# LETTER TO THE EDITOR

## INTRUSION DETECTION USING NUCLEAR RADIATIONS

Dear Sir:

We have studied the feasibility of using nuclear radiations to detect door intrusion. We mounted $^{57}$Co (0.8 mCi) on a vertical door frame, 85 cm from the floor, and placed a NaI(T1) crystal with photomultiplier and preamplifier across the door at 90 cm (exit door at Argonne) from the $^{57}$Co. The detector was equipped with a linear amplifier, a single channel analyzer, a count-rate meter, a dc voltage analyzer, and an alarm relay system. The single channel analyzer accepted the 123-keV $\gamma$ radiations of $^{57}$Co, and the rate meter converted the count rates into output voltages. The dc voltage analyzer sorted out the output voltages which fell within the limits set by the upper and lower windows. The relay system remained open at this preset count rate. As soon as the count rate decreased or increased by 5%, the output signal of the voltage analyzer closed the relay which, in turn, then sent out an alarm. The response took only a second. The alarm continued even when the count rate returned to the preset value. A 60-kg person walking slower than 60 cm/sec through the door would trigger the alarm. Power failure of the counting system would also close the relay and send out an alarm.

We were not able to use the 1.1 to 1.3 MeV $\gamma$ radiations of $^{60}$Co to differentiate between human bodies and steel chassis. We found that a hip of 30 cm attenuated 80% of the $^{60}$Co photopeak radiations, whereas a typical laboratory equipment such as a scaler attenuated only 61%. A person moving faster than 6 cm/sec through the door would escape detection by $^{60}$Co.

For door security, we mounted $^{54}$Mn (0.8 $\mu$C ) on the inside of the swung-out edge of the door. With the door closed, the $^{54}$Mn was 2 cm from the NaI crystal face. The analyzers' windows were reset for the 840-keV $\gamma$ radiation and activities of the $^{54}$Mn. When the door opened to only 2 cm, the alarm started.

The radioactive source may contain isotopes emitting several $\gamma$ radiations to confuse the would-be intruders. The use of an upper window in the voltage analyzer makes it possible to detect any attempt to duplicate the preset count rate with an intense radioactive source of high $\gamma$ energies. The entire system can be completely concealed, and nuclear radiations are not easily detectable. With proper shieldings, the radioactivities are below the maximum permissible level. An estimated cost of the components of this intrusion detection system is $2500.

For added effectiveness, we placed another detector on top of the door, 220 cm from the floor, and another $^{57}$Co underneath the threshold. The matched outputs of the two detectors were added to the single channel analyzer.

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