EMRP Call 2010 – Industry & Environment

Topic number: SRT-13i

Title: Ionising radiation metrology for metallurgical industry

Abstract

Foundries produce millions tons of steel a year that could potentially be contaminated by melting radioactive sources hidden in scraps. This can result in contamination of cast metal, furnaces, the environment and the irradiation of the population. Current radio-assay controls do not guarantee appropriate traceability and there is a need for harmonised European action to develop new instruments, reference materials, technical procedures and standards for SI-traceable radioactivity monitoring of scrap, slag, gaseous leaks and steel casting, to prevent this contamination. Joint Research Projects (JRPs) submitted for this topic should aim at developing specific instruments, methods and references for addressing this metrological need.

Conformity with the Work Programme

This call for JRPs conforms to the EMRP 2008, section on focused single discipline and applied metrology related to Industry on page 29 and Grand Challenge Environment (sustainable use of resources and improved quality of life) on page 24.

Keywords

Metallurgy, Foundry, Steel casting, Radioactive contamination, Reference materials, Measurement procedures, Technical standards.

Background to the Metrological Challenges

Foundry industries frequently recycle metal scrap loads that have been previously tested for unadvertised presence of orphan radioactive sources by passing scrap containers under radiation detection portals. However, self-shielding of sources or the attenuation by other scrap pieces in the container make that approach less than 100 % reliable and it can result in furnace damage, radioactive contamination of cast steel, consequent trade disputes, or even dissemination of radioactivity into the environment. This can then lead to irradiation of end users from cast steel products contaminated by radionuclides like ^{60}Co or ^{192}Ir arising from radiotherapy or gammagraphy sources, trade disputes about the contamination of products, and financial impact on market prices.

To mitigate this risk, controls are still necessary to guarantee and certify the absence of radioactive contamination in gaseous discharges, slag wastes and cast steel batches. Although several gamma detection systems are available to monitor the steel production batches, they differ in geometry, energy resolution sensitivity and throughput, and the reference standards for these systems are either missing (replaced by mathematical modelling) or lack traceability to the SI, making the comparison of results between companies inaccurate and subject to disputes and claims. Differences between national regulations and the lack of a harmonised international standard also contribute to this undesirable situation.

Scientific and Technological Objectives

Proposers should address the objectives stated below, which are based on the PRT submissions. Proposers may identify amendments to the objectives or choose to address a subset of them, in order to maximise the overall impact, or address budgetary or scientific / technical constraints, but the reasons for this should be clearly stated in the JRP-protocol.

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The focus of this SRT is to develop harmonised metrological tools and methods addressing radioactive contamination in metallurgical products and waste.

The objectives include:

1. Design of overall standardised traceable measurement method for control/measurement of scrap, metal products, slag and gaseous discharges according to the EC, national regulations and to NEA and IAEA recommendations.
2. Development of standard reference sources for cast steel and slag at the contamination threshold levels for:
    a. potential contaminant radionuclides (^{60}Co, ^{137}Cs, ^{192}Ir, ^{226}Ra, …),
    b. different steel compositions,
    c. different sample geometries suitable for on-line measurements.
3. Characterisation of reference sources by combined measurement-simulation methods and interlaboratory comparisons.
4. Development of reference measurement system(s) (NaI, HPGe, plastic scintillation detectors, …).
5. Development of technical procedures for calibration of measurement systems and on-line radioassay controls.
6. Development of measurement, evaluation, calibration and control software.

Proposers shall give priority to work that meets documented industrial needs and that which supports transfer into industry e.g. by cooperation and/or by standardisation.

Proposers should establish the current state of the art, and explain how their proposed project goes beyond this.

Potential Impact

Proposals must demonstrate adequate and appropriate participation/links to the “end user” community. This may be through the inclusion of unfunded JRP partners or collaborators, or by including links to industrial/policy advisory committees, standards committees or other bodies. Evidence of support from the “end user” community (e.g. letters) is encouraged.

Where a European Directive is referenced in the proposal, the relevant paragraphs of the Directive identifying the need for the project should be quoted and referenced. It is not sufficient to quote the entire Directive per se as the rationale for the metrology need. Proposals must also clearly link the identified need in the Directive with the expected outputs from the project.

You should detail the impacts of your proposed JRP as detailed in the document “Guidance for writing a JRP”.

You should detail how your JRP results are going to:

- Feed into the development of urgent standards through appropriate standards bodies
- Interact with the regulatory community
- Collaborate with detection system manufacturers
- Transfer knowledge to the steel industry

You should also detail how your approach to realising the objectives will further the aim of the EMRP to develop a coherent approach at the European level in the field of metrology. Specifically the opportunities for:

- improvement of the efficiency of use of available resources to better meet metrological needs and to assure the traceability of national standards
- the metrology capacity of Member States and countries associated with the Seventh Framework Programme whose metrology programmes are at an early stage of development to be increased
- outside researchers & research organisations other than NMIs and DIs to be involved in the work

Time-scale

The project should be of 3 years duration.

Additional information

The references were provided by PRT submitters; proposers should therefore establish the relevance of any references.

1. Council Directive 96/29/EURATOM (1996) of 13 May 1996 laying down basic safety standards for the protection of the health of workers and the general public against the dangers arising from ionising radiation.
2. Directive 2008/1/EC of the European Parliament and of the Council of 15 January 2008 concerning integrated pollution prevention and control.
3. UNECE Releases Recommendations on Radioactive Scrap, United Nations Economic Commission for Europe, ECE/TRANS/07/P01 (2007).
4. IAEA, Safety Guide "Management of waste from the Use of Radioactive Material in Medicine, Industry, Agriculture, Research and Education", IAEA Safety Standards Series No. WS-G-2.7 (2005).
5. "Reducing Risks in the Scrap Metal Industry", IAEA (2005).
6. "Guia de Eguridad de actividades de recuperacion y reciclado de chatarras", Consejo de Seguridad Nuclear, Madrid (2003).
7. "Radiological impact on the UK Population of Industries. Part II: The Steel Production Industry", National Radiological Protection Board NRPB-W48 (2003).
8. International Conferences : "The Radioactivity in the Metal Scraps Recycling Industry", Brescia (1998), "Control and Management of Inadvertent Radioactive Material in Scrap Metal", Tarragona (2009).