



Optimisation in the management and disposal of **NORM wastes**

– experience from the EAN_{NORM} project

Klaus Flesch, IAF - Radioökologie GmbH, Dresden

Rainer Gellermann, HGN Hydrogeologie GmbH, Magdeburg

Hartmut Schulz, IAF - Radioökologie GmbH, Dresden

Eckhard Ettenhuber, Berlin

IAF - RADIOÖKOLOGIE GMBH

Labor für Radionuklidanalytik Radioökologische Gutachten Consulting

HGN

HYDROGEOLOGIE GmbH
Ingenieurgesellschaft für Wasser · Boden · Umwelt



Introduction



WORKSHOP

European
ALARA Network
for NORM

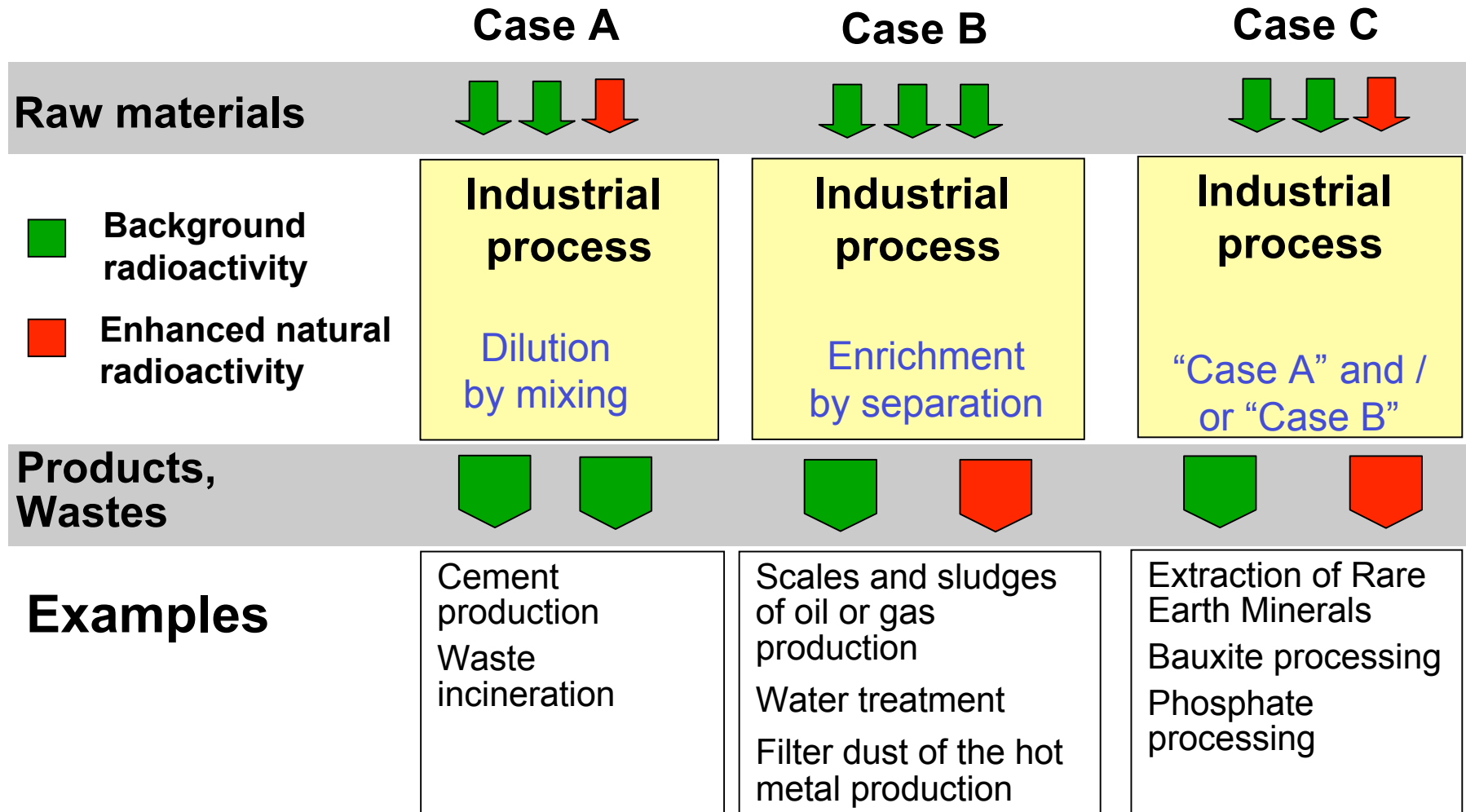
<http://www.ean-norm.net>

Nov. 20th - 22nd 2007, Dresden (Germany)

- NORM industries in Europe are confronted with Radiation Protection measures since about 10 years. A special RP culture for NORM is still in a developing stage.
- Under the sponsorship of the EC, IAF - HGN - RDS are active in developing an EAN NORM Network since 2007. The objectives of this network are
 - Promoting rational and coherent management of RP optimisation in non-nuclear (“NORM”) industries,
 - Assistance of the dissemination of good ALARA practices within all sectors of the European NORM industries.
- According to Art. 40 EC Directive 96/29, NORM regulations are referred to “*work activities which lead to the production of **residues** ... which contain naturally occurring radionuclides, causing a significant increase in the exposure of members of the public and, where appropriate, of workers*”
→ **RP of NORM is frequently connected with waste management.** (Disposal of “NORM-Wastes”)



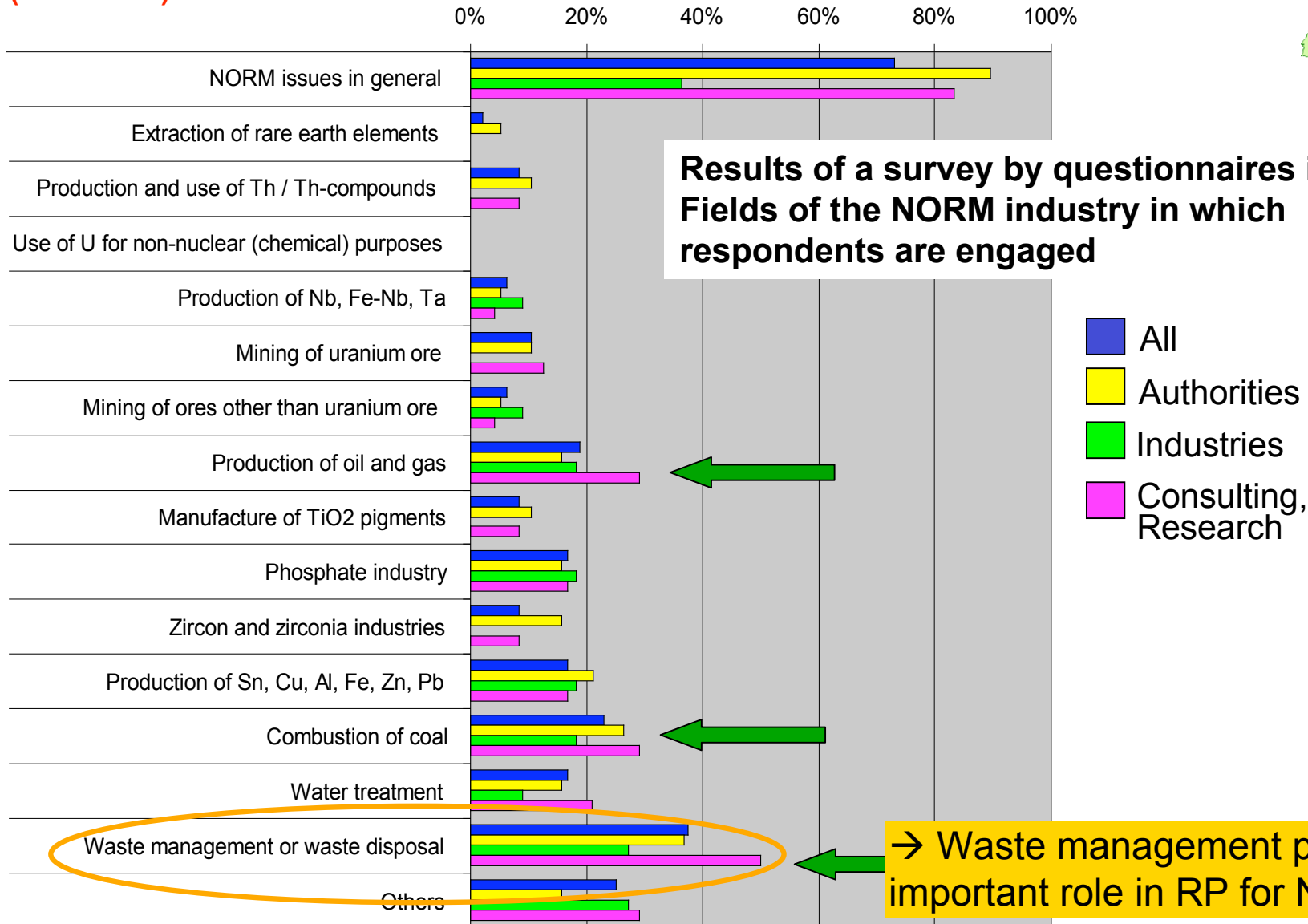
Formation of NORM wastes



European ALARA Network for Naturally Occurring Radioactive Materials - **EAN_{NORM}**



(Perceived) Relevance of the NORM industries





Classification of wastes

According to the European Waste Catalogue – and residues implicitly covered

	Specification	Kind of residue	Relevant radionuclides
01	Wastes resulting from exploration, mining, quarrying, physical and chemical treatment of minerals	Sludges	Uranium, Thorium
05	Wastes from petroleum refining, natural gas purification and pyrolytic treatment of coal	Scales, Sludges	Ra-226, Ra-228, Pb-210
10	Wastes from thermal processes	Filter dust, Slag	Pb-210
12	Wastes from mechanical surface treatment and coating of metals and other materials; non-ferrous hydro-metallurgy	Abrasives (corundum, zirconia)	Thorium, Uranium
19	Wastes from waste management facilities, off-site waste water treatment plants and the preparation of water intended for human consumption and water for industrial use	Scales, Sludges	Ra-226, Ra-228, Pb-210



Disposal of NORM wastes – Radiation Protection and ALARA

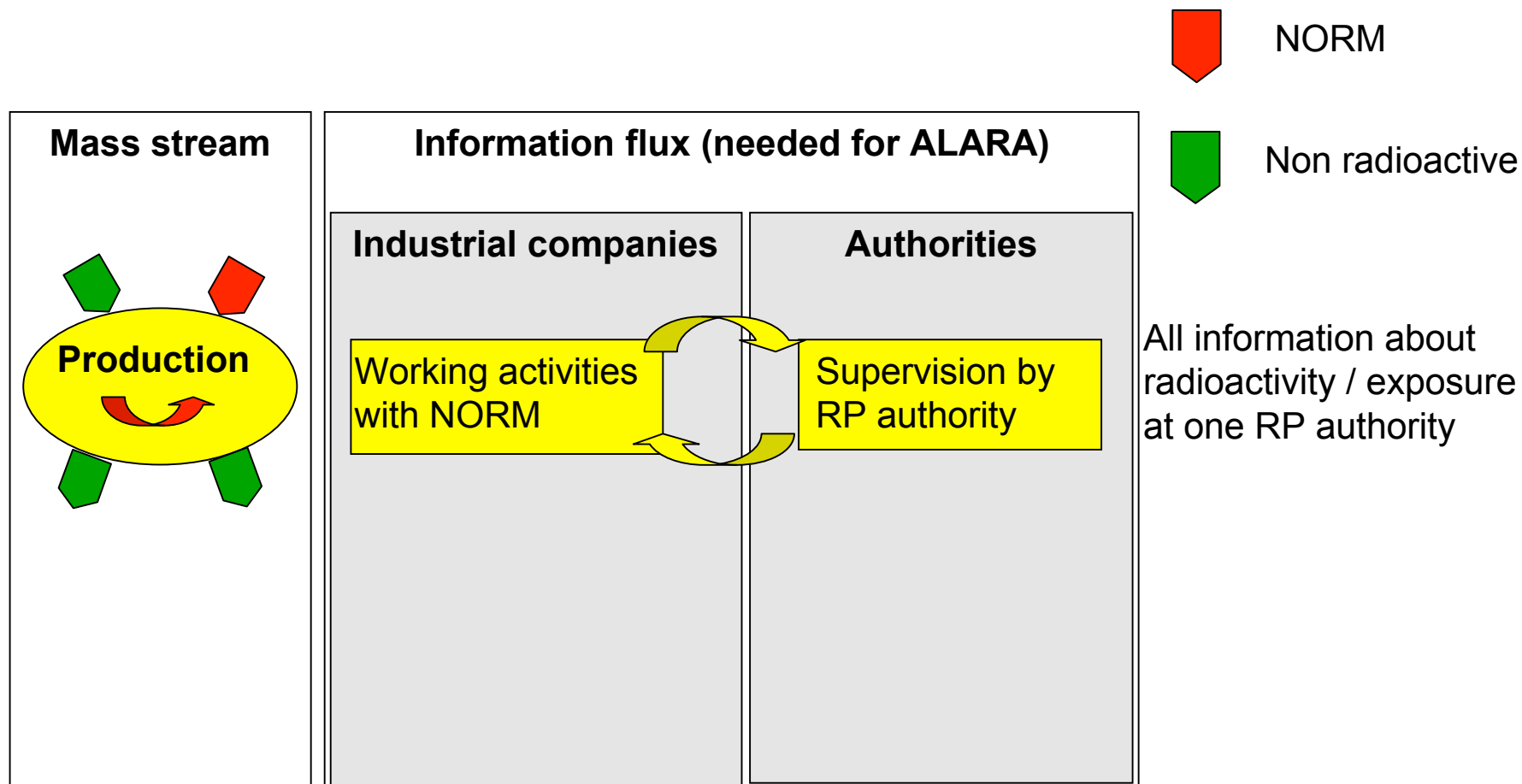
- NORM wastes are an integral and important part of the common waste streams.
- Disposal of NORM wastes at landfills or dumps requires release from control.
- According to EURATOM/96/29, the release is based on an indicative dose of **1 mSv** per year. The accumulation of several such sources might result in an exposure significantly above 1 mSv per year.
- Exposure estimations have to include the workers on landfills or other disposal facilities as persons of the public (not supervised regarding RP)
 - ALARA needs both
 - information on the wastes with enhanced radioactivity and
 - an appropriate RP practice
 - The limitation and optimisation of exposures in the sense of the ALARA principle requires **a well organised information flux** concerning radioactivity between all involved institutions.

Some aspects concerning information flux will be discussed based on 4 typical cases



Case 1: One production unit (“source”) – no disposal (“sink”)

 Working activities with NORM – no NORM waste.

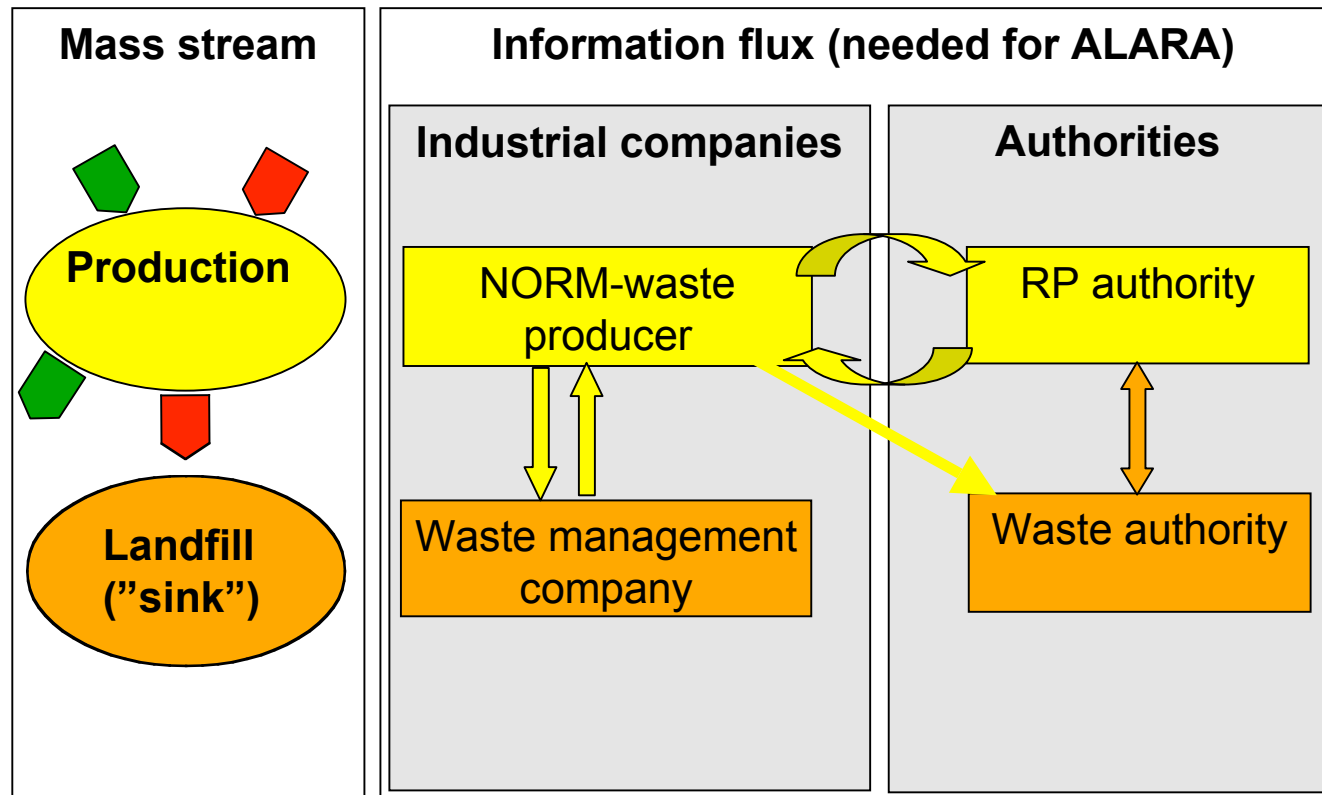




Case 2: One source – one sink



In difference to Case 1, in the production process (large amounts of) NORM wastes accrue, which has to be disposed on a mono-landfill or a dump.



All information about radioactivity / exposure at one RP authority



Example from the Netherlands Case 2: One source – one sink



Mono-landfill site for low-level waste from TiO₂-/pigment-industry in the Netherlands
Low-level waste (< 10 Bq/g, scales, Uranium and Thorium with daughters); about 25,000 tonnes per year are disposed at the site.

→ One control institution (COVRA)

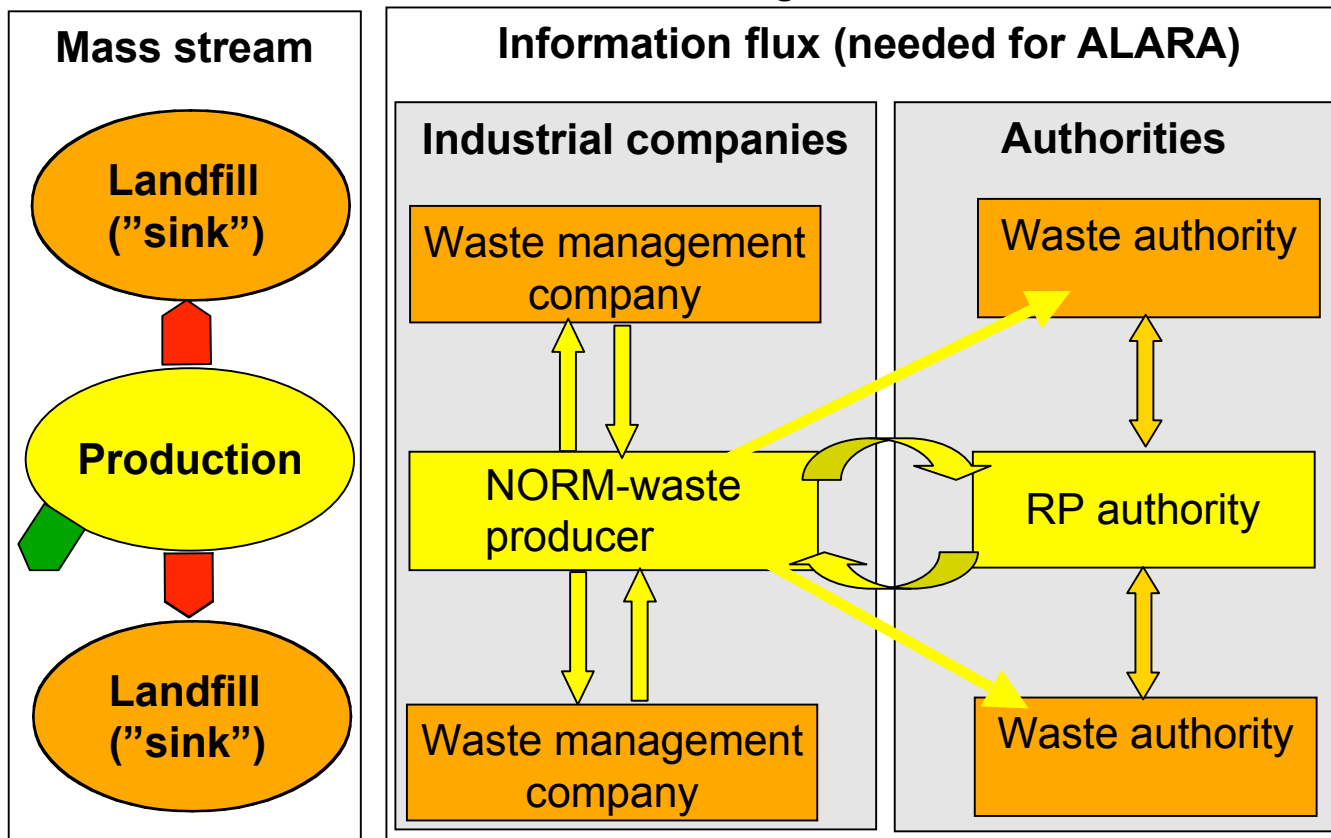
From: Welbergen J., Dose Control in the NORM industry in the Netherlands. – 1. Workshop European ALARA Network for NORM (Dresden, Nov. 2007)



Case 3: One source – several sinks

From one production unit NORM wastes are disposed

- deposit at landfill(s)
- re-use as a secondary raw material in other industrial processes
- re-use as additives into building materials



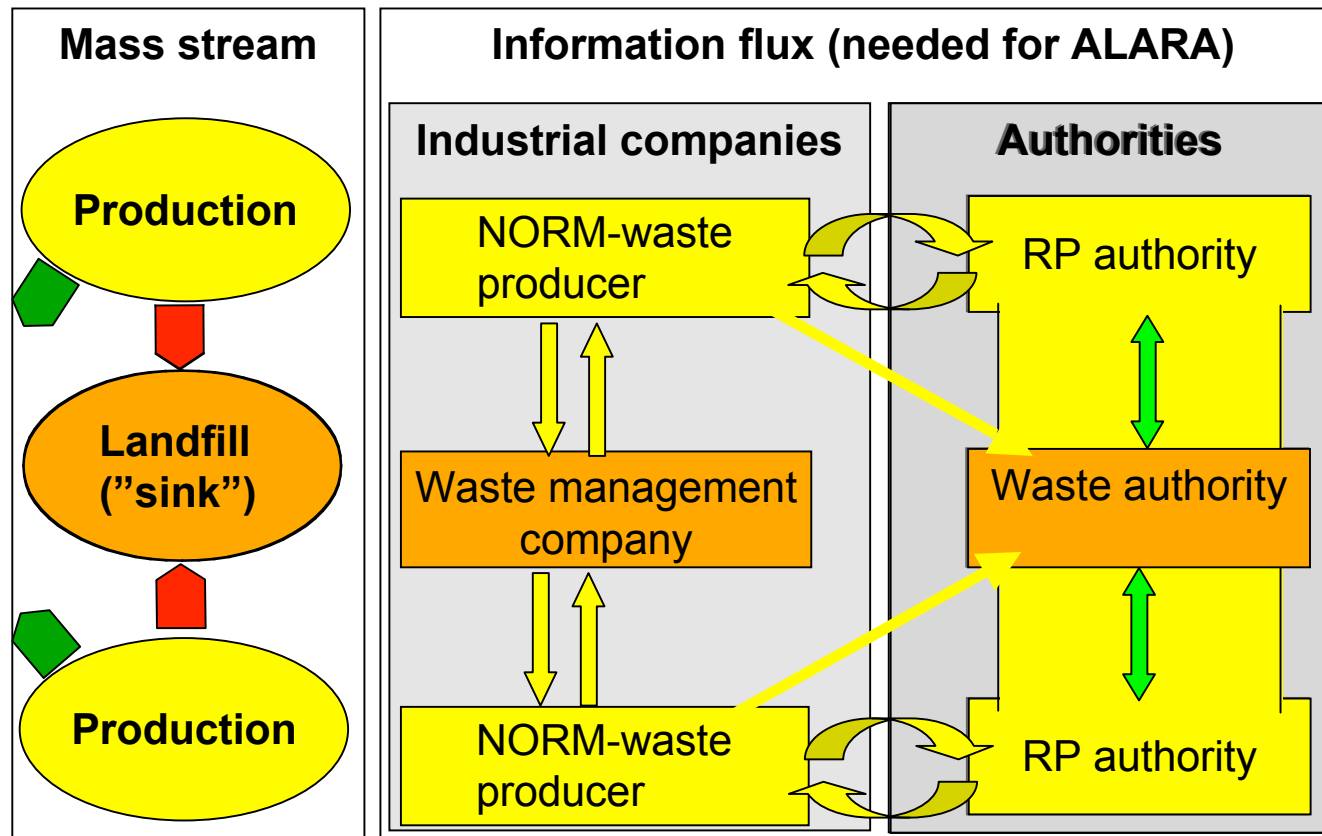
All information about radioactivity / exposure at RP one authority



Case 4

Many sources – one sink

Disposal of waste from several NORM industries at **one landfill** or in one underground waste deposit.



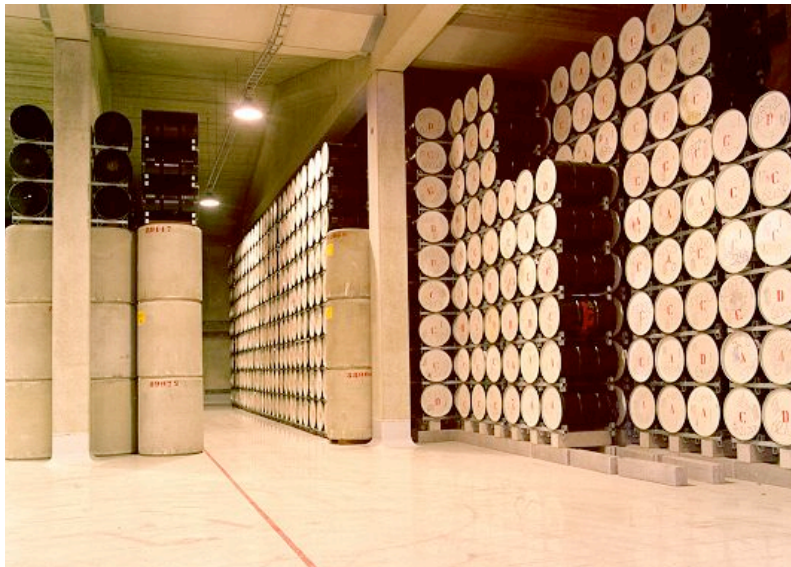
Information about radioactivity / exposure at several RP authorities

... or at a central authority / central register

European ALARA Network for Naturally Occurring Radioactive Materials - **EAN_{NORM}**



Example from the Netherlands Case 4: Many sources – one sink



Storage for solid waste from TiO₂-/
pigment-industry



Storage for the Phosphor industry waste

→ One storage and one control institution (COVRA)

*From: Welbergen J., Dose Control in the NORM industry in the Netherlands. –
1. Workshop European ALARA Network for NORM (Dresden, Nov. 2007)*

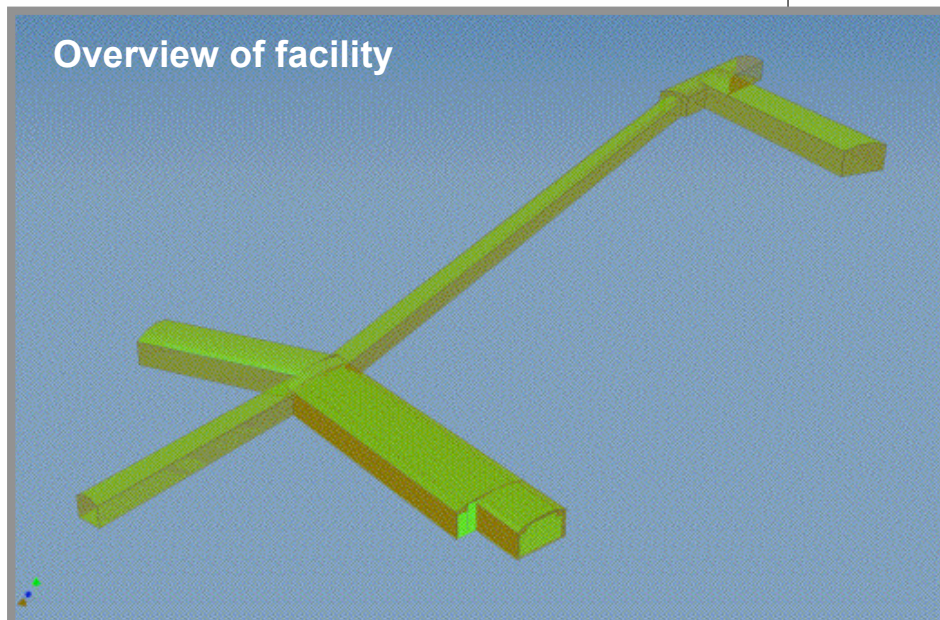
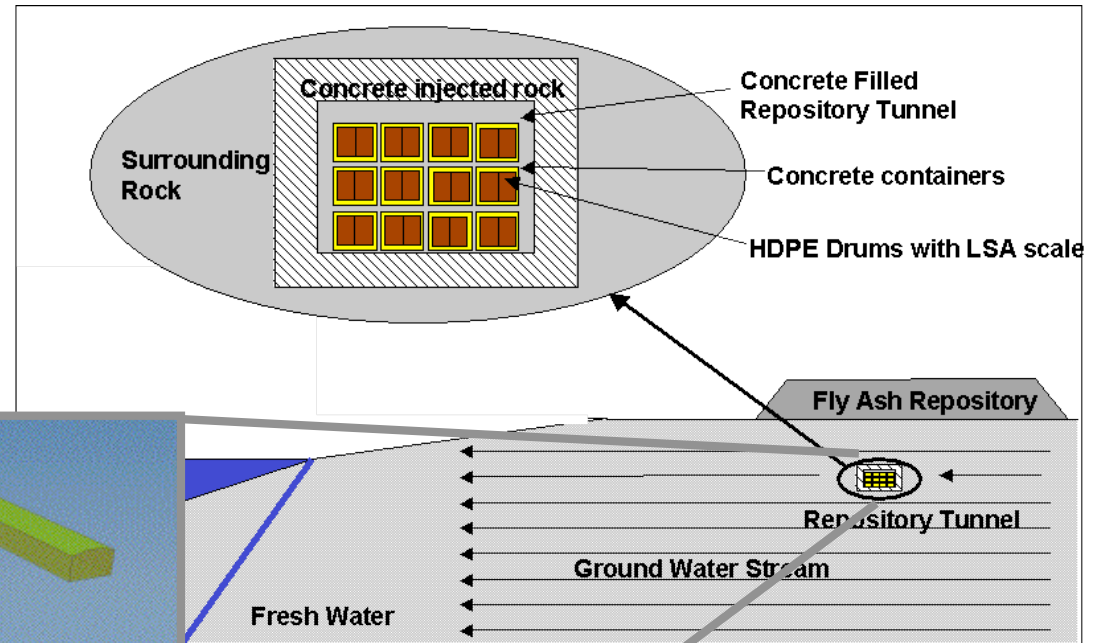
European ALARA Network for Naturally Occurring Radioactive Materials - **EAN_{NORM}**



Example from Norway

Case 4: Many sources – one sink

Oil industry → One disposal and one control institution (managed by NORSE DECOM)



From: Varskog P., Norway's disposal site for oil industry NORM. - 1. Workshop European ALARA Network for NORM (Dresden, Nov. 2007)



Example from Germany

Case 4: Many sources – one sink

Vacuothermic extraction of mercury from residues of the oil-/gas-industry by GMR Metallrecycling Leipzig. In 2006 about 8 t pure mercury from 60 t of sludges **from all (4) oil/gas companies in Germany** and partly NL).



Facility for extraction of raw-mercury by evaporation, condensation and purification (GMR Leipzig)

RP:

- Release of NORM wastes from oil/gas companies considers the handling at the oil/gas companies and the transport to GMR.
- Work at GMR is licensed and supervised by Saxonian RP authority.
- Release of wastes from GMR is based on dose level 1 mSv/yr by Saxon. RP author.
- Immobilisation of the residues by addition of a “geo-polymer” for reducing the wash-out of RN at a landfill.

From: Richter J., De-mercurisation and disposal of NORM residues from oil and gas industries. – 1. Workshop European ALARA Network for NORM (Dresden, Nov. 2007)



Summary

- Radiation protection control of NORM residues has to consider workplaces in the industries and also workplaces at landfills or in other disposal facilities.
- If NORM waste from a single “NORM facility” (“source”) is released from control on the basis of an indicative dose of 1 mSv per year, the accumulation of several such “sources” might result in an exposure significantly above 1 mSv per year.
- Therefore, RP and especially optimisation needs information about the radioactivity at all involved responsible institutions.
- The information exchange between NORM industries (“source”) - authorities and waste disposal companies (“sink”) is a crucial element of RP.
- Regarding RP of workers in the waste disposal facilities, the most difficult situation arises, if various NORM wastes are disposed from many “sources” into one “sink”.
- The EAN_{NORM} could be a useful support in this field by exchange of experience based on an international platform.