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Group of Experts on Monitoring of
Radiologically Contaminated Scrap Metal
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**REGULATIONS AND TECHNICAL FACILITIES FOR THE RADIATION
MONITORING OF SCRAP METAL IN THE RUSSIAN FEDERATION**

**Submitted by the Central Iron- and Steelworking Research Institute
of the Russian Federation**

1. The radiation monitoring of scrap metal in Russia is at present regulated by a number of texts, among them the licensing regulations on the procurement, processing and sale of scrap iron, steel and non-ferrous metals approved by resolutions Nos. 552, "Health rules and standards", and 553, "Radiation safety requirements for the procurement and sale of scrap metal; HRS 2.6.1.993-00", of the Government of the Russian Federation dated 23 July 2002; Ministry of Health order No. 325 dated 15 August 2001, "Health and safety and disease-control inspection of output"; resolutions Nos. 369, approving the rules governing the handling and disposal of iron, steel and non-ferrous metal scrap and waste, and 370, "Radiation monitoring of scrap metal", of the Government of the Russian Federation dated 11 May 2001; and Ministry of Health instructions on inspection methods 2.6.1.-01, issued in 2001. These require organizations and businesses engaged in the procurement, processing - including melting - and sale of scrap metal to conduct routine radiation monitoring.
2. Routine radiation monitoring of scrap metal takes place at two points: inspection upon arrival, to which all incoming scrap is subjected, and inspection of a consignment of scrap ready for sale which is used to give the scrap an official health and safety and disease-control rating. In the latter case, inspections are carried out by duly accredited radiation monitoring laboratories.
3. In the case of consignments of scrap destined for export, and when scrap is found to contain gamma-ray doses exceeding the natural background, the strength of the dose at the surface of a freight unit ready for dispatch is also measured.

Inspection upon arrival

4. All incoming scrap is subject to inspection upon arrival. The inspection is to check the level of gamma radiation. According to the health and safety requirements for radiation safety in the procurement and sale of scrap metal, the inspections must reliably detect cases where the level of gamma radiation near the surface of the consignment exceeds [the natural background] by 0.05 $\mu\text{Sv/h}$ or more. If the radiation background is found to be exceeded near the consignment, the excess radiation dose of the scrap is measured.
5. Businesses conduct inspections on arrival with the help of highly sensitive fixed installations or portable radiation dosimeters.

Monitoring with fixed installations

6. Fixed installations generally consist of two large, 50-250 kg detector units positioned on either side of the road or track along which vehicles or wagons carrying scrap move. The scrap is monitored automatically, without operator intervention, by means of continuous measurements of gamma-ray levels as the vehicles move past the detectors with their recording devices. The comparative specifications of a number of installations used to monitor freight in Russia are given below.

Parameter	System		
	SIMMET (I.P. Bardin Central Institute for Iron and Steel Research)	Yantar 2 L Aspekt	Eberline (Germany)
Minimum increase in radiation dose from source over background that is reliably detected by system, nSv/h	2-3	3-4	4-5
Probability of false positives	$\leq 10^{-4}$	$\leq 10^{-3}$	$\leq 10^{-3}$
Can identify the radioactivity detected	+	-	-
Can measure the excess radiation dose emitted by object monitored	+	-	-
Mass of detector units, kg	40	220	200

7. To comply with the 2.6.1.993-00 health and safety regulations, systems must detect excess gamma radiation of 0.05 $\mu\text{Sv/h}$ or more at a distance of 10 cm from the cargo surface. As the detectors are between 0.5 and 1.5 m from the cargo surface, the detection threshold of the monitoring system should not exceed 3-5 nSv/h.

Monitoring with portable equipment

8. Cargoes of scrap are monitored with sniffer devices (DRS-RM 1401, ISP-1401M, MKS-RM 1402M), radiation meters (SRP-88), multipurpose devices (DKS-96, DKS-1117A, MKS-A02), and high-sensitivity dosimeters (EL-1101, DKS-1119C). Inspection takes place in a specially designated area where the cargo of incoming scrap is parked. Every day, before any scrap is admitted, background readings from the devices are taken in the centre of the empty

inspection area. The measurement error is determined, and this is used to establish the control threshold, which is the sum of the background level and the error. Monitoring is carried out by moving the detector along lines parallel to the earth's surface at a distance of not more than 10 cm from the outer surface of the scrap cargo. To comply with the 2.6.1.993-00 health and safety regulations it is necessary to use the most sensitive devices (DKS-96, EL-1101), moving past the cargo at a speed not exceeding 0.1-0.2 m/s; the distance between the lines along which the detector moves must be between 0.3 and 0.5 m.

Monitoring of a consignment of scrap produced for sale

9. This kind of monitoring is performed by accredited radiation monitoring services. Initially the consignment is checked to make sure it contains no local sources of contamination; then the radiation dose above the background level at the surface of the vehicle carrying the scrap is measured.

10. For the first part of this procedure, the consignment must be identified, i.e. covered by a document specifying the kind, quantity and dimensions of the scrap consignment and the legally required details of the consignee. The scrap is evenly stacked 1.5-2 m wide and 0.3-0.5 m high so that the inspector can freely pass on either side of it. The inspection sequence is as follows: check for the presence of local sources of contamination; if local sources are found, measure the radiation dose; measure the alpha- and beta-particle flow density where local sources are found.

11. The procedure for discovering a local source of contamination consists in moving the detector along the stack of scrap at a distance of not more than 10 cm from the surface and plotting points at which the device consistently reacts (sporadic false positives may occur at a rate of less than one every 5-10 seconds). If the device beeps or buzzes consistently (more than once a second) the inspector stops advancing and carefully checks the nearest part of the stack for a local source. By scanning over the adjacent surface of the stack and making use of any gaps between pieces of scrap, the inspector brings the detector as close as possible to the presumed whereabouts of the local source. Using the rising frequency of beeps or buzzes from the device, he will delimit the area within which radiation levels exceed the control threshold, and mark it on a scale diagram.

12. If there are areas where radiation exceeds the background level, the gamma radiation dose and levels of alpha- and beta-contamination are measured. The dosimeter sensor is placed at the point where the radiation is strongest and measurements are taken until the statistical error is under 10% (for DKS-1119 dosimeters or MKS-RMs). If the excess radiation dose at the point where the level is highest, combined with the error, does not exceed 0.2 $\mu\text{Sv/h}$, the scrap consignment is considered not to contain local sources of contamination. Otherwise the scrap is acknowledged to contain local sources and the consignment will be subjected to further checks and subsequent triage.

13. Once the scrap has been loaded onto the vehicle, the gamma radiation dose at the surface of the cargo unit ready for dispatch is measured. This may be done by means of a fixed installation capable of determining the radiation dose above the background level, or with portable dosimeters as in the case of inspection upon arrival. The same fixed installation as is used to check incoming scrap upon arrival may be used for this purpose.