

Radioactive Material in Scrap Metal Recycling

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Scrap metal can become contaminated when radioactive material is inadvertently introduced to the scrap metal recycling chain. If a source of radiation is ruptured or melted down with other scrap metal, it may be incorporated into products and contaminate the recycling and production facilities.

There have been incidents where items such as rebar, table legs and elevator buttons have been recalled worldwide due to the discovery that they were made from scrap metal that was contaminated with radioactive material.

The cost to remediate scrap processing and production facilities, such as smelters, can be devastating, costing as much as tens of millions of dollars.

Sources of radioactive material

Artificial sources of ionising radiation have many uses in industries such as energy production, construction, manufacturing and medical and dental and research. Radioactive material found at metal recycling facilities tends to originate from three sources.

- **‘Orphan’ radioactive sources**

‘Orphan’ radioactive sources are those that have fallen out of regulatory control. They often result from mixing industrial gauges or other retired radioactive equipment with scrap metal. They can include waste from medical applications or old radium-226 (^{226}Ra) painted dials. Gauges are likely to contain caesium-137 (^{137}Cs), cobalt-60 (^{60}Co) or americium-241 (^{241}Am). Industrial radiography sources include iridium-192 (^{192}Ir) or selenium-75 (^{75}Se), often housed in depleted uranium-238 (^{238}U) containers.

- **Naturally occurring radioactive material (NORM)**

NORM enters the metal supply chain when items such as pipes are sent for scrap after being used in processes where radioactive material can build up inside them. Some examples include ^{238}U and thorium-232 (^{232}Th) from zircon sands and refractory materials or ^{226}Ra from the oil and gas industry.

- **Imported steel**

There have been incidents around the world where a country has imported steel that contained radioactive material as a result of an orphan source being melted with the steel during the production process.

How to detect radioactive material in scrap metal

Ionising radiation cannot be detected by human senses, however, you can develop an awareness for the typical packaging and devices containing radioactive material. Containers for radioactive material may be brightly coloured, and usually contain lead for shielding so they are heavy for their size. All devices and packages for transport must include a label with the international symbol for radiation, the three-lobed trefoil shape (see Figure 1). The label may state the radionuclide present in the container and the activity.

The main way of detecting radioactive material in scrap metal is through routine monitoring of consignments coming into a facility, using a stationary detector, typically a portal monitor at the entrance. A portal monitor allows vehicles carrying large loads of scrap metal to be screened as they enter the premises. The monitor gives a pass/fail indication and triggers an alarm if radiation levels reach a pre-set threshold.

The Office of Radiation Safety strongly advises scrap yards use portal monitors at their gates to prevent radioactive material entering the scrap metal recycling stream.

Figure 1: Forms of labelling used to indicate a container housing radioactive material.

There are a range of containers used to house sources of radiation, either during use or for transportation (for example, see Figures 2–8).



Source: ORS

Figure 2: Shielded package used for transporting high-strength radioactive sources for industrial irradiation.



Source: ORS

Figure 3: Package used for transporting a gauging system loaded with radioactive sources.



Source: ORS

Figure 4: A radioactive shielding device used in industrial processing-plant gauging systems.



Source: ORS

Figure 6: Various radioactive sources typically used in most of the applications described above. Maximum length about 3 cm. Maximum diameter about 0.5 cm.



Source: ORS

Figure 8: Moisture density gauge used in road building and agriculture.



Source: ORS

Figure 5: Shielded radioactive device used in transporting and operating industrial gamma radiography systems, such as for weld inspections in engineering and construction.



Source: Israel Hughes

Figure 7: Typical engraving detail on a radioactive source.

Source: ORS



Source: ORS

Steps to follow when radioactive material is identified in scrap metal

If screening indicates the presence of radioactive material, take the following steps.

- 1 Confirm whether the load contains a radioactive source. This is done by driving the load through the portal again or by assessing it with a handheld survey meter. The Office of Radiation Safety has published a guide on **radiation monitoring and instrument selection**.
- 2 If the load is confirmed as containing radioactive material, it must be isolated until the radioactive material can be identified and removed.
- 3 Once the presence of radioactive material has been confirmed, a qualified staff member (for example, the radiation safety officer) should complete a survey of the dose rate around the exterior of the vehicle, using a survey meter (see Figure 9 for more details).
- 4 If the dose rate around the outside of the vehicle is less than 5 $\mu\text{Sv/hr}$, have a qualified staff member use the survey meter to inspect the driver, any passengers and the vehicle until the radioactive items are found. The load can be emptied in an isolated area in the yard to help with this more detailed inspection.
- 5 Note: A driver or passenger who has recently undergone nuclear medicine treatment or is wearing a luminescent watch painted with radium could trigger a false alarm. If this is a possibility, recheck the load without the affected person present.
- 6 Once all radioactive items have been identified, use the survey meter to check the dose rate of each item. If the rate is more than 5 $\mu\text{Sv/hr}$, set up a 5-metre cordon. Once the dose rate has been confirmed, call the national Office of Radiation Safety emergency duty officer for further advice.

High dose rate: If the dose rate in contact with the side of the vehicle is greater than 5 $\mu\text{Sv/hr}$, set up a 5-metre cordon and call the Office of Radiation Safety emergency duty officer on 021 393 632.

Do not touch any suspected or confirmed radioactive material with your bare hands.

Figure 9: Steps for identifying and responding to an alarm raised using a large-volume portal radiation detector, at the entrance to a scrap metal yard.

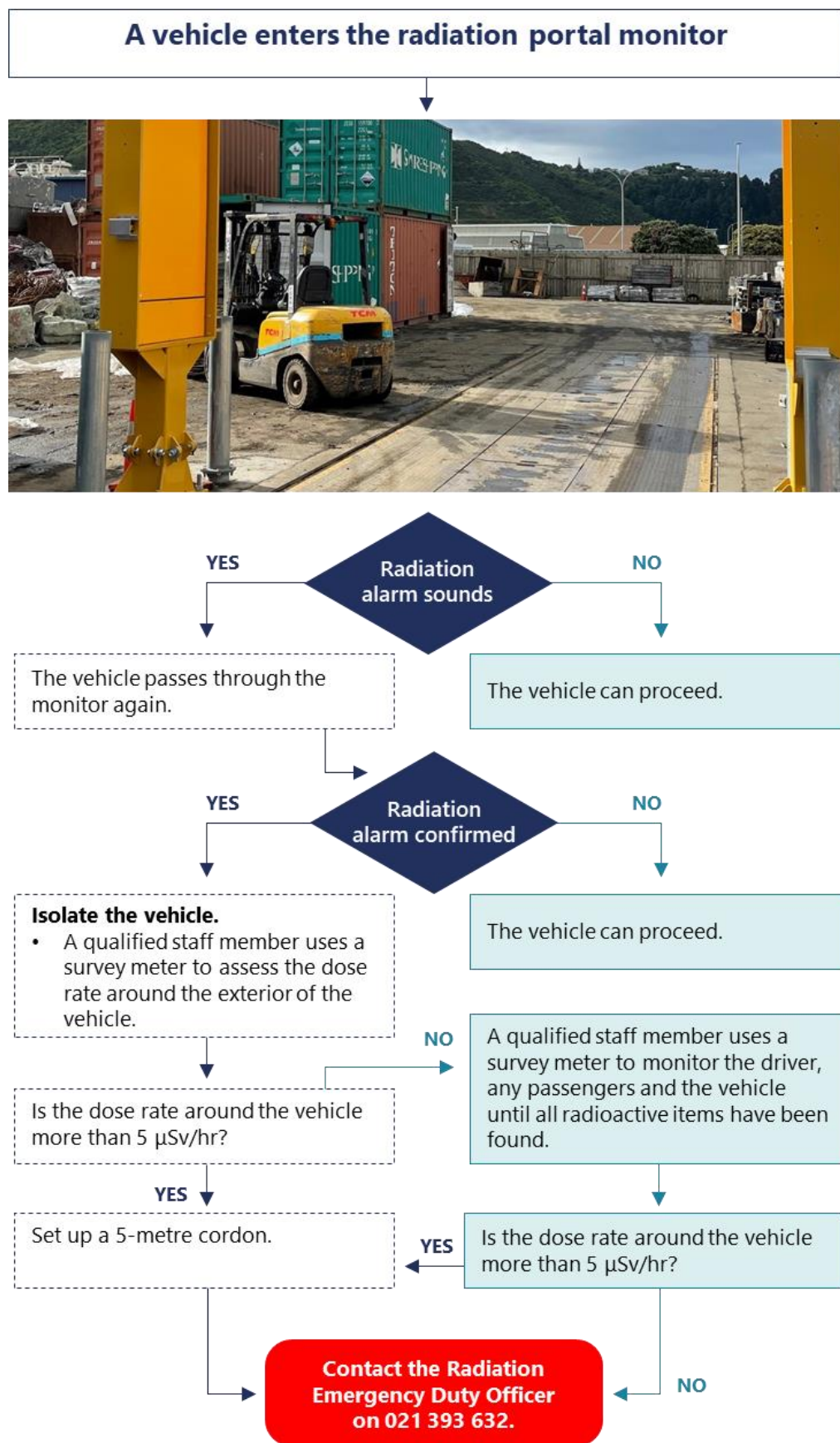


Image credit Macaulay Metals.

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