

EXECUTIVE SUMMARY

1. GENERAL PRESENTATION OF THE ISSUE

In order to conserve natural resources, recycling of materials is becoming more and more important. Recycling actively contributes to sustainable development.

This is particularly the case in the metal industry, where recycling has a long history and has been carried out for over a century before sustainable development became an important issue. Compared with other materials, metals have the major advantage of not just being recyclable but of being infinitely recyclable. This advantage has been well recognised since the industrial revolution and currently about half of the steel production world-wide is made from metallurgical scrap. This percentage is still increasing, as it is for most other metals.

Although stringent controls are applied to radioactive substances, when there is a loss or lack of regulatory control, radioactive materials can be accidentally introduced into metallurgical scrap and hence into the metal production process.

International organisations have issued safety standards¹ and recommendations to keep radioactive sources or radioactively contaminated materials under strict control. Many countries have adopted these safety standards and recommendations in their national regulations. Nevertheless there are still situations where regulatory control is not effective or sources over which regulatory control has been lost. This is particularly the case in countries where the regulatory and technical infrastructure is not sufficiently developed. Since the metallurgical scrap market is a world-wide market, import of scrap may then cause some additional risk of introduction of radioactive materials into the recycled material.

In addition to regulatory control, the metal recycling and producing industries have organised themselves to reduce the probability of sources that escape regulatory control being introduced into the recycling loop. These measures are aimed at detecting such radioactive substances as early as possible, but their detection is not an easy task. Even with the most sensitive and sophisticated equipment, undetected radioactive sources or materials may be introduced into the recycling process. Systematic controls on measuring the radioactivity of products leaving the metal works have therefore proven necessary in order to guarantee their quality.

This report presents recommendations that should help avoid the introduction of discrete sources and improperly released radioactively contaminated material into the recycling stream. Taking into account such recommendations the probability of any undesirable introduction of radioactive materials into the recycling loop will be minimised. This will ensure better protection of the workers and the public.

The report also expresses the desire of the scrap recycling and metal production industry to be able to make informed decisions on the purchase and use of the material that is properly released from specific activities such as the nuclear industry.. This is to assure the customer of

¹ "International Basic Safety Standards for protection against ionising radiation and for the safety of radiation sources", published by the International Atomic Energy Agency under the Safety Series n° 115. This document is jointly sponsored by the Food and Agriculture Organisation of the United Nations, the International Atomic Energy Agency, the International Labour Organisation, the Nuclear Energy Agency of the Organisation for Economic Co-operation and Development, the Pan American Health Organisation and the World Health Organisation.

the recycled metal product that it meets desired specifications regarding radioactivity, and thereby maintain consumer confidence.

The report also reflects the concern of the industry as regards the costs arising from the detection or processing of radioactive substances that enter the recycling loop.

2. RECOMMENDATIONS FOR IMPROVEMENT OF THE SYSTEM

Radioactive material may be introduced in metallurgical scrap through three different pathways.

- Discrete radioactive sources may be introduced into the scrap, due to the fact that such radioactive sources may escape from regulatory control because they are abandoned, lost, misplaced, stolen or otherwise transferred without proper authorisation.
- Uncontrolled radioactively contaminated material may appear in the scrap stream from the process where the material has been used. The material may have become contaminated after contact with either natural radionuclides or man-made radionuclides. One example of this might be in an extraction industry where scale containing naturally occurring radioactive material (NORM) that is deposited in pipes or equipment may not be under regulatory control in the first place. Another example could be improperly released material that has been used in the nuclear industry and was contaminated with man-made radionuclides above regulated limits.
- Introduction of material with a very low level of radioactivity, released in accordance with - the national regulatory framework.

Three main topical areas related to the risk of introduction of radioactive materials into the scrap recycling process have been identified where improvements -should be made by international organisations, national Governments and industry, namely:

- Prevention of the introduction of radioactive materials.
- Detection of such an introduction (measurement, procedures and voluntary provision of information).
- Reaction capability to cope in the event of a detection of such an introduction.

These topical areas are developed hereafter for each of the three introduction pathways mentioned before.

A. Introduction of discrete radioactive sources

Discrete radioactive sources may be introduced into the scrap, due to the fact that such radioactive sources may escape from regulatory control because they are abandoned, lost, misplaced, stolen or otherwise transferred without proper authorisation. Such sources could cause both external or internal exposure as well as significant economic impacts. External exposure can occur due to physical contact or close proximity to the radioactive material. Internal exposure can occur due to direct contact with or processing of any uncontained material that can cause a worker to inhale, ingest or absorb the radioactive material. In addition, the introduction of such material may generate significant business disruption and financial loss due to detection and rejection

of the material or from the handling and processing of undetected material which could contaminate equipment, grounds, products and by-products.

Prevention

The main measure to prevent entry of radioactive material into metal scrap is to ensure adequate control over the discrete sources by users and the national regulatory authorities.

The IAEA has developed standards of safety for protection against ionising radiation and radioactive sources. Their application significantly contributes to the prevention of radioactive sources from becoming orphaned. All Governments are strongly encouraged to expeditiously implement or strengthen their own regulations based on these standards, and to strictly enforce these regulations. In particular, the Code of Conduct for the Safety and Security of Radioactive Sources is recommended for implementation by all States.

Detection

Scrap recycling and metal producing companies, with the assistance of trade associations, national radiological protection organisations and suppliers of radiation sources, are encouraged to:

- train their personnel;
- develop procedures for visual inspection of scrap, principally during collection, in order to find discrete sources at their point of entry to, or early in the recycling industry; and,
- install and use detection equipment according to the manufacturer's specifications and to the recommendations of this document. Detection equipment should be installed at crucial points in the recycling loop, in particular, prior to locations where handling, processing or melting of the scrap could damage a source.

Reaction

Sealed sources may well have labels and markings indicating past ownership, or certification, as well as serial numbers that give the possibility of tracing an original user. However, it is in the nature of the demolition sector that even if an investigation were undertaken, the original owner may turn out to be a now-defunct business.

The issue of the management and disposal of orphaned sources that have been discovered needs to be addressed urgently by each State's regulatory body. The IAEA Code of Conduct makes the statement that "Every State should ensure that its regulatory body ...is prepared, or has established provisions to recover orphan sources and to deal with radiological emergencies and has established appropriate response plans and measures". Some considerations in this respect include:

- guidelines for identifying and characterising such sources;
- arrangements for identifying appropriate destinations for managing their storage or disposal;
- adequate arrangements for transporting them to such destinations, including return of materials across national borders.

Competent authorities should make provisions to clearly allocate responsibilities associated with managing discovered orphaned sources. It is regarded as unfair to place

the cost burden of storage and disposal of orphan sources, or clean-up of contamination caused by them, on the facility that finds them.

For new sources, the producer responsibility concept may also be used with the costs of the end-of-life management of sources internalised in their initial selling price. This removes the financial burden from the last owner or holder of source.

Several countries are providing a free-of-charge method of disposal for orphan sources as a means to encourage their detection and appropriate disposition. It is recommended that such a procedure be applied world-wide. In addition, efforts to require the return of sources to the supplier at the end of life are to be encouraged since this also decreases the probability of a source becoming out of regulatory control. The use of voluntary agreements and codes of practice as exemplified by the Spanish protocol (cf. annex 5) is recommended on a national and international basis

The scrap recycling and metal producing industry is encouraged to actively provide information to the reporting mechanisms set up by the IAEA following the discovery of orphaned sources. These data can then be analysed with a view to making further improvements and recommendations.

B. Introduction of uncontrolled radioactively contaminated material

The introduction of uncontrolled material into the recycling stream that is radioactively contaminated with either natural radionuclides or man-made radionuclides could pose similar health and economic impacts as those for discrete sources. This would also cause significant business disruption and financial loss due to detection and rejection of the material or handling and processing of material which could contaminate equipment, grounds, products and by-products. However, such impacts would usually be of a lesser magnitude than those encountered with discrete sources but at a greater frequency.

Prevention

The main measure to prevent entry of uncontrolled radioactively contaminated material into the metal scrap stream is to ensure adequate control over the materials coming from these specific activities or industries. This has to be supervised by the national regulatory authorities based on the recommendations of the IAEA, as set up in its standards and guidelines, especially the Basic Safety Standards.

A special case concerns industries whose activities deposit NORM at detectable levels onto materials that could be recycled. This can be the case for example in the extractive industries, notably those dealing with oil, gas, coal and phosphate. Since NORM is generally not regulated, NORM contaminated materials are often freely sold into the open market. This undesirable situation is being addressed by the IAEA, which is rapidly developing further recommendations regarding which materials should come under the scope of regulatory control. In the meantime, it is a practical desire of the scrap metal industry that they be informed by those selling or disposing of such materials whenever there is good reason to believe that due to origin or function, the particular materials are likely to be NORM contaminated. This avoids the problems associated with rejecting material after NORM contamination has been detected at a receiving operation, perhaps after passing through several hands. It is desirable that such contaminated materials be specifically identified and kept separate from the normal scrap recycling circuit so it does not enter unrestricted metal products.

Detection

Scrap recycling and metal producing companies, with the assistance of trade associations, national radiological protection organisations are encouraged to:

- train their personnel;
- develop adequate procedures, principally during collection, for determination of possible NORM contaminated materials based on their origin or function;
- install and use detection equipment according to the manufacturer's specifications and to the recommendations of this document. Detection equipment should be installed at crucial points of the recycling loop, in particular prior to locations where handling, processing or melting of the scrap may present an exposure potential to workers or the potential for contamination of equipment, grounds, products or by-products.

Reaction

The metal recycling industry is seriously disadvantaged with regard to these materials and requires assistance. Its operations are unfairly bearing a major share of the costs of detecting, characterising, segregating, storing and disposing of contaminated materials. It would seem appropriate that the concept of the "polluter pays" principle also be used for management of uncontrolled radioactively contaminated material and radioactive contamination caused by these materials. In this respect, issues related to the proper disposition of materials discovered to be contaminated needs to be treated in a similar manner to that of discrete sources discussed above.

Some considerations in this respect include:

- guidelines for identifying and characterising such material;
- arrangements for identifying appropriate destinations for managing their storage or disposal;
- adequate arrangements for transporting them to such destinations, including return of materials across national borders.

Competent authorities should make provisions to clearly allocate responsibilities associated with managing the contaminated material. It is regarded as unfair to place the cost burden of storage and disposal of these contaminated materials, or clean-up of contamination caused by them, on the facility that finds them.

The concept of the 'polluter pays' principle may also be used for the management of such contaminated material, alternatively a free-of-charge method of disposal for such contaminated material is recommended. The use of voluntary agreements and codes of practice as exemplified by the Spanish protocol (cf. annex 5) is recommended on a national and international basis.

C. Introduction of material with a very low level of radioactivity, released in accordance with a national regulatory framework

The introduction of low level radioactive material into the general recycling circuit, which is properly released according to the appropriate regulatory framework, is also of concern to the scrap recycling and to the metal producing industry. Because naturally occurring radioactive materials can cause alarm in the detection systems which might be considered from artificial origin, it is important to be able to trace the original supplier of the material to determine the appropriate response.

Prevention

Radioactive materials that are exempt from the requirements of the IAEA Basic Safety Standards or materials that are released from regulatory control do not have any significant radiological hazards associated with them. However, there is a perception that all radioactivity or all radiation is hazardous regardless of the level.

Therefore, as part of the contractual provisions and in order to satisfy the general customer demand, the metal recovery and recycling industry requires from the facility selling or disposing any metal with enhanced naturally occurring radioactivity or cleared from nuclear use, to be informed of this fact and the regulatory framework under which they have been released. Such information should be conveyed with the released materials to the successive suppliers and buyers of the metal scrap - up to and including the melting unit - to allow prior informed approval by the purchaser of the material.

Detection

Material released in accordance with appropriate national regulatory frameworks would have very low levels of radiation that are generally not detectable by commercial equipment used by the scrap recycling and metal producing industries. However, detection capabilities are continuously improving and may alarm with released material: therefore, it is advisable that all incoming scrap material be subjected to the same detection systems.

Reaction

Reactions following detection should be based on the contractual arrangements between seller and buyer.

D. Controls on the output materials from the metal works – metal, slag and off-gas dust

A final control on the output materials of the metal works, in particular the produced metal, the slag and the off-gas dust should be conducted, thereby providing additional assurance that radioactive materials have not been accidentally introduced into the plant.

It should be recognised that very sensitive detection equipment is needed for the final control of the produced metal because of the dilution that would have occurred when any unnoticed radioactive material was melted with a much larger bulk of clean material. Nevertheless, appropriate measurement of the produced metal will ensure that the final metal product meets the customer's specifications.
