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ON THE CONTAMINATED SCRAP IN BOSNIAN FOUNDRY PRODUCTION

ZAGAĐENO STARO ŽELJEZO U LJEVARSTVU BiH

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Ključne riječi: Opasno staro željezo, kontminacija radioaktivnošću, oljevci, monitoring

SAŽETAK

Ljevarska industrija oduvijek vrši recikliranje starog željeza što je dovelo do zagadjivanja metalnog materijala usljed uključivanja nepoželjnih komada. Zbog toga su se u zadnjih nekoliko decenija u svijetu odvijale aktivnosti na uklanjenju opsanih metalnih materijala iz proizvodnih procesa i proizvoda. Za to vrijeme situacija sa opasnim metalima postala je mnogo kritičnija, posebno zbog radioaktivnošću zagadjenih metala, tako da su zemlje EZ i SAD počele štititi svoje granice vrlo rigorozno zakonskom regulativom i kontrolom. Ove zemlje su vratile sa svojih granica stotine hiljada tona sumljivog metala i gotovih proizvoda. Bosna i Hercegovina bez odgovarajuće zakonske legislative i sa difuznom granicom je nedovoljno zaštićena. Po cijelom svijetu se godišnje dešava mnogo incidenata pod utjecajem radioaktivnih metala, pa vjerovatno i u Bosni i Hercegovini.

Key words: Hazardous scrap, radioactivity contamination, castings, monitoring

ABSTRACT

Foundry industry for long time perform recycling of metal scrap what has leaded to appearance of contamination of metal materials because of including of non-wanted components. Because of that in the last few decades on the world there were performed activities for elimination of hazardous metals from production process and final products. During that time situation with hazardous metal become more sever, especially because of radioactivity, so that countries of EC and USA began to protect their borders very sever by regulatory and control. The countries of EC and USA have returned from their border crossing hundred thousands tons of suspicious hazardous scrap and final product. As state Bosnia and Herzegovina without suitable law regulatory and diffuse state is insufficiently protected.
All over the World each year it is occurred plenty of accidents under the influence hazardous, radioactivity contaminated metals, and perhaps in Bosnia and Herzegovina.

1. INTRODUCTION

Throughout the world, efforts are under way to reduce amount of hazardous waste that can by radioactivity contaminate recycled metal material in foundry (steel) industry. At the first efforts are directed into discovering sources of radioactivity-contaminated scrap, orphan sources, etc, as well as putting into operation system of monitoring and control contaminated metal and decontamination of plants. Those actions are supported by good regulatory systems, analysis of the radiation incidents with radioactivity metal scrap and waste as environmental problems as well as detection of presence of abnormal radioactivity contaminated scrap. Recycling and reuse of radioactivity-contaminated scrap cause contamination as well as castings so metal product. As result it appears that very important aspects become radioactivity protection aspects and clearance criteria as well as international co-operation, prevention and initiative for international radioactive international radioactivity contamination management.

Bosnian authorities on all levels have to become familiar as much as possible with mentioned problems and try to solve them and improve to the world level of H&S inhabitants' protection.

2. RADIOACTIVITY-CONTAMINATED METAL SCRAP

In the first half of the early 1990s in Bosnia was not possible to sequence technological development in foundry industry. In meantime EC undertake activities to eliminate hazardous metal materials from their production processes as well as possibility of their appearance in metal final products. The appearances of metal hazardous materials in melting equipment of foundry (steel) industry cause that one has to stop process and perform very expensive ecological decontamination of plant. Therefore countries of EC perform very rigorous borders monitoring and control of hazardous metal materials for protection their own manufacturing processes. There are, especially controlled radioactivity contaminated metal materials: scrap, semi-final or final products. For example, Italy return back each year from its border only up to 100.000 t of radioactivity contaminated metal scrap, as well as some quantity of semi-final or final products at which it was traced radioactivity contamination as well as other countries of EC[1,2)].
Radioactive ferrous scrap arrives in the form of:

- Man-made radioactive materials in medical, research, military and industrial systems. They contain the radioisotopes: Ce^{137}, Co^{60}, Ir^{192}, Ra^{266}, and Am^{241} or natural as Po^{40}, Th^{232}, and U^{235}.
- Alloyed metals and vintage scrap ferrous metals containing Co^{60}, Ir^{192}, Th^{232} etc.
- Scrap from decommissioned facilities.
- Scrap from the import.

The foundry (steel) industry is confronting the issue of radioactive material found in iron and steel scrap supply. Highly radioactive sources encased in metal shields (orphan sources) are in widespread use in research, medical and industrial applications. There are estimated about 2,000,000 different sources in use worldwide. Lost highly radioactive sources encased in metal shields are so called "orphan sources". During the past decade numerous incidents have occurred because of orphan sources, where these shielded sources have been accidentally mixed with scrap, and subsequently melted or ruptured in the steel melting process. Clean-up costs resulting from such incidents have ranged as high as 20,000,000 US dollars.
How far foundry (steel) mill would be contaminated by radioactivity contaminated materials depends on the radioactive source. A radioactive material containing, for example, Co^{60} or Ir^{192} alloys with the melted metal contaminating all surfaces that come in contact with the melt. Ce^{137} vaporises and enters the furnace exhaust, contaminating the dust and air pollution control systems. Other isotopes, such as Ra^{266} end up in the slag.

3. INCIDENTS WITH RADIOACTIVE SCRAP AS ENVIRONMENTAL PROBLEM

Recognising that iron and steel scrap is the most recycled material all over the World it is advocated:

- the promotion of steel recycling;
- the implementation of continuous improvement in environmental performance; and
- the participation with government and community groups in creating responsible laws, regulations, and standards to safeguard the community and the environment.

Recognising that people are the most important asset, and that the World populations live in the communities surrounding the facilities, it is possible to commit to:

- the integration of environmental awareness in our operations by educating our employees on the environmental impact of our processes and involving them in decisions that will have a direct impact on the environment;
- meet or exceed the requirements of environmental laws and rules;
- the distribution of information to local communities about our operations and their impact on the environment through reasonable efforts; and
- the advancement of research on the health, safety, and environmental effects of our industry.

On such conclusions and intentions indicate plenty of happened accidents all over the world.

3.1 San Josie, Costa Rica

A serious accident in Costa Rica involved radiotherapy patients. The initiating event occurred at the San Juan de Dios Hospital, in 1996, when a Co^{60} source was replaced. When the new source was calibrated, an error was made in calculating the dose rate. This miscalculation resulted in significantly higher radiation doses than those prescribed for more than 115 patients being treated for neoplasms by radiotherapy. The error was realised in late September 1996, and treatments were stopped. The exposure rate had been greater than assumed, by about 50% to 60%. By July 1997, within nine months of the accident, 42 of the patients had died.

3.2 Gilan, Iran, Ir^{192}

In 1996, a worker at the Combined Cycle Fossil Power Plant, noticed a shiny pencil-sized piece of metal (object was a "pigtail" of a radiograph with an Ir^{192} source) and put it into the loose pocket of his overall on the right of his chest. It led to severe haemopoetic syndrome and an unusually extended local radiation injury. Plastic surgery was successfully performed at the Curie Institute in Paris. The patient has been in satisfactory general condition since then, though his injuries are debilitating.

3.3 Istanbul, Turkey

Old teletherapy sources kept in a firm's warehouse in Ankara in lead containers where remained there for about five years. In 1998, the firm shipped the containers to another warehouse in Istanbul, where it remained for about nine months. When those premises were sold. The buyer took the containers to an open yard and with another person dismantled them. Ten persons received radiation doses high enough to cause acute radiation syndrome. One of the sources is still missing.

In similar accident on scrapyard in Istanbul died two persons and two received very high doses.

3.4 Yanango, Peru

In 1999, a radiation accident happened at the construction site of a hydroelectric power station in Yanango, Peru. The victim was a welder working on the site who inadvertently - picked up an Ir^{192} industrial source left uncontrolled. He put it in the back pocket of his trousers. He was initially hospitalized at the Lima, suffering from severe radiation burns, and later transferred to France.

3.5 Republic of Georgia

Many unsecured radioactive sources have been found in Georgia over recent years. The local authorities first requested international assistance in October 1997, when a group of border frontier guards undergoing training at a centre in Lilo, near Tbilisi, became ill and showed signs of radiation induced skin disease. Eleven servicemen had to be transferred to specialised hospitals in France and Germany. The cause of the exposures was found to be several sources of Ce^{137} and Co^{60} of various activities, abandoned in a former military barracks that used to be under the control of the former Soviet Union. In July 1998 three more abandoned sources with an activity of 50 GBq, 3.3 GBq and 0.17 GBq were found in Matkhoji, about 300 km west of Tbilisi. At the same time, another site of a former Soviet military base dose to Kuthaisi was discovered containing an area contaminated with Ra^{226}. Another military base in the city of Poti, dose to the Black Sea, was also found to contain two further radioactive sources buried in a sand floor. In October 1998 two other powerful sources were discovered in Khaishi, western Georgia, as part of eight thermo-electric generators placed in the region used to hold an activity of anything between 740 and 5550 TBq. Since then, four of the generators have been located. One was recovered from the bed of the Inguri river, which flows through this region in western Georgia. Recently two other discoveries were made: on June 1999, a Co^{60} source of around 37 GBq was found buried below a road dose to the botanical gardens in Tbilisi; on July 1999, two Ce^{137} sources were found in the town of Rustavi, close to Tbilisi.

3.6 Radioactivity detected in Scrap Metal

A truck passing through the front gate of Smorgon Steel had activated the radiation monitors. The load was from an aircraft being dismantled at Avalon Airport. Following an inspection of the load it was ascertained that the radiation monitors had detected depleted uranium.

A load of scrap metal entering Smorgon Steel, Altona had triggered the radiation monitoring equipment. The load of scrap was returned to the originating company, Norstar Steel Recyclers, Altona for monitoring. The radioactive item was an old aircraft engine that had been sold as scrap metal. A cast alloy "ring" was radioactive alloy contained radioactive thorium. The material was most likely a Mg-Th-Al alloy containing about 2% Th. Total radioactivity involved was 1.5 MBq.

3.7 Loss of Co^{60} Veterinary radiotherapy source

In 1996 has been lost a Co^{60} pad from the University of Melbourne Veterinary Clinic for treating lameness in horses. The pad had been inadvertently disposed of with bandages. The pad was with the large tonnage of garbage. After projected lifetime for disposal of fifteen years and the Co^{60} pad 4-5 metres below the surface, land in the foreseeable future will be parklands and grazing land.

3.8 Industrial Radiography in Intico at Mobil

In 1996 had been an incident involving an "out of control" the 370 GBq (10 Ci) Ir^{192} industrial radiography source. The source being used at the site could not be returned to the shielded container. The radiation safety officer recovered the source into container. The TLD monitors doses reported were 1070 TSv and 370 TSv for the two operators and zero for the radiation safety officer.

3.9 Mohammedia, Morocco - An Ir^{192} source

In Mohammedia, Morocco, an Ir^{192} source being used to radiograph welds at a construction site is inadvertently misplaced. A passing labourer picks up the tiny metal cylinder and takes it home. Within a few months, he and seven relatives are dead from radiation poisoning.

3.10 Goiania, Brazil - A rotating head

A rotating head from a discarded cancer therapy unit is stolen from a storage facility and sold to a scrap metal dealer. The dealer breaks up the heavy shielding, and bits of the radioactive source, which glow in the dark, are taken by friends to various parts of the city. Within two weeks, 249 people are contaminated, four people die and more than 100,00 people must be screened.

3.11 US - Mexico border, Brazil - A heavy metal head

Along the US-Mexico border, a heavy metal head from a radiotherapy machine is mistakenly melted down to make chair supports for a US fast food chain. The supports are trucked into the US, but the radioactivity triggers sensitive alarms at a nuclear research station as the vehicle passes the facility. Unknown numbers of hamburger lovers barely escape low-level radiation exposure.

Besides of only a few mentioned accidents there are tens and hundreds accidents in foundry (steel) industry in past a few decades, what is possible to represent only by suitable tables or longer text.

4. REGULATORY

Most industrialized countries with more or less quantities of radioactivity contaminated metal scrap have independent regulatory authorities backed by strict law enforcement, well-trained personnel and assured budgets. But as the incidents above illustrate, many developing nations still lack the radiation and waste safety infrastructures to properly manage the sources they currently use. IAEA officials by the early 1990s concluded that safety systems in many developing countries had to be dramatically strengthened to meet the requirements derived from the **Basic Safety Standards (BSS).**
Yet policy makers and regulators still sometimes perceive the industry as a suitable target for enforcement. In same time proposed rule permit the unrestricted release of radioactively contaminated materials for use in such things as home appliances, cars, and other consumer products, and that would expose unprotected workers processing contaminated materials at scrap mills to potentially significant levels of radiation.
Many national state authorities established "Criteria for the approval of products intended for use by the general public" and their policy for products containing radioactive substances intended for use by the general public without any regulatory controls on the consumer-user. Approval depended upon a product being unlikely to expose individuals to more than a few hundredths of the national dose limits

and the radioactive components having utility. For many years some organization have acknowledged the complexity and risks of permitting consumer products to contain radioactive substances.
Although recycling of radioactively contaminated materials has been considered for decades and permitted on a small scale. At the same time, unprecedented quantities of radioactively contaminated materials, such as scrap metals and concrete are becoming available from the decommissioning of facilities. Estimating indicate that some million tons of radioactively contaminated metals alone may become available for recycling all over the world.
Several factors influence the threat posed by a given radioactive element:
(1) whether the radionuclide remains in the recycled material or partitions into a by-product of the recycling process (e.g., for metals it can partition into the product, slag, or dust);
(2) the type of radiation the radionuclide emits (i.e., alpha, beta, gamma);
(3) the residence times of the radionuclide in an individual once it is ingested and
(4) the length of the radionuclide's half-life.
For example, some radionuclides like U^{238}, Pu^{239}, Np^{237}, and Tc^{99} are extremely long lived, some have long residence times like Pu and Np, and some partition almost exclusively into the recycled metal, such as technetium and cobalt.
These different characteristics mean those radionuclides present substantially different risks to workers and the public and present different challenges from a regulatory perspective. For example, radionuclides that partition exclusively into the slag that is generated during recycling are less likely to pose a significant threat to the public through commercial products, but pose potentially significant risks to workers. Establishing an across-the-board rule under these circumstances raises the potential for substantial regulatory problems and could undermine safe implementation of a standard.
For radionuclides that partition into the recycled material, the governmental organizations must be particularly vigilant in ascertaining the potential uses and risks posed by the residual radioactive contaminants. Where these risks cannot be reliably calculated, the scrap materials should not be recycled for unrestricted use. The governmental organizations bear the burden of demonstrating the safety of its rule under real-world conditions.
In addition, where radionuclide partition into recycling by-product materials, such as metal slag produced during smelting, the governmental organizations must evaluate requiring proper disposal of such materials at regulated facilities under as low as reasonably achievable. This applies particularly to metal slag, which is sold for, among other things, soil conditioning and ice control because it is of low economic value and certain long-lived radionuclides concentrate in it during the melting process.
Public concern about radioactively contaminated materials remains high because history of regulatory mismanagement, the technical challenges, and the direct impacts recycling radioactive materials will have on consumer products.
In connection with recycling of radioactivity contaminated scrap some national governmental reports included the following recommendations and findings:

- If recycling of scrap metal were to proceed, promulgation of credible national standards for the unrestricted release of radioactively contaminated materials is a necessary prerequisite.
- It is essential that a meaningful stakeholder and public involvement process be implemented before recycling of any radioactively contaminated materials occurs.
- Recycling of contaminated materials could cause health risks to workers and the public.

Great care must be taken to ensure that releases of contaminated castings do not increase residual radioactivity in the nation's castings supply to an unacceptable level, particularly because increases in contaminants have been observed in the past.

5. DETECTION OF RADIOACTIVITY CONTAMINATED SCRAP

The most pressing needs of more than 70 countries need help for upgrading radiation protection and waste management infrastructures.

5.1. Method of Assessing and Criteria the Performances of a Monitoring Equipment

Survey measurements for radioactivity contamination is difficult and challenging where large, complicated pieces of equipment are involved. Problems that can undermine effective surveying include the following:

- Complex geometry's with difficult to reach surfaces are challenging to measure accurately, and workers will tend to avoid these measurement areas.
- Large errors can be introduced into measurements of volumetric contamination if the contaminant concentration is not uniform or if the geometry of the contaminated piece is complicated.
- Even where measurements are straightforward, the accuracy of the measurements is limited by the presence of unavoidable background radiation.

Typical measurement uncertainties, even for the most favourable geometries, are likely to be several percent. More complex geometries will result in greater measurement uncertainty. In studies, there are acknowledges that current detection instruments may not be sensitive enough to detect contamination, reliably under a 1 mrem/y standard, which is a "reasonable" level often quoted by regulators. For example Co^{60}, a major contaminant in materials at licensed facilities and an important radionuclide in risk assessments, could be difficult to detect under a 1 mrem/y standard. If a standard is set, the governmental agencies must be able to demonstrate that the available detection equipment can reliably survey materials to satisfy its standard. Conversely, if regulatory identifies an acceptable standard but adequate detection equipment is not available for certain radionuclides, unrestricted release of materials contaminated with those radionuclides should be prohibited.

These technical constraints raise several basic issues:

It is unclear whether the detection equipment available can protect the public against improper releases of radioactively contaminated materials if a stringent standard were set.

No data have been provided estimating the rate of potential false negatives (measurements that incorrectly find that a piece of equipment is not contaminated).

National governmental organizations have not conducted any assessments of the potential impacts of improper releases on workers or the public. In same time national governmental organizations have not demonstrated that surveying can be conducted adequately for the large quantities of scrap metal available for recycling.

Therefore, any standard establishing an exposure limit constitutes an over-exposure. Since the governmental organizations acknowledge that the public will be exposed to radiation as a result of this recycling scheme, the agencies should establish a population - dose limit based on a credible source term. If some governmental agencies are concerned with the fact that current criteria are inadequate to protect public health and safety, they should establish a zero tolerance for release of contaminated metals.

Local and state governments began passing ordinances and resolutions requiring ongoing regulatory control of below regulatory concern policies radioactive waste.

Some national regulatory authorities should require zero tolerance for radioactive material in consumer goods by developing a standard that bans any radioactivity in consumer products.

5.2. Monitoring System for Radioactivity Contaminated Ferrous Scrap

Increasingly, metal consumers worldwide are demanding that suppliers provide certification that castings (products) are free of radioactivity. To respond to the possibility of radioactive devices concealed in scrap supply, foundry (steel) mills, scrap metal recyclers, suppliers and even landfill operators and incinerator plants are installing sophisticated radiation detection systems to monitor all incoming shipments of scrap. These systems are capable of detecting very low energy, shielded radioactive sources deeply buried and randomly positioned in a fully loaded truck or rail car of scrap metal.

Portable or laboratory radiation detector is suitable to analyse levels of castings radioactivity and to accurately detect the associated level of contamination.

Radiation detection facilities are considered a quality control measure to prevent the inclusion of radioactive scrap. This helps the company to be recognised as a high quality supplier, providing customers with shipments free of radioactivity.

5.3. Places for Control

Monitoring of scrap is typically done on the state boundary crossings for wagons and vehicles, the best opportunity to reject the scrap before it enters the country or in bound approach to a weigh scale. Although, the possible other locations are feasible for control.

The installation of the detectors immediately in front of the scale provides maximum protection to workers, and also the best opportunity to reject the scrap before it enters the site.
All incoming wagons or vehicles pass between fixed or portal detectors for measuring of radiation. The wagons and vehicles speed are measured as well as scrap radiation as they, wagons and vehicles are entering and leaving the detectors area or gate allowing for the calculation of wagons or vehicles acceleration.
An exact knowledge of what has to be detected differentiates various commercially available detection systems. The detector output is analysed for signatures characteristic of buried shielded radioactive source. If the system determines that a source of radioactivity is present, it sounds an audio alarm and displays the alarm information on a monitor indicating the location of any radioactive source.
Total radiation protection for a foundry (steel) mill consists of:

- Radiation detector system to detect radiation at the ports during unloading scrap from transport ships at the coast.
- Scale radiation detector system to detect radiation at the state boundary entrance or near foundry gate.
- Shredder and conveyor monitors.
- Furnace charge basket monitors to check scrap before it enters the furnace.
- Charge buckets may be monitored while loading or when fully loaded.
- Radiation detector system to detect radiation of process slag.
- Baghouse dust radiation detectors.
- Castings radiation detectors to detect products' radiation.

6. FINANCIAL CONSEQUENCES OF ILLICIT MOVEMENT OF METALLIC CONTAMINATED SUBSTANCES

The economics of radioactive materials recycling will undermine safe implementation of a standard.
Except in the case of nickel, and to a lesser extent copper, the primary economic gain from recycling scrap metal and other radioactively contaminated materials derives from avoiding disposal costs. This means that from an economic perspective there is little difference between limiting standards to restricted releases, such use solely within licensed facilities, versus permitting unrestricted recycling of such materials.
However, the savings from avoiding disposal are often more than offset by the costs of cleaning the materials to meet unrestricted release standards and, to a lesser extent, costs from surveying the materials for radioactive contaminants. Unless there are effective regulatory oversight mechanisms and significant penalties for regulatory violations, companies engaged in recycling will:

- maximize the amount of material they release without cleaning it;
- want to limit survey costs.

The economics of the radioactive recycling therefore strongly favour lax implementation of surveying requirements and compliance with release standards. Given the amount of material potentially available, the economic incentives, the limits of survey equipment, and the poor track record of the nuclear industry in managing radioactive materials, issuing an national regulatory standard could result in substantial quantities of material being released in violation of whatever standard might be set.
Some industries as well as nuclear industry have determined that it would be more cost-effective to dump radioactive waste into the public domain under the guise of recycling rather than paying the high fees for dumping this radioactive waste in a "low level" waste dump.

7. RECYCLING AND REUSE OF RADIOACTIVITY CONTAMINATED SCRAP

The national regulatory authorities must evaluate the potential impacts from such improper releases and ensure that there are regulatory mechanisms to protect the public against them. It is the practical challenges of implementing a standard that represent the greatest source of public concern, even if a safe standard, in principle, were identified.

The foundry industry processes, also, generate significant quantities of cupolas, induction furnaces, electric arc furnaces dust, rejected metal material, slag and other co-products. Because of the large volumes involved, the foundry industry may appear being a significant potential risk to the environment. In fact, the opposite is true. A substantial portion of the foundry industry ships melting equipment dust to recycling companies to recover its zinc content. Similarly, all companies process and recycle melting furnace slag. The volume of metal constituents being reported as part of the recycling of melting equipment dust, scrap, send and slag is an environmental success story, rather than viewed by some as a potential trigger to target a company for enforcement.
The foundry (steel) is the largest recycling industry on the World. Scrap metal from junked cars, appliances, construction debris etc is recovered, processed and productively recycled into new ferrous or non-ferrous castings. This process requires: less energy, fewer virgin resources and produces lower emissions of hazardous slag, air pollutants, greenhouse gases, and water pollutants than do other forms of by-products. Much of ferrous castings that are recycled have been galvanised.
Although the foundry industry faces numerous compliance challenges, they have achieved a high overall level of environmental compliance. This was amply demonstrated by the higher than expected compliance rates found during a recent governmental organization enforcement initiative. This outcome was not a surprise to the industry. The initiative should demonstrate to govrnmental organizations that their perception of foundry (steel) industry as a target for enforcement scrutiny is misplaced. Foundry industry is extremely proud of its contribution to the environment as the world large recycler. Through its efforts, ferrous metal is the most recycled material as well as non-ferrous metals.
In the industrialised countries, a few times the nuclear industry and its regulators are trying to promote the deregulation of radioactive wastes and materials.

8. MANAGEMENT

The problems raised by appearance of radioactivity contaminated metal scrap as well as the lack of public notice and comment in the project installing of depony of radioactivity contaminated materials show that the present rulemaking is being developed in the context of decades of mismanagement of radioactive wastes. Each state rulemaking mismanagement has caused incalculable environmental harm, S&H problems of many foundry (steelmill) workers, perhaps citizens, and perhaps created an environmental debacle that will cost too much to remedy when we become conscious of problems. Unfortunately, these problems are present, because tomorrow it could be possible to trace radioactivity contaminated metal materials offsite, into homes, businesses, rental cars, trucks and elsewhere. Significant contamination events with metal materials continue to occur all over the World.
In a few cases firm management had illegally disposed of radioactive materials in local sanitary landfills, at random sites in a local state wildlife preserve, and through largely unmonitored on-site recycling operations. In the other case management had illegally released radioactively contaminated wastes for disposal at municipal dumps, sold and recycled radioactively contaminated metals, and sent contaminated trailers to local schools without even conducting adequate monitoring.
In some industrialized countries are interested in restrictions on the unrestricted recycling and sale of radioactively contaminated materials for use in, among other things, consumer products until these issues are resolved and public confidence is restored.
The public of these countries is interested in ability to ensure that radioactively contaminated materials are managed safely. It is therefore essential that the Governmental offices consider the practical, technical, and administrative limitations of the firm management that will be responsible for releasing contaminated materials into markets, and that it factor these constraints into its decision on how to proceed.

9. RADIOACTIVITY CONTAMINATION OF CASTINGS OR PRODUCTS

Some governmental organisations and some ministries of industrialised countries recently intend to make contracts for allowing huge amounts of radioactive metal to be released. This is rather irresponsible plan; it has to be backed by suitable set standards. These documents look at the feasibility of recycling radioactive scrap metal into consumer products. This is the beginning of a rule

making that could result in radioactive metal being made into strollers, appliances, bed frames, belt buckles anything made from metal. The metal, which remains mildly radioactive after decontamination, is used in the production of cars, windows and a wide variety of consumer goods, including kitchen equipment such as pans. Authorities claim the recycled metal cannot find its way into cans for food.
By establishing radiation-protection standards it would be ensured that public health is protected by preventing to release highly radioactivity contaminated metal. In this case regulation is to assure that if any metals are released, they will be released at safe levels and can be processed and reused with the confidence that they are safe. This, however, presupposes that there is such a thing as a safe dose of radiation.

10. RADIOACTIVITY PROTECTION ASPECTS

Besides the country-level information, an international database is being developed on accidents and near accidents with sources. Recently have been carried out studies concentrated on "lessons learned" from mishaps at medical, research and industrial irradiation facilities. They will help regulators and workers in participating countries as they analyse the causes of more than a few hundred accidents.
The overall goal is to help countries attain the infrastructure and expertise to avoid the kind of disasters described earlier. By the time the project ends at the turn of the century, those countries that fully co-operate will have everything in place to safely manage the use of ionizing radiation for whatever purposes they choose.

11. INTERNATIONAL CO-OPERATION

International co-operation, prevention and initiative for international radioactive source management have been implemented throughout some projects. An action plan has been developed together with each participating country, setting out the key steps that must be taken. The project's first aim is to inventory what sources are being used, for which applications, and where, as well as where and how no-longer-used sources are stored. A computer database is being developed based on questionnaires sent to the countries about sources they know they has, and to manufacturers and suppliers on what they have provided in the past. The two-track findings - country records plus supplier information - should provide a comprehensive picture for national regulators, many of them only recently established.
Many countries simply have not known what they have because they lacked the mechanisms to keep proper inventories. As regulatory structures are built up, the records will provide a base to monitor, control, ensure safe licensed use and finally to store radioactive sources securely.
Establishing laws, regulations and other means of control over sources are only part of the process. The governments have to set up infrastructures to keep good records, monitor radiation for workers and emissions that affect the public, and assure the quality of radiation used in medicine. The project will also help procure essential equipment, provide the training to utilize them and monitor the safe transport of source andisposal and waste handling.
It also recognizes the value of developing self-reliance and common experience through technical co-operation among countries developing similar control systems. The Slovak Republic, for example, which developed a full-scope nuclear regulatory authority almost from scratch within a few years, is now helping Ukraine restructure its struggling system.
Besides the country-level information, a second international database is being developed on accidents and near accidents with sources. Three recent studies concentrated on "lessons learned" from mishaps in radiography, radiotherapy and at industrial irradiation facilities. They will help regulators and workers in participating countries as they analyze the causes of more than 100 accidents.

12. RADIOACTIVITY CONTAMINTED METAL SCRAP OR WASTE AND BOSNIAN FOUNDRY (STEEL) INDUSTRY

Before the war Bosnian foundry industry production was about 130.000 t castings per year. By the way, steel industry production was about 2,000.000 t steel per year at the same trime. Such foundry (steel) industry production must use a large mount of metal scrap. Beside today used scrap quantity

the import of metal scrap, as well as hazardous metal scrap, transport of scrap is ocurring troughout 27 official road border crossing, 5 official railroad border crossing and 4 official international airport border crossing. On these crossing ther is no any monitoring or control. Really, with Republic Croatia there are in use only 7 official road border crossing, more than over 210 are unofficial road border crossing and with Serbia nad Montenegro much more. On such crossing there is no mimimal possibility control of the import, too. That fact indicate that beside of lack of Bosnian regulatory for radioactivity conataminated metal scrap there is no possibility of covering Bosnian border by monitoring and control systems. Such situation does not allow control of returned radioactivity conataminated metal scrap from foreign boundries especialy borders countries of EC.
Even appearance of returned radioactivity conataminated metal scrap from foreign boundries from the export indicates that on the Bosnian territory there is radioactivity conataminated metal scrap, orphan sources or radiactive nuclides.
All over the World there is increase of number of accidents with radioactivity conataminated metal scrap, orphan sources or radiactive nuclid which are dangerous for S&H of workers and citizens which are quainted with such material. The lack of monitoring systems or data about accident does not indicate that there is no accidents in foundry (steel) industry. Threfore it is important begin to work on regulatory and mornotoring of such material in Bosnia, espacialy of processes in foundry industry.
In a spite of Bosnian foundry (steel) industry retardation because of the war, there is certain foundry industry production. In Bosnian foundry (steel) industry are two possible sources of radioactivity contaminated metal scrap:

- Sealed sources, typically installed in industrial, medical, research or military equipment, systems, instrumentation or devices;
- Imported scrap.

In after the war situation is many destroyed building with many lost (industrial, medical or research) radioactive (nuclide) sources in instrumentation, equipment or devices, which could be sold as a metal scrap. Such Bosnian situation has been considered more detailed in previous paper[3)]. At among 73 purchasers of metal scrap in F BiH and unknown number of purchasers of metal scrap in the second Bosnian entity from since anything was not still changed in a spite of presentation of situation. Therefore, the import of scrap or metal goods is extremely difficult for monitoring and control. Only small quantity of radioactivity contaminated scrap or final steel products occasionally have been in time detected by another country border customer control and returned to producers[11)].
In accordance to Federal B&H insufficient regulatory (from 1999) for metal scrap recycling is not jet published additional proposed technical part of law issue. So for this matter there is no jet regulatory arrangement.
Same situation as with scrap is on semi-product or final products market. <u>For example</u>, recent data[11)] indicate that plenty of final products, as reinforced steel bars, have been transported to the second Bosnian entity over Serbia and Montenegro and freely imported from Ukraine, Russia. Occasional control shows that there are radioactivity-contaminated products by Co, Ni, etc. <u>Example two</u>: in before mentioned idea of deposing of radioactivity contaminated substances and metals a few kilometres from Bosnian border, in USK, is still in option without any resistance from Bosnian governmental and official authorities.
In spite of, in previous paper mentioned suggestions[3)] about organisation of domestic monitoring and control system, especially against import of hazardous materials, generally radioactivity contaminated metal scrap, semi-products or final-product, such ideas are not yet under the consideration of Bosnian Government or governmental organizations. In meantime all recommendations and suggestion have been confirmed by plenty examples all over the World as well as in Bosnia. In Bosnia there is no independent regulatory mechanisms to ensure that radioactivity contaminated metal materials could be properly managed in any accidental situation.
Bosnian rulemaking mismanagement has caused incalculable environmental harm, S&H problems of many foundry (steelmill) workers, perhaps citizens, and perhaps created an environmental debacle that will cost too much to remedy when we become conscious of problems. Unfortunately, these problems are present, because tomorrow it could be possible to trace radioactivity contaminated metal materials offsite, into homes, businesses, rental cars, trucks and elsewhere. Significant contamination events with metal materials could expect that it happens in Bosnia too, but we do not perform any examination. In same time we do not any preparation in connection with accidental situation or choosing of place for urgent possibility of deposing radioactivity contaminated metal materials.

It is important to mention that if other industries as civic engineering or engineers, contractors and fabricators get stuck with this problem, that in foundry (steel) industry responsible persons analyse the metallurgical effects on castings or products of prior exposure to various forms of radioactivity. Such suggestion is in connected with directors' responsibilities for H&S of employees and the public. This issue is in accordance to the draft code from H&S Governmental bodies all over the World, especially in industrialized countries.

Therefore the most pressing needs of Bosnia have to be determined on the basis of BSS requirements and information gathering, the waste management advisory programme and special expert teams for foundry industry. To accelerate the upgrading process, time limited objectives and decentralized management has to be established.

Bosnia simply has not known what there is on its territory because of lack of the mechanisms to keep proper inventories. Therefore it is important to built up regulatory structures, system of the records as a base for monitoring, control and ensuring safe licensed use and finally to store radioactive sources securely. The initial focus has to be on larger industrial, medical, research and military sources.

Reconstructing regulatory for hazardous materials, especially for radioactivity contaminated metal materials and scrap, establishing laws, regulations and other means of control over sources are only part of the monitoring process. In liaison with the suitable Bosnian technical staff and by help of IAEA's experts, Bosnian government has to set up infrastructures to keep good records, monitoring system for radiation emissions that affect the public, and assure the quality of radiation used in industrial, research and medical purposes. Such project has to help procure essential equipment, provide the training to utilise them and monitoring the safe transport of sources and disposal and waste handling.

In same time it is important to answer on a few questions as:

- Should contractors be checking designed and constructed castings (steel) on the job site for radiation to protect construction workers?
- Who owns the liability if harmful levels of radioactivity are discovered in buildings, machines, facilities, etc?
- Should foundry (steel) control be wearing dosimeters?
- Who will be responsible for damage of H&S status of personnel or inhabitants, if harmful effects of radioactivity are discovered?
- Who is responsible for protecting Bosnian citizens in the case when there is waste or scrap radioactivity contaminated depose place of foreign country just near Bosnian border?
- Who will be responsible for paying damages and for consequences of radiation damage?

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