c. RTG. Each of them contains radionuclide $^{90}Sr/^{90}Y$ (initial activity of ^{90}Sr is 1 290 TBq). There were found and recovered six RTG-s. The sources were used to produce electric supply for antennas installed into the gorge of high mountain river Enguri. Due to braking radiation the sources are very hot, therefore using of thermocouples gives the possibility to receive enough electrical voltage to supply the antenna with energy. Usually the sources were installed into special device (Fig.1).

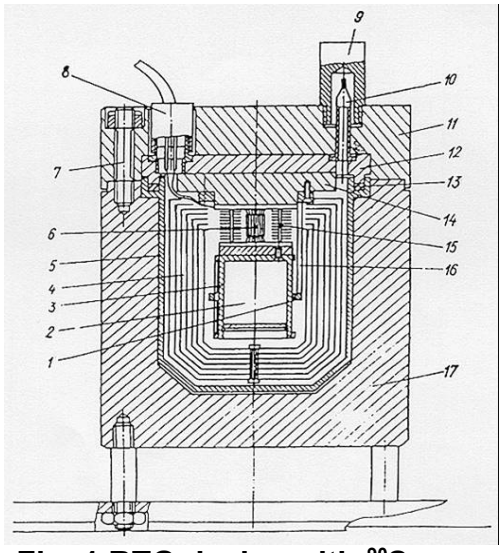

Fig. 1 RTG device with ^{90}Sr source

Usually two sources were used to supply by electricity one antenna.

Very often found orphan sources are military devices containing ^{137}Cs radionuclides (para. 4.1.2). As it was mentioned above there were fixed two types of devices (special containers): The firsy contains one source with activity ~3Ci, the second two sources with activity ~10mCi for each. Fig.2 demonstrates distribution of found and recovered orphan source on radionuclides.

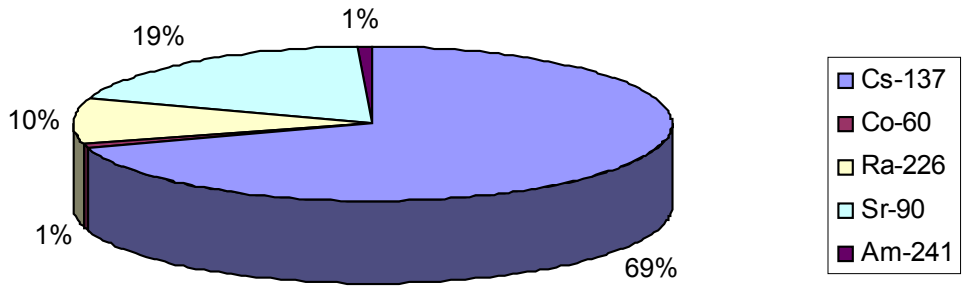

Fig. 2 Found and recovered orphan radioactive sources[1]

Analyzing the situation with orphan radioactive sources in Georgia, it can be concluded that there were two ways for originating of orphan radioactive sources in Georgia: military and civil. Situation with orphan radioactive sources in Georgia is caused by complex of facts. At first it should be considered that as a part of former Soviet Union, Georgia was neighboured by NATO country. Therefore a huge amount of militaries were deployed on Georgian territory. The many of them use radioactive sources were not under civilian regulatory control. At the troops withdrawal from Georgia no strong regulatory control existed. There was period of time of soviet empire ruining, when old regulatory system was destroyed, but new one was not established still. At the same time weakening control within military deployments gave the possibility to sell or even abandon (to avoid fees for transportation and disposal) radioactive sources. Simultaneously many enterprises owned the sources due to economical difficulties stop their activities or changed the profile. As a result, in absence of regulatory control, number of sources becomes uncontrolled. To take into account main causes for loss of control over the sources (Fig.3), it is possible to conclude that the main aspect loss of control and originating of orphan sources was **Financial Motive** [1]. This motive was existed when some people found abandoned radioactive sources. They just tried to earn money and improve their wealth in difficult economical situation. Based on above-mentioned there is possible to identify three main causes for originating of orphan radioactive sources in Georgia:

- Temporary absence of regulatory control;
- Absence of radioactive waste management system
- Difficult economical situation

2. Accidents

Several radiological accidents have been developed in Georgia since 1997. The first great radiological accident took place at the military base in Lilo, when 11 soldiers were irradiated by ^{137}Cs (orphan ^{60}Co and ^{226}Ra sources also were found) [2].

In the scope of IAEA TC project GEO/9/004 “Radiological Emergency Assistance to Georgia” some analytical and monitoring equipment was provided to Georgian

[1] Fig.2 does not consider RTG-s.

specialists to enable them to locate any additional sources left behind by the former Soviet Army on the territory of Georgia**.**

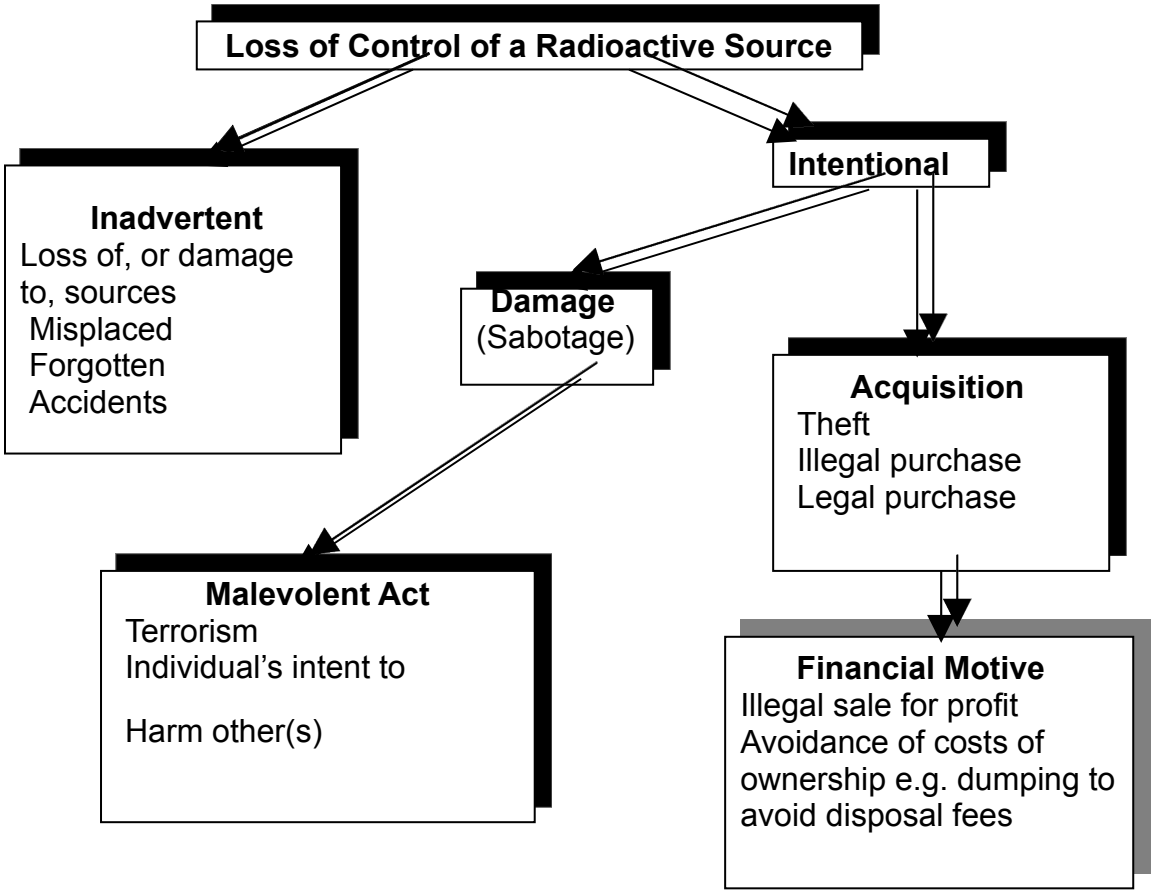

Fig.3 Causes loss of Control of a radioactive source

The next great accident was happened in Matkhoji in August 1998 were three powerful ^{137}Cs and one ^{60}Co were found. The same type sources are found in different regions of Georgia. The last orphan sources were found in Racha (two 137Cs sources) region during the searching operation at summer 2005.

Especial attention also should be paid to illegal movement of radioactive sources through Georgian borders.

Notable cases refer to thermoelectric generators based on 90Sr. Initial activity each of them was 1 295 TBq. There were found and safely stored six such sources. All these sources maybe used for terrorist purposes.

The last accidents occurred at 2009 when the orphan sources were found in western Georgia near village Ianeti (four^{137}Cs sources with activity ~ 10 mCi each) and contaminated by ^{137}Cs details in Tbilisi.

3. Searching operations

Georgia took necessary steps to establish regulatory control on every type of nuclear and radiation activity: radioactive waste management system is under development (some important parts are already implemented – centralized storage is under operation); economical situation in the country increased greatly and continues become better. Simultaneously with this it is important to search and recover the sources which already became orphaned. Administrative searching can be considered as a first phase

for whole searching operation, which should be followed by physical searching. There are three main possibilities to conduct physical searching operation: Airborne survey, car survey and pedestrian survey.

All types of survey ware conducted in Georgia. Each type is characterized by its effectiveness and difficulties.

Airborne survey:

The most effective to quickly find and identify sources or land contamination.

Difficulties: Required expensive equipments. Not applicable for mountain regions.

This type survey was carried out in Georgia within the scope of IAEA TC project GEO/9/006 “Assistance for safe disposal of ^{90}Sr the thermogenerators” when 56 hours of airborne gamma survey of a large territory of the western part of Georgia and around Tbilisi was carried out at 2000 (Fig.4).

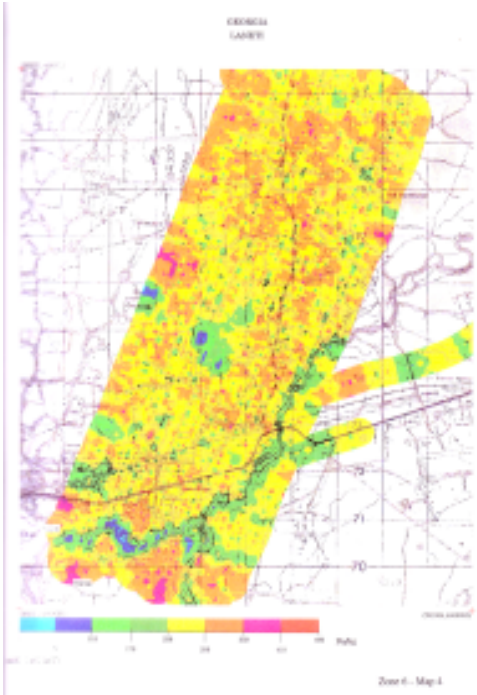

Fig.4 Result of Airborne survey for one area

Car and pedestrian survey

Effective to allocate the source. Applicable for mountain relief. (Not so expensive as airborne survey) (Fig.5)

Difficulties: Covering of large regions

Car survey can be effective if it is accompanied with pedestrian searching. These types of surveys were conducted in Georgia at 2002, 2003 and 2005. All these activities were actively supported by IAEA in close collaboration with USA, France, Indian and Turkish experts.

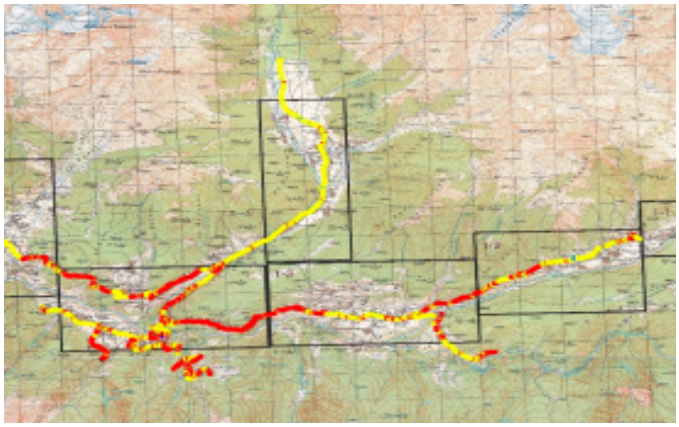

Fig.5 Results of car searching operation for one area

4. Recovery operations

All found orphan radioactive sources should be recovered. There is possible to distinguish to type recovery operations: recovery operation during searching activity and large scale recovery operation. Large scale recovery operation is required when powerful orphan radioactive source was found. Usually large scale recovery operations usually contain three phases:

- Assessment
- Actions planned
- Implementation

During the first phase the relevant information should be gathered and determined the nature and magnitude of the problem. During the second phase (Fig.6) evaluation of problem and remedial action should be carried out. The special recovery plan should be elaborated and taken all action for its implementation. It is also important to consider actions to prevent such accidents in future as on legislation, as on regulation level. The third phase is implementation of the recovery operation and assessment of its results.

Good examples for this activity are recovery operations for RTG and ^{137}Cs sources found near Ianeti.

The last accident connected to RTG was happened at the end 2001 - beginning of 2002 when two local woodgazers near village Lia (Tsalendjikha) district found two RTG sources. They naked them and tried to transport (Fig.7). As result two of them received serious damage for their health. (One of them was dead after long curing in Tbilisi and Paris). NRSS conducted on site measurement and collected all information for situation evaluation. Based on the basis of the special recovery plan was elaborated agreed among interested organizations. The special trainings were conducted to assess effectiveness of the elaborated plan. The recovery operation was carried out by specialists of Department of Civil Dependence and Emergency Situations leaded by NRSS experts. The same methodology was used for recovery operations sources found near village Ianety and contaminated details found in Tbilisi.

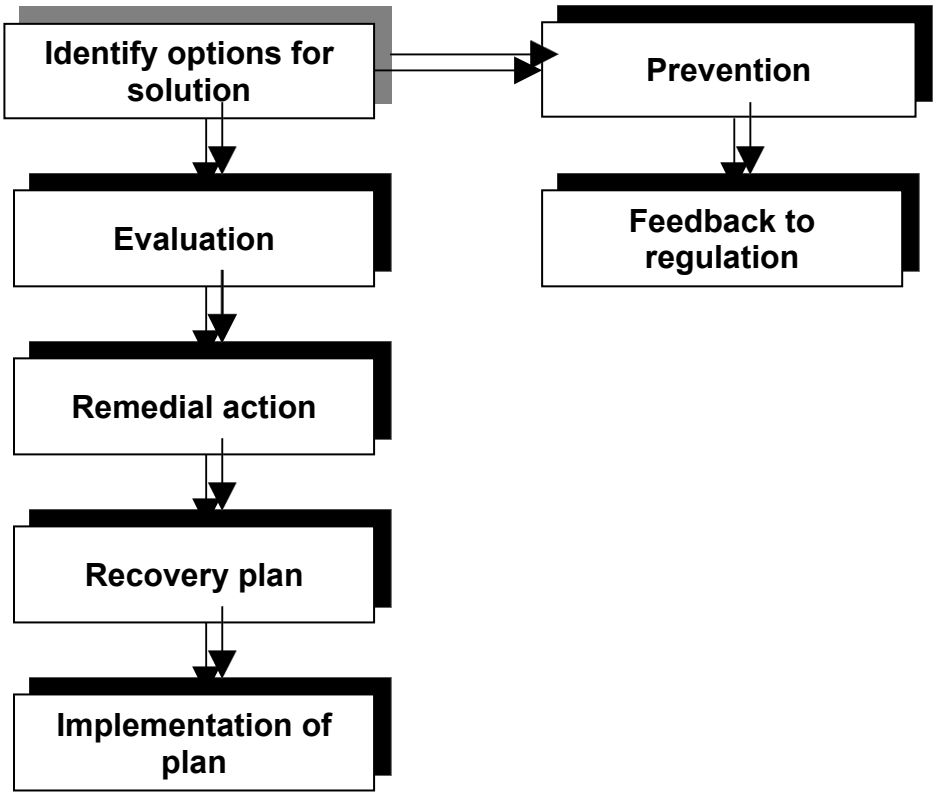

Fig. 6 The second phase for large scale recovery operation

Fig. 7 RTG sources found near village Lia (Tsalendjkha)

REFERENCES

1. Strengthening control over radioactive sources in authorized use and regarding control over orphan sources, IAEA-TECDOC-1388, Vienna 2004.
2. The radiological accident in Lilo, IAEA, Vienna 2000.