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CENTRE D'ÉTUDE SUR L'ÉVALUATION DE LA PROTECTION DANS LE DOMAINE NUCLÉAIRE

Clearance and recycling of low level radioactive materials: an ALARA practice?

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Clearance of radioactive materials: international recommendations

- Clearance of radioactive materials has been a deeply discussed topic.
- IAEA as well as EC provide guidance and recommendations based on the same dose criteria:
  - Individual dose: 10 μSv.year^{-1},
  - Collective dose: 1 man.Sv.year^{-1}.
- Dedicated exposure scenario, based on the future use of the radioactive material to be cleared, are used to elaborate clearance level. Recycling of metallic materials is a specially studied case for re-use and recycling of radioactive materials.

Clearance of radioactive materials: international recommendations

Radionuclides	IAEA unconditional clearance level RS-G-1.7 ($Bq.g^{-1}$)	EC unconditional clearance level RP122 Part 1 ($Bq.g^{-1}$)
^{3}H	100	100
^{14}C	1	10
^{58}Co	1	0,1
^{60}Co	0,1	0,1
^{235}U	1	1
^{238}U	1	1

Clearance of radioactive materials: international recommendations

Radionuclides	Metal scrap - Re-use/Recycling, EC RP89 ($Bq.g^{-1}$)
^{3}H	1000
^{14}C	100
^{58}Co	1
^{60}Co	1
^{63}Ni	10 000
^{235}U	1
^{239}Pu	1

Clearance of radioactive materials: national regulations

- Many countries within Europe adopted clearance levels for very low level radioactive materials:
  - Germany: Radiation Protection Ordinance (RPO), July 2001.
  - Belgium: Royal Decree, 20 July 2001.
  - Sweden: The Swedish Radiation Protection Institute's regulations on clearance of goods and oil from controlled areas at nuclear facilities, SSI's Code of Statutes SSI FS 1996 :2, 1996 (under revision).

Clearance of radioactive materials: national regulations

Radionuclides	Germany*	Belgium	Sweden
^{3}H	1 000 $Bq.g^{-1}$	100 $Bq.g^{-1}$	0,5 $Bq.g^{-1}$ for β/ γ emitters 0,1 $Bq.g^{-1}$ for α emitters
^{14}C	80 $Bq.g^{-1}$	10 $Bq.g^{-1}$	
^{63}Ni	300 $Bq.g^{-1}$	100 $Bq.g^{-1}$	
^{60}Co	0,1 $Bq.g^{-1}$	0,1 $Bq.g^{-1}$	
^{235}U	0,5 $Bq.g^{-1}$	1 $Bq.g^{-1}$	

** RPO, Column 5, unconditional clearance for solid and liquid.*

Clearance of radioactive materials
The French context

- In France, any material located in a “nuclear waste zone” is considered - with no regard to its real radiological content, but to its potential radiological content - as a nuclear waste (see Jérémie Vallet’s presentation “For a consistent management of radioactive waste: The national plan for the management of radioactive material and waste”).

- The management of nuclear waste does not rely on clearance level.

- But it may be pointed out that the National Plan for the Management of Radioactive Material and Waste mentioned “For particular cases, for wastes with a very low quantity of radioactivity, recycling within specialized facility may be considered if followed by a re-use in the nuclear industry”.

Recycling of low level radioactive material Case 1

- FeursMetal (foundry) asked its Regional direction for industrial and research activities and environment the possibility to recycle metals from SOCATRI (AREVA Group). Radioactive content : < 1 $Bq.g^{-1}$ (Uranium).
- Objective: recycling of 200 tons per month of very low level radioactive metal.
- Occupational exposure: individual dose < 30 μSv per year.
- Public exposure - to people living around foundry -: individual dose < 1 μSv per year.
- Public exposure - to end-users of product -: individual dose < 2 μ Sv per year.

Recycling of low level radioactive material Case 1

- Traceability of product ensured with current quality insurance practices.
- Consultation of Nuclear Safety Authority, local Health and Safety Affairs Department, local Work and Employment Department.
- Decree by the local government representative (Préfet) to authorize FeursMetal to carry out a test. Additional demands regarding radiological conditions at the work place and the management of wastes.
- Massive opposition of FeursMetal workers and local inhabitants with the support of national NGO. Concerns regarding health effects associated with dissemination of radioactivity in the public domain.

Recycling of low level radioactive material
Case 1

- Legal demand to cancel the authorization provided by the Préfet.
- Even if the demand was rejected, the board of FeursMetal decided not to go further in the practical phase of the test.

Recycling of low level radioactive material
Case 2

- Dismantling activities on the CEA Marcoule site led to the production of large amount of low level wastes, among which 2 500 tons of very low level radioactive lead.
- In the same time, dismantling activities create new needs for biological protections.
- Storage of lead is feasible at the very low level radioactive waste storage facility of Morvilliers - dedicated storage facility managed by ANDRA -. But problems linked to the chemical toxicity of lead: quantity to be stored is limited.
- The CEA Marcoule site can benefit from a furnace, which is located in the site.

Recycling of low level radioactive material Case 2

- All these considerations lead the CEA Marcoule RP staff to engage a reflection on the potential for re-use, within the nuclear sector, low level radioactive lead (mainly uranium contamination) that come from dismantling activities.
- First step was to identify an industrial partner for the melting of lead and production of biological protection. D'Huart Industrie agreed to partner CEA.
- Common project sent for advice at the Regional direction for industrial and research activities and environment in December 2000. Request for a radiological impact survey.
- Elaboration of a common survey by CEA (dose calculations) and D'Huart Industrie (exposure scenario development).

Recycling of low level radioactive material Case 2

- Results (after decontamniation in Marcoule's furance):
  - Highest occupational exposure: 6,3 μSv per year,
  - Highest public exposure: 1,5 μSv per year.

- Further demands from the Regional direction for industrial and research activities and environment:
  - Development of a quality control procedure,
  - Public enquiry (December 2002),
  - Public meeting (February 2003).

- Review of the "impact" study by a NGO (demand of D'Huart Industry workers)

- Within the same time, exchanges between CEA and D'Huart Industry.

Recycling of low level radioactive material Case 2

- Opportunity for D'Huart Industrie workers:
  - To discuss RP practices as well as the follow-up of ionising radiation conditions at the work place,
  - To progressively acquire a RP culture.
- Opportunity for CEA workers to better use their furnace.
- Development of measurements protocols and procedures for the continuous improvement of radiation protection follow-up and decontamination practices.

Recycling of low level radioactive material Case 2

- The advices from ASN and the Environment Ministry were also required by the DRIRE, which finally provides its agreement for the Marcoule lead procedure recycling in May 2003.

- 23 tons of lead were sent to D'Huart Industrie in July 2003 and the first biological shield with recycled lead were sent to Marcoule in September 2003. So far, 500 tons of lead have been recycled.

- The agreement provided by the DRIRE has evolved. Firstly dedicated to CEA Marcoule lead recycling, it has been extended to other operators (mainly EDF and AREVA) and sites. Another reflection has also been engaged on the possibility to extent the recycling procedure to other metallic materials recovered within the dismantling activities (copper, steel and brass).

Discussion

- Within the nuclear sector, individual dose lower than 10 μ Sv.year^{-1} may be seen as meaningless, which is rather understandable.
- Nevertheless, outside the nuclear sector, due to an absence of RP culture, any individual dose is not seen as meaningless.
- Regarding clearance and recycling, in order to avoid blockage, the implementation of good practices, based on a practical ALARA approach, is needed to reach a common ALARA level:
  - Commitment of all involved parties,
  - Development of an RP culture (radiological risk and its management),
  - Follow-up of ionising radiation conditions at the workplace.

Discussion

- An open process appears to be facilitated when the approach for clearance and recycling is not only based on the respect of dose criteria; individual and collective doses being only one dimension of a complex issue.

- Such a process allow to establish a debate between all the concerned stakeholders and favour social acceptance of the practice.