STUDY CASE N° 18: INCIDENT INVOLVING RADIOACTIVE LIGHTNING CONDUCTORS IN CROATIA

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❑ Description of the incident

Radioactive lightning conductors (RLC) have been used in a number of countries for several decades because it was believed that radioactive attachments improve the effectiveness of the lightning conductors. Even though these types of RLC have not been manufactured in last 10 years, many are still in regular use in Croatia and have created a number of specific radiation protection and regulatory problems. RLCs represent the largest homogenous group of radioactive sources in Croatia. These devices were classified as consumer products. The consumer products are usually covered by the general license concept with little or no regulatory control. The general license concept enables persons with minimal or no training in radiation safety to possess and use licensed radioactive sources or devices. The RLC installed in Croatia used cobalt-60 or europium-152 and 154 with activity 10 – 20 GBq, which exclude them from the consumer products category. They are treated as sealed radioactive sources.

As time has gone by, warning labels and signs on RLC often became obliterated as a result of exposure to adverse environments and improper maintenance. Also, personnel knowledgeable about the RLC retire, are discharged or otherwise leave the licensee's plant.

Not surprisingly, as a consequence of these developments and the absence of control and inspection, some of these RLC entered the public domain, most frequently by being discarded with scrap metal.

In August 2005 two radioactive sources in original lead container (open on upper side) were dismantled from RLC installed on the roof of one hotel and sold as scrap metal. During transfers of the devices two 15 GBq europium-152 and 154 sources were dislodged from the containers. Scrap metal was exported to Italy. It was transported from Croatia via Slovenia to Italy by truck.

At the Italian border during routine monitoring of the cargo on the truck transporting this scrap metal, according to Italian law procedures, the presence of radioactive material was detected. Two intact sealed radioactive sources were discovered (1 cm x 1.5 cm). No leakage of radioactive content was detected. The sources were placed in an interim storage and after some time with the consent of the regulatory authority of Croatia they were returned to Croatia and stored in the recognised storage facility.

The State Office for Radiation Protection asked for an investigation, dose reconstruction and evaluation of the consequences.

Direct measurements at the source gave 5 mSv/h maximum at a distance of 10 cm; and 1 mSv/h at a distance of 1 m. The driver and passenger were exposed to the sources as were workers who were handling the scrap metal in the scrapyard. However, only the driver and his companion were identified. They had no radiation monitor during transport. It was estimated that the dose at the driver's position was 100 μSv/h. Based on the transport time, average distance and simulation of the transport it was estimated that they received an effective dose of about 3 mSv. They were sent for a medical examination including chromosomal aberration analysis.

❑ Conclusions and lessons learned

Lost and unwanted sources can cause safety and security problems such as radiation exposures to workers and members of the public and radioactive contamination. The described incident has not resulted in especially significant radiation exposures and no contamination occurred. Nevertheless it should be stressed that prevention of radioactive sources from entering the public domain in an uncontrolled manner has become an international challenge to authorities responsible for regulating the safe use and disposal of radioactive sources. A new specific safety problem had appeared during the 1991-95 war in some newly independent countries formed after the disintegration of Yugoslavia. Investigation showed that many RLC in war-affected areas were displaced, and some were even found buried under the ruins. These damaged RLC became available for unauthorised uses or subject to unsafe handling by the local population. Furthermore, radioactive materials could be collected by local scrap merchants and sold to scrap processing facilities. For these reasons over the past years Croatian authorities mounted campaign to locate, recover and dispose of all RLC that had been damaged, lost or abandoned. After successful completion of the campaign some specific lessons were learned from this experience that served as a basis for further actions in this field. RLCs represent the largest homogenous group of radioactive sources in Croatia but with the least regulatory control of all radioactive sources and they frequently enter the public domain in an uncontrolled manner from time to time. In order to maintain and regain full control over all radioactive sources in the country and because of some doubts about their operational effectiveness, there is now consensual decision that about 250 RLC still installed in Croatia have to be dismantled and properly stored as soon as possible. With the assistance of IAEA this project would be completed in 2006 and hopefully incidents of the type described will not happen in future.

The scrap metal recycling industries should be concerned as well, because of more and more experiences with sources becoming mixed with scrap metals destined for recycling. If the owner or the manufacturer of these sources cannot be identified or is no longer in existence, the source is considered to be an "orphan source" and the unlucky finder may be held responsible for long-term security and eventual disposal of the unwanted source. The metal scrap dealers are encouraged to establish monitoring system for radioactivity at the entrance to their scrap-yards.

In conclusion, an important lesson to be learned from the incident is that periodic contacts by regulators (for example via more frequent inspections) with users of radioactive sources serve as reminders to them of the need to maintain control and accountability of the sources, to properly dispose of the sources when they are longer needed, and to otherwise provide for their safe use. It is also necessary to give higher priority to an ongoing review of general license policies and procedures especially taking into account Directive 2003/122/Euratom on the control of high-activity sealed radioactive