NORM: EU Directive Implications beyond EU Borders

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DEFINITION

The definition of NORM:

Radioactive material containing no significant amounts of radionuclides other than naturally occurring radionuclides

AND:

Material designated in national law or by a regulatory body as being subject to regulatory control because of its radioactivity.

Three lists of 'industries of interest'

- EU: Article 23 and Annex VI of the 2013 Directive (building on the Title VII of the 1996 Directive)
- IAEA: Safety Report No.49 (Assessing the need for radiation protection in mining and mineral processing), 2006
- Australia: Safety Guide for NORM, RPS-15, 2008

Whilst the lists are generally similar, there are some important differences.

Three lists of 'industries of interest'

Industry	EU	IAEA	Australia
The same in all three sources:			
Thorium compounds and products			
Niobium			
Oil and gas production			
Titanium pigment			
Thermal phosphorus			
Phosphate fertilisers			
Phosphoric acid production			
Zircon and zirconia			
Coal fired power plants			
Iron and steel			
Tin, lead, copper			
Mining ores other than uranium ore			

Three lists of 'industries of interest'

Industry	EU	IAEA	Australia
	DIFFERENCES:		
Rare earths	From monazite only		From all minerals
Tantalum	✔	-	✔
Geothermal energy	✔	-	✔
Cement, clinker ovens	✔	-	-
Water treatment	Only ground water		All water
Aluminium	-	✔	✔
Zinc, lead	-	✔	-
Scrap metal recycling	-	-	✔
Tunnelling	-	-	✔
Building industry	✔ (Annexes 8 & 13)	-	✔
Paper and pulp production	-	-	-
Hydraulic fracturing	-	-	-

Levels applicable

Comparison given in the EU RadPro-157 (2010):

List of radionuclides of "natural origin" grouped according to the ratios of values in RS-G-1.7 and RP 122 Part I

Ratio up to ...	Nuclides
0.01	Th-231
0.1	Bi-210, Th-234
1	Ra-223, Ra-224, Th-227, U-234, U-235, U-238
10	K-40, Th-228, Th-230
100	Pb-210, Po-210, Ra-226, Ra-228, Ac-227, Th-232, Pa-231

Now 2013 EU Directive and IAEA BSS 2014 are aligned:

TABLE A PART 2

Naturally occurring radionuclides

Values for exemption or clearance for naturally occurring radionuclides in solid materials in secular equilibrium with their progeny:

Natural radionuclides from the U-238 series	1 kBq kg^{-1}
Natural radionuclides from the Th-232 series	1 kBq kg^{-1}
K-40	10 kBq kg^{-1}

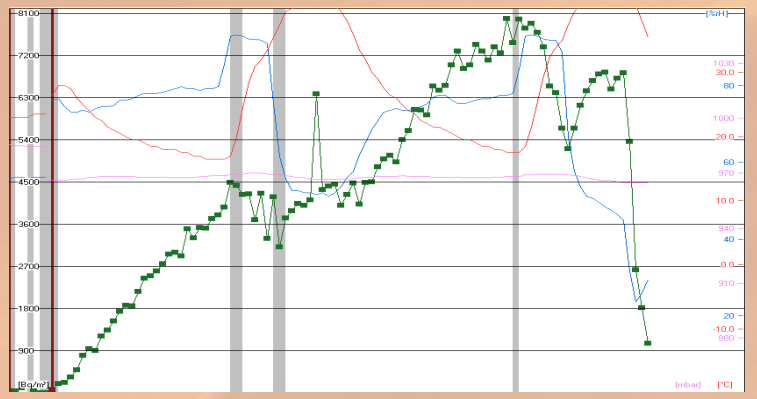
The radiation levels measured are far from “low”

Monazite deposit in Australia, gamma ~ 140-180 µSv/h

20 mSv/year may be reached in two weeks

Abandoned U and Th plant in Ukraine, gamma up to 1300 µSv/h

20 mSv/year may be reached in two days



Build-up of ^{222}Rn in a container with mineral containing only 1.2 Bq/g of ^{238}U, up to 8,000 Bq/m^3

20 mSv/year may be reached in one month

Additional serious safety hazards are very often present

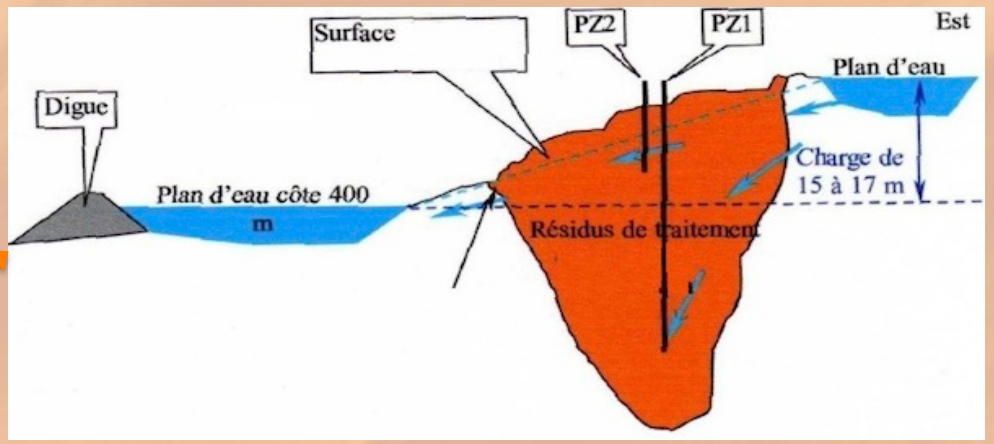
Nest of feral bees in a rusted drum with NORM, Australia

~20 bites = 50% fatality

Wall cracks in an underground mine

NORM waste mixed with chemicals, asbestos and mercury, Asia

There are many environmental hazards as well, such as acid mine drainage



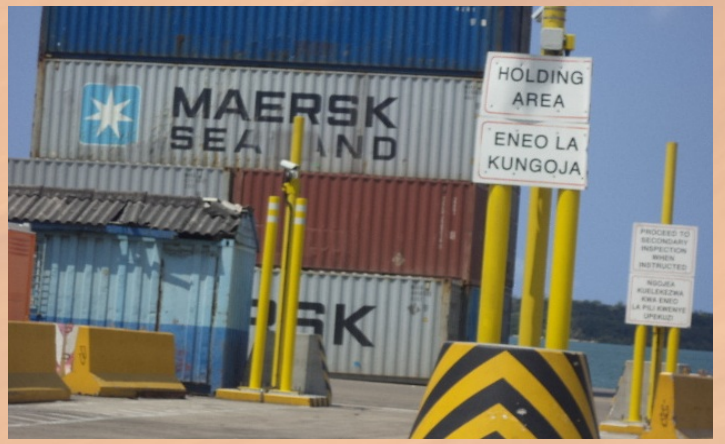
Acid mine drainage, pH~4.5, ^{226}Ra ~ 7 Bq/L, Africa

Detection of radioactivity at EU border crossings

Relevant to the transport of all NORM, whether it is exempted from the Transport Regulations or not.

Issue:

The concentrations of radionuclides may cause elevated gamma radiation levels outside the packages (e.g. sea containers). The equipment that is used at border crossings and in ports worldwide easily detects these levels.



Detection of radioactivity at EU border crossings

Solution:

The transport documentation for a particular material must contain detailed information about the concentrations of naturally occurring radionuclides in this material, irrespective of its classification.

MATERIAL SAFETY DATA SHEET

Monazite concentrate

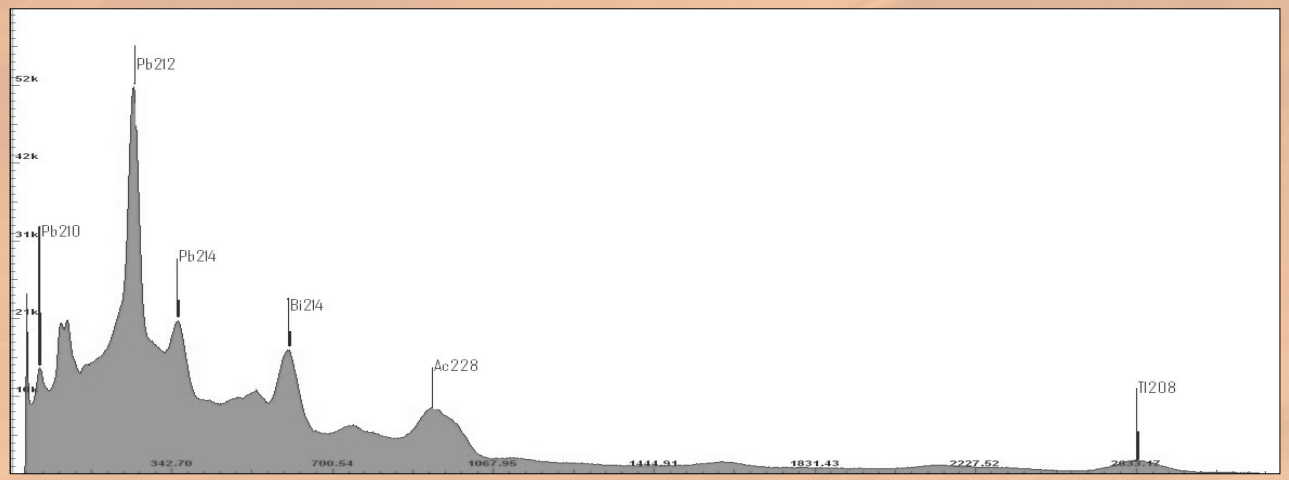
1. PRODUCT AND COMPANY IDENTIFICATION

Product Identification

Product names : Monazite

Company Identification

Company :
Address :
Telephone Number :
Fax Number :
E-mail address :



Potential adoption of the 2013/59/EURATOM into the regulation of a non-EU country

- Regulators in the francophone countries tend to rely more on the documents from the EU, which are immediately available in French, and not on the IAEA ones.
- Typically, only Safety Standards of the IAEA are translated into six official UN languages.
- The IAEA documents are not translated into the languages such as Portuguese.

It is, therefore, quite possible that the text of the EU Directive (or some parts of it) will be adopted into the regulations in some developing countries.

Potential adoption of the 2013/59/EURATOM into the regulation of a non-EU country

Reference levels:

Article 7.2

- *The choices of reference levels shall take into account both radiological protection requirements and societal criteria. For public exposure the establishment of reference levels shall take into account the range of reference levels set out in Annex I.*
- Annex 1*: Without prejudice to reference levels set for equivalent doses, reference levels expressed in effective doses shall be set in the range of 1 to 20 mSv per year for existing exposure situations*

However, without even looking into any annexes: Article 12.2

- Member States **shall** set the limit on the effective dose for public exposure at **1 mSv in a year**.

Potential adoption of the 2013/59/EURATOM into the regulation of a non-EU country

Even if there is an argument about planned or existing exposure situations – in each and every case (except abandoned 'legacy' sites), the same 1 mSv/year will still apply.

Article 100.3 on existing exposure:

Existing exposure situations which are of concern from a radiation protection point of view and for which legal responsibility can be assigned shall be subject to the relevant requirements for planned exposure situations and accordingly such exposure situations shall be required to be notified as specified in Article 25(2).

It should be noted that §3.4 of the IAEA 2014 BSS contains similar requirements.

The Problem

"Precautionary principle": in dealing with potentially hazardous technologies the benefit of the doubt must go to the public and not to technologies.

The combination of this principle with the uncertainty about health effects of low level ionising radiation means that *a theoretical possibility* "a small dose may cause harm" is transformed into *an axiom* "a small dose most definitely will cause harm".

The implementation (basically, copying) of Article 12.2 of 2013 EU Directive into the regulations in developing countries could (and most likely will) lead to the diversion of limited funds from other more important health problems of the population as a whole.

The Problem

→ Over-regulation results in billion dollar costs, despite Linear-No-Threshold dose response model still being just a hypothesis, not a conclusively proven fact.

"Each human life hypothetically saved by implementing the US Nuclear Regulatory Commission's regulations costs about $2.5 billion. Such costs are absurd and immoral when compared to the costs of saving lives by immunisation against measles, diphtheria and pertussis, which in developing countries range between $50 and $99 per one life saved." (Z. Jaworowski, 1998)

The Problem

Radiation is not the only low-level risk that is over-regulated. There appears to be an obsession with regulating relatively low risks and an overall blindness to diseases such as measles, malaria and tuberculosis, and to other potentially fatal dangers, such as prescription opioids and alcohol.

Developing and applying regulations intended to reduce risk from minor or hypothetical hazards (such as low-level radiation) –

1. Gives elected officials an opportunity to say "we are here to protect you",
2. Provides support for the scientific research that may not be needed, and for the government departments that, in some cases, have much more staff that is necessary, and
3. Appeases BANANA's – people of the following opinion: "Build Absolutely Nothing Anywhere Near Anything".

Possible solution…?

NORM are existing exposure situations, because the source is not deliberately introduced, it already exists when a decision on control is taken; concentration and dissemination of radionuclides are incidental. …some control is needed and should be provided; the level of protection should be commensurate with the risk. (J-F Lecomte, NORM-VIII, 2016)

This may not entirely correct. If the decision is made to open a new mine, bring up the ore that is rich in uranium and thorium and process it – the source is deliberately (albeit incidentally) introduced. Each and every new operation dealing with NORM appears to deliberately introduce the source.

Possible solution…?

It can be argued that the source is not deliberately introduced, it was already existing – but what about the situation when radioactivity concentrations are increased thousands of times, making the NORM material dangerous?

Linking the planned exposure situation with the possible use of material for its radioactive properties also may not be a good idea.

Following a similar logic it could be argued that nuclear fuel is also NORM, as both ^{238}U and ^{235}U were already existing – just the ratio has changed during enrichment…

Yes, ^{235}U may have been introduced for its radioactive properties, but ^{238}U in depleted uranium – wasn't.

- So – is depleted uranium a NORM residue/waste?

Possible solution…?

Two possibly absurd situations:

A worker is spending half the time in a copper flotation circuit, and another half – in uranium processing circuit. What is the exposure situation then?

Two ^{226}Ra atoms floating in the river side by side, one is from the farmer's field (fertilizer use), another one – from a 'nuclear' facility. Then:

- The one from the farmer's field is more or less "harmless" (NORM, existing exposure situation), but –
- Another one (exactly the same) acquires some magic powers and must be managed properly (nuclear, source is deliberately introduced, planned exposure situation).

Possible solution…?

Maybe, similar to the three bands for workers:

- Less than 1mSv/y
- From 1 mSv/y to a few mSv/y
- From a few mSv/y to 20 mSv/y

a recommendation can be made on the application of the reference levels to the industries dealing with NORM?

A typical operator would always be of the opinion of "just give me the number that I should not exceed". The "practice – intervention" concept was not well understood, and the introduction of variable reference level will, undoubtedly, result in a confusion for many regulators, who would simply use "the lowest denominator" of 1 mSv/year…

Problem 2 – verbatim adoption of limiting values

Table …. Limits for radioactive materials in drinking water

SI No.	Radioactive material	Unit	Concentration (max)
i)	Gross *alpha* activity	pCi/l	1
ii)	Gross *beta* activity	pCi/l	15

Africa: 15 times less than US EPA. There is no laboratory in the country capable of measuring such low levels

WHO, Guidelines for Drinking Water Quality, 2011:

Screening levels for drinking-water below which no further action is required are ***0.5 Bq/litre for gross alpha activity*** *and 1 Bq/litre for gross beta activity. …****The screening level for gross alpha activity is 0.5 Bq/litre (instead of the former 0.1 Bq/litre****).*

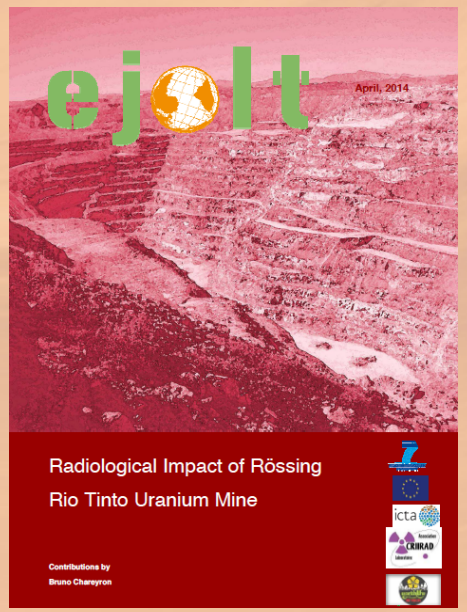
BUT – draft regulations from one of the countries in West Africa:

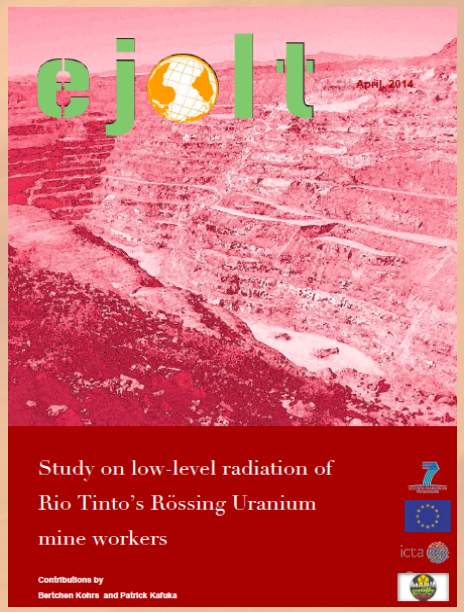
Le seuil de contrôle recommandé pour ***l'activité alpha globale est de 0,1 Bq/l****. Le seuil de contrôle recommandé pour l'activité bêta globale est de 1,0 Bq/l.*

Copied directly from Annex III of the Council Directive 2013/51/Euratom of 22 October 2013 laying down requirements for the protection of the health of the general public with regard to radioactive substances in water intended for human consumption.

Problem 3 – advice by EU experts to developing countries

Namibia: Two reports by Environmental Justice Organisations, Liabilities and Trade (EJOLT), supported by the EU, 2014





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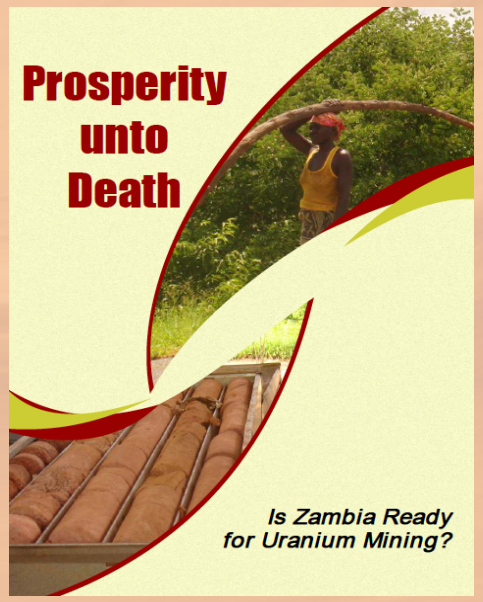
The National Radiation Protection Authority of Namibia was not aware of visits to the country and of the reports themselves.

Problem 3 – advice by EU experts to developing countries

Zambia: A report financed by Norwegian Church Aid, 2010



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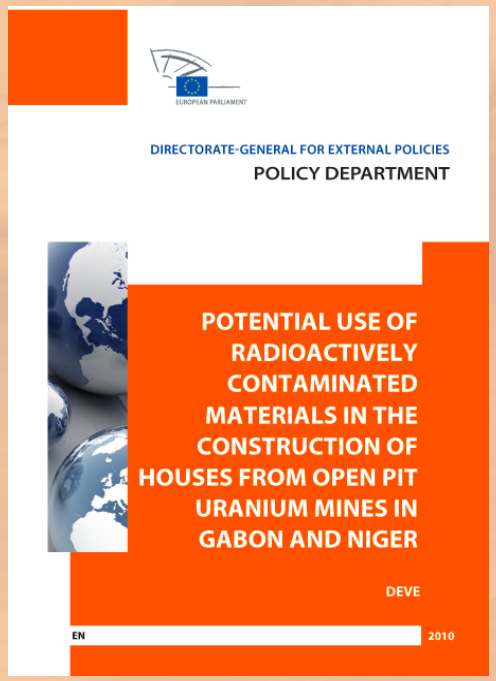
National institute
for
scientific and industrial research

The National Institute for Scientific and Industrial Research and Environmental Management Agency of Zambia were not aware of a visit to the country and of the report.

Problem 3 – advice by EU experts to developing countries

Gabon – 2010 report by Ecologic Institute, Germany, requested by European Parliament



Centre National de Prévention et de Protection contre les Rayonnements Ionisants (CNPPRI) was not aware of the visit to the country, the report and its contents.

No radiation monitoring equipment was taken by experts for the visit to Gabon, thus no conclusions of the report could be verified.

Niger – only a desktop study of documents was carried out.

Problem 3 – advice by EU experts to developing countries

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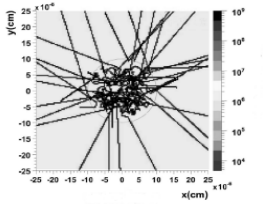
From visits to all accessible areas of the site and from the numerous discussions with the site personnel and the members of the public in 2011 it appears that these photographs were taken relatively long time ago, when the remediation of the site was still in progress…

Problem 3 – advice by EU experts to developing countries

ECRR

2010 Recommendations of the European Committee on Radiation Risk



The Health Effects of Exposure to Low Doses of Ionizing Radiation

Regulators' Edition: Brussels 2010

ECRR

EUROPEAN COMMITTEE ON RADIATION RISK
COMITE EUROPEEN SUR LE RISQUE DE L'IRRADIATION
AVENUE DE LA FAUCONNERIE 73
B1170 BRUXELLES
BELGIUM
admin@euradcom.org

GUIDANCE NOTE NO. 2003/1.
CRITERIA FOR "CLEARANCE":
CONTROLLING THE RELEASE OF SOLID MATERIALS OF VERY LOW AVERAGE ACTIVITY FOR REUSE, RECYCLING AND DISPOSAL
June 2003

European Committee on Radiation Risk (ECRR)

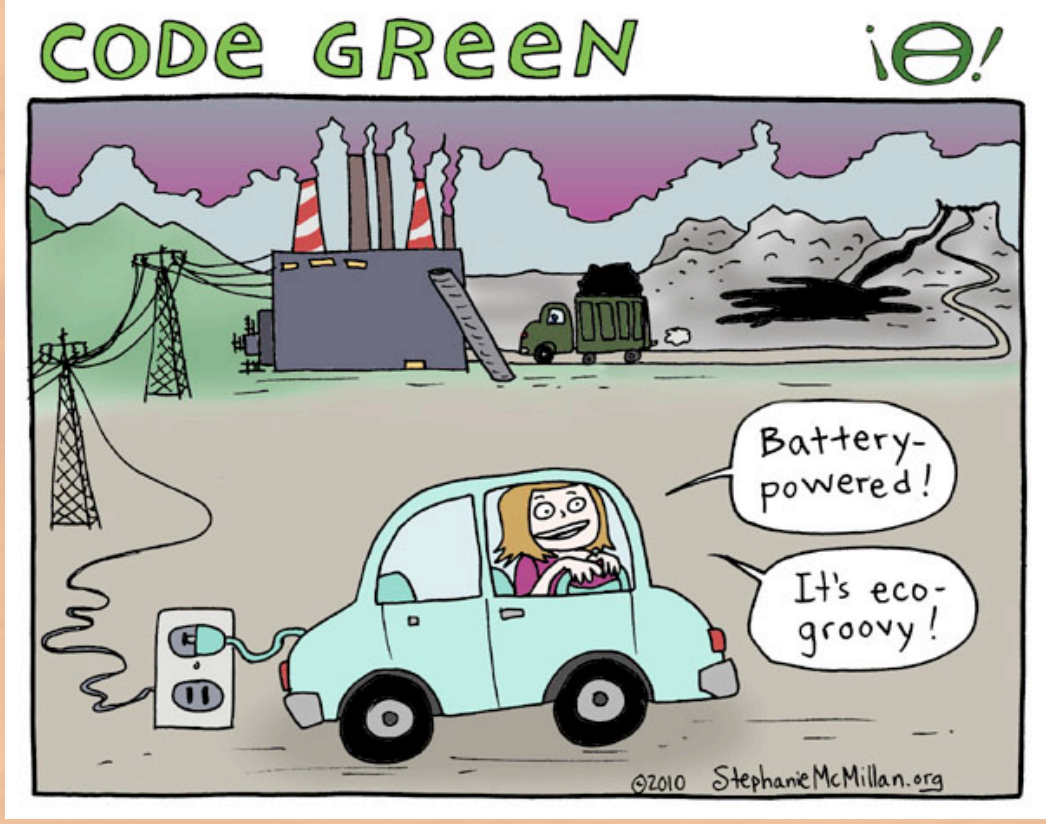
An **informal** committee formed in 1997 following a meeting by the European Green Party at the European Parliament to review the 96/29Euratom Directive. However –

Relatively often presented by some EU experts and local environmental organisations in Africa and Asia as the last and definitive word of European Community on the issue of radiation protection.

Result →

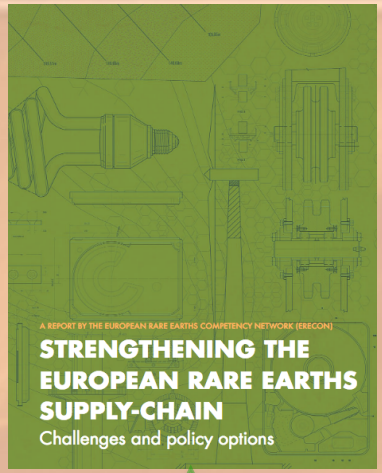
Another potential implication of the 2013 Directive

Outsourcing of 'NORM' industries out from the EU



An example

Each turbine requires ~0.5 tonnes of neodymium for the magnet BUT –



~**300-400 tonnes** of ore needs to be mined, crushed, leached and processed to get enough material for one magnet.
Generating **200-250 tonnes of radioactive waste** in the process.

A typical mobile phone would need about **3 kg** of radioactive ore for the magnet, speaker, screen…

Conclusion and questions for consideration

1. There are areas of high natural radiation background in Africa and Asia, where annual exposure of the public may reach 7-8 mSv/year.

But –

- How many African and Asian children will not have malaria or other badly needed vaccinations because the health budget would be re-directed to keep everyone under 1 mSv/year?

Conclusion and questions for consideration

2. Having a predominantly service economy, importing everything may not be as good as some people think…

As the former Australian Liberal Party Leader J. Hewson said in 2015:

With an economy that is 68 per cent services, the entire country is basically sitting around serving each other cups of coffee…

Thus –

What are the world-wide and, subsequently, local health and environmental implications of production of nice, clean and green products for the EU elsewhere, where the controls over radiation are either at a low level or may not exist at all... ?


Thank you for your attention!