SEARCHING FOR A LOST RADIOACTIVE SOURCE IN A MINING-MILLING FACILITY

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THE INCIDENT

The mining-milling facility in question has a radioactive level gauge installed at the beginning of its conveyor-belt system, used to turn it on when the run-of-mine ore reaches the chemical plant. The gauge was not in use when the incident occurred (radioactive source installed, detector and associated electronics not installed), the conveyor-belt being controlled manually.

During a routine inspection, a maintenance worker found the inner part of the gauge's lead shielding on the floor. Since he knew that that equipment was "dangerous", he called a technician supposed to know how to deal with it. The technician monitored the fallen piece, found no activity and concluded, erroneously, that the radioactive source was inside the shielding (actually, his detector was not working). The fallen part was put in its place. All this happened in a Saturday, October 1st, 1994, beginning of a long weekend, so the occurrence was only reported to the responsible for the radiation protection in the following Tuesday.

THE SOURCE

The lost source was a 185 MBq (5 mCi) Cs-137 source, of unknown making. A bibliographic search led us to believe that the radioactive material was prepared as a vitrified pellet.

AN ANALYSIS OF THE CAUSES OF THE OCCURRENCE

The gauge is installed on an equipment subjected to a high level of vibration. Since no preventive maintenance was routinely made, the vibration destroyed a safety pin which impeded the inner part of the shield to be removed. This was the cause of the mechanical failure.

Notwithstanding, it should be concluded that the incident, the loss of control over a radioactive source, was caused primarily by the mismanagement of the radiation protection matters in the facility without trying to be exhaustive, we can point: lack of preventive maintenance, source installed without motive since the detector was not installed; incompletely trained technician; lack of a routine to check the functioning of the sole radiation monitor of the facility; responsible for radiation protection with other more pressing activities.

THE SEARCH FOR THE SOURCE

On October, 18th, 1994 the engineer in charge of radiation protection of the facility, feeling unsecured with the situation, contacted our Center, asking for help, 17 days after the probable loss of the source.

Our emergency group, using scintillation detectors, searched for the source all over the facility, as well as the houses of all employees with even a remote possibility of inadvertently having take the source home. We found nothing.

During this unfruitful search for the source we noticed that the ore that have fallen under the conveyor-belt

was frequently swept and introduced again in the process. Reckoning that there was a good probability of the source being also processed we started looking for activity in ore samples collected for process control.

The samples were counted in a HPGE detector, in a low background shielding, for periods of 24 hours each. We found clear peaks of Cs-137 in the samples collected at points 1, 2 and 3 (Figure 1).

The first activity was detected at point 1, on October, 14th, that is, 14 days after the date on which we believed the source was lost. This delay should be attributed to the big ore storage bin that exists between the conveyor-belt and the input to the flotation cell bank. At the same day the activity was detected at the output of the flotation cells (overflow, point 2), which is understandable if we consider the low inventory of material in the flotation cell bank.

On the other hand, it took at least 2 more days for the activity to appear at point 3, the output of the concentrate stock tanks, were it appeared extremely diluted. This time leg and dilution can be easily explained by the volumes of the mill, thichener and concentrate stock tanks.

THE FATE OF THE CONTAMINED ORE

With the sparse data we get, the best conclusion to which we could arrive is that a good part of the activity went to backfill the underground mine and to the tailings pond. Part of it, however, entered the process and, probably, reached the end product. In this product, we were not able to find any activity, at least in the limits of sensitivity of portable scintillation detectors.

It should be noted, too, that the dilution of the radioactive material was very high, leading to contamination levels below regulatory limits (1,2).

REFERENCES

1. FAO, IAEA, ILO, OECD/NEA, PAHO AND WHO, "International Basic Safety Standards for Protection Against Ionizing radiation and for the Safety of Radiation Sources", Vienna, 1994.
2. Comissão Nacional de Energia Nuclear, "Gerência de Rejeitos Radioativos em Instalações Radiativas", CNEN - NE - 6.05, Rio de Janeiro, Novembro 1985.

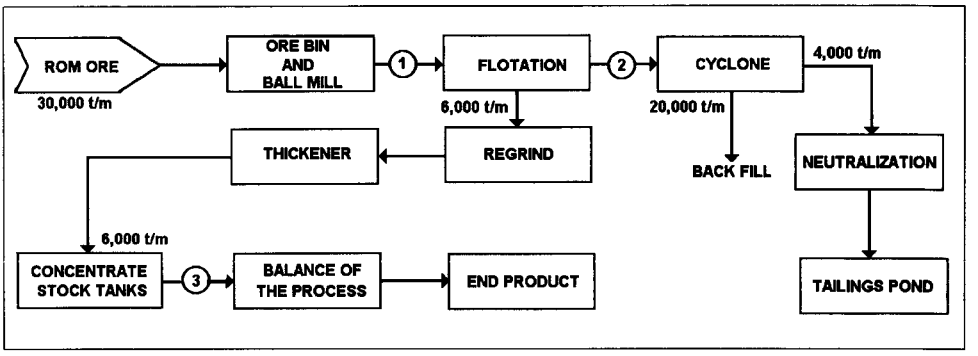

Figure 1 - Process flowsheet

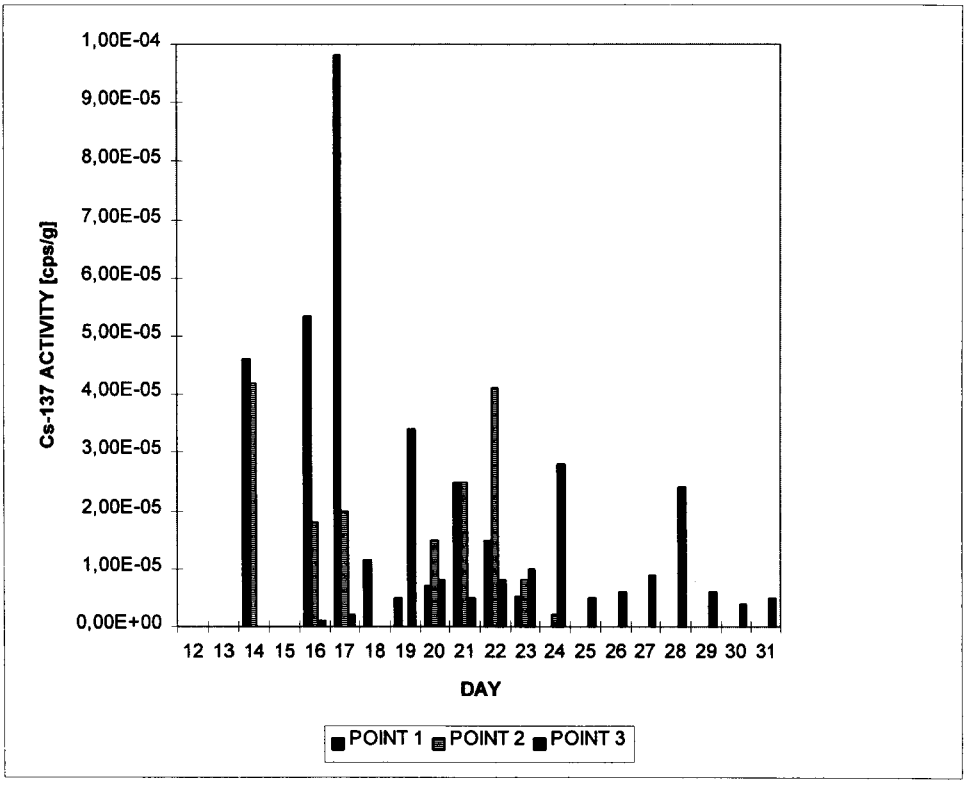

Figure 2 - Actitivity detected in the ore samples