NORM in Norwegian Mineral Industry

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Change in legislation - two kinds of radioactive waste

- radioactive waste
- radioactive waste subject to a disposal requirement

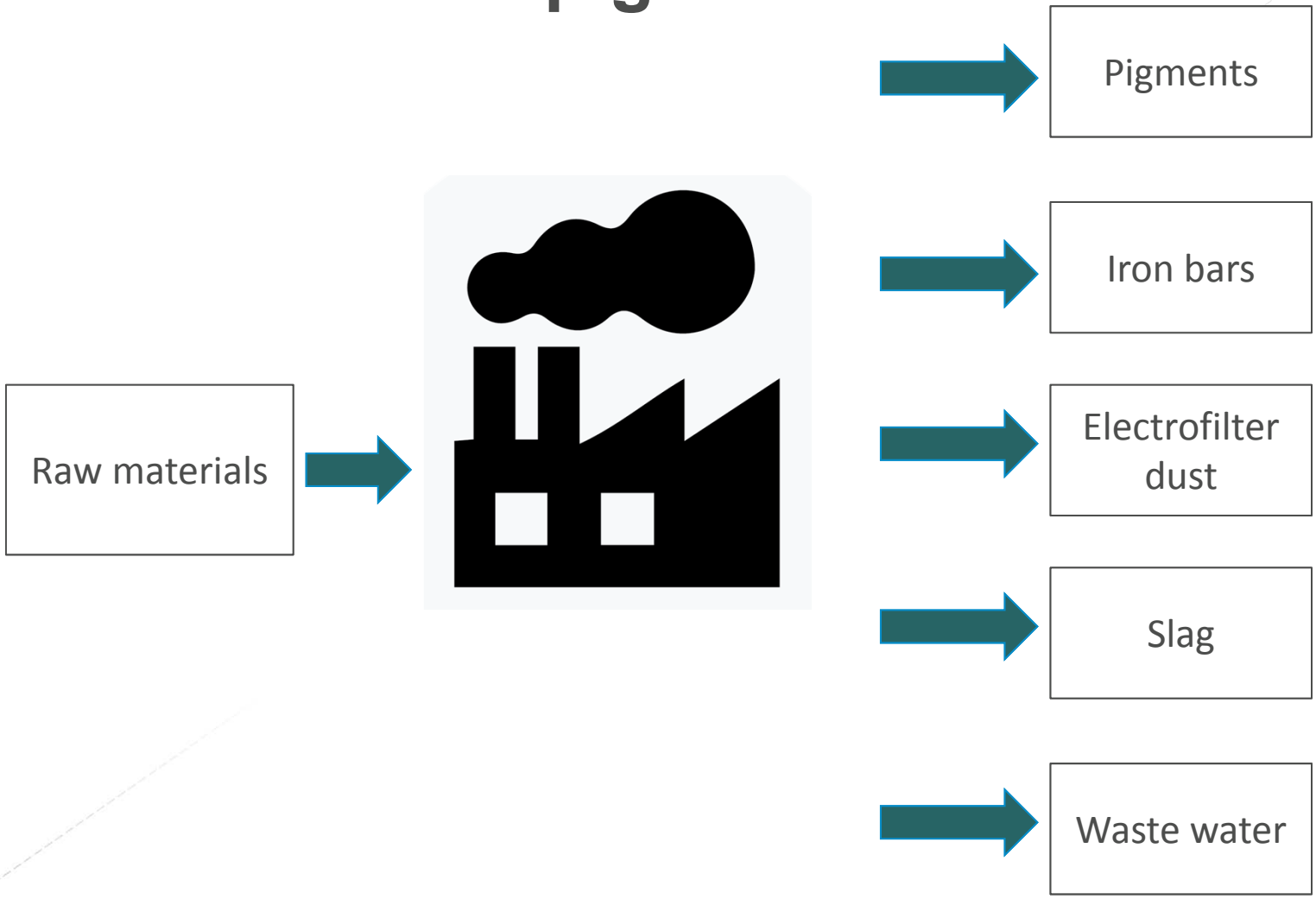
New definition for who needs a permit for radioactive pollution

- "release of radioactive substances with a total activity (Bq) per year, or specific activity (Bq/g) that is greater than or equal to the values in this annex always requires a permit"

$$\sum_k \frac{C_k}{C_{e,k}} \geq 1 \text{ or } \sum_k \frac{A_k}{A_{e,k}} \geq 1$$

	Bq/year total	Bq/g
U_{nat}	100	0,1
U-238	1000	1
U-234	1000	1
Th-230	1000	0,1
Ra-226	1000	1
Pb-210	1000	1
Po-210	1000	1
$Th\text{-}232_{nat}$	100	0,1
Ra-228	10000	1
Th-228	1000	0,1

1. Production of pigments



Discharges to water [MBq]

	Total
^{210}Po	*3100 ± 900*
^{210}Pb	55 ± 10
^{226}Ra	-
^{230}Th	*1,3* ± 2,6
^{234}U	-
^{238}U	-
^{228}Th	-
^{228}Ra	*
^{232}Th	-
^{235}U	-

Discharges to air [MBq]

	Total
^{210}Po	12 ± 72 *
^{210}Pb	236 ± 15
^{226}Ra	0,75 ± 0,18
^{230}Th	0,24 ± 0,08
^{234}U	0,6 ± 0,3
^{238}U	0,5 ± 0,3
^{228}Th	4,1 ± 1,3
^{228}Ra	1,00 ± 0,19
^{232}Th	1,2 ± 0,6
^{235}U	0,004 ± 0,004

Doses to the public – 1,1 µSv

- IAEA Generic models for use in assessing the impact of discharges of radioactive substances to the environment
  - Public use of contaminated beaches
  - Consumption of fish and other seafood
  - Drinking of water

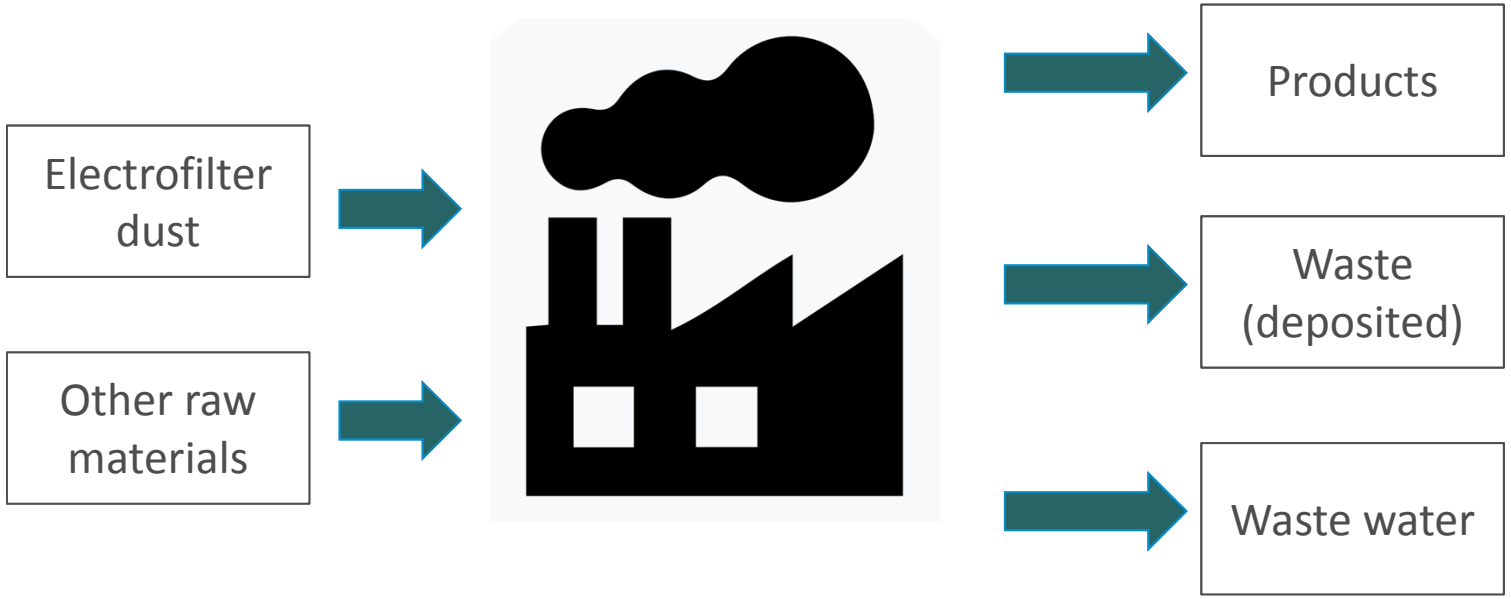
- Model does not take in to account the vertical distribution of the contaminant
  - Salt water / fresh water layers
  - Other meteorological aspects

Environmental monitoring

- Water, sediments, fish, blue mussels

- Enhanced levels of Pb-210 in blue mussels

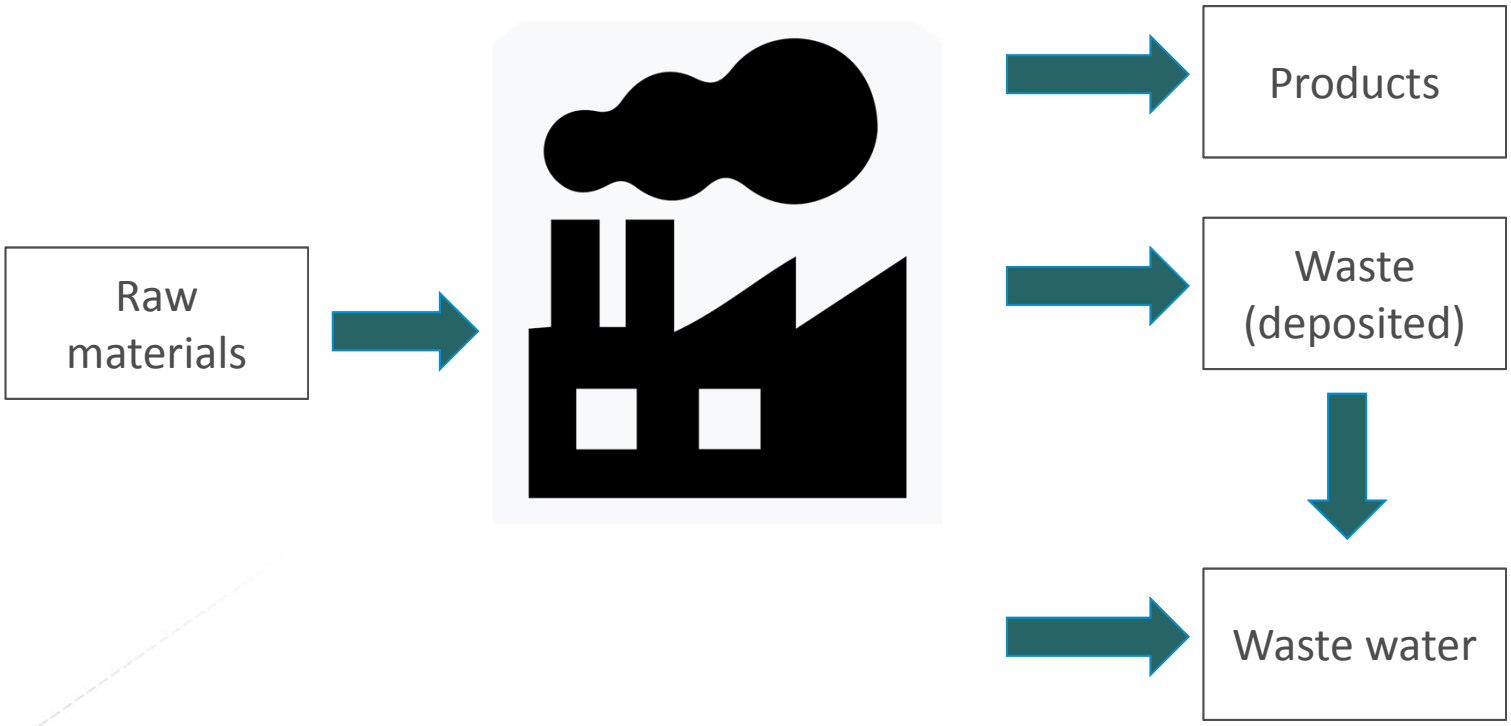
2. Zink production



Can we determine if there is a discharge in legal terms?

- Enormous waste water volumes (~million m^3)
- Need to establish if there is an additional 1 µBq/liter above natural background
- Calculations based on sampling of all raw materials and solid waste?

3. Production of silica based products



Discharges to water [MBq]

	Total
^{210}Po	2 ± 4
^{210}Pb	1030 ± 40
^{226}Ra	3500 ± 400
^{230}Th	760 ± 140
^{234}U	630 ± 110
^{238}U	680 ± 120
^{228}Th	1560 ± 260
^{228}Ra	0,24 ± 0,05
^{232}Th	680 ± 130
^{235}U	31 ± 10

Discharges to air [MBq]

	Total
^{210}Po	6 ± 27
^{210}Pb	35 ± 14
^{226}Ra	5,4 ± 2,2
^{230}Th	0,7 ± 0,4
^{234}U	0,08 ± 0,06
^{238}U	0,08 ± 0,06
^{228}Th	5,6 ± 1,5
^{228}Ra	1,5 ± 0,8
^{232}Th	-
^{235}U	0,005 ± 0,004

Challenges for the industry

- Knowledge – understanding regulations
- PR – Communication challenge
  - Applying for a permit attracts attention
- Economical
  - Cost of mapping, environmental monitoring, dose calculations, consultancy for application etc
  - Waste handling
- Available deposits for waste?

AF Decom hoggeri og Raunes Fiskefarm ligger vegg-i-vegg med i Nedre Vats. **FOTO: Pål Christensen**

- Her slippes det ut tonnesvis med radioaktivt avfall fra oljeskrot

Nye målinger viser at det kan ha skjedd utslipp av flere tonn med radioaktivt materiale fra opphogging av gamle oljeinstallasjoner i Vats.

Regjeringen vil lagre radioaktivt avfall i Oslofjorden

Presser NOAH til å ta imot - mot NOAHs vilje

DEPONI: Her på Langøya ønsker regjeringen å lagre radioaktivt avfall fra en nedlagt gruve i Telemark - mot eierens vilje.
Foto: ALF ØYSTEIN STØTVIG, VG

Future work

- Estimation of dose to workers

Thank you for your attention!

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