Sampling bulk NORM minerals and preparing for Analysis

Jeroen Welbergen

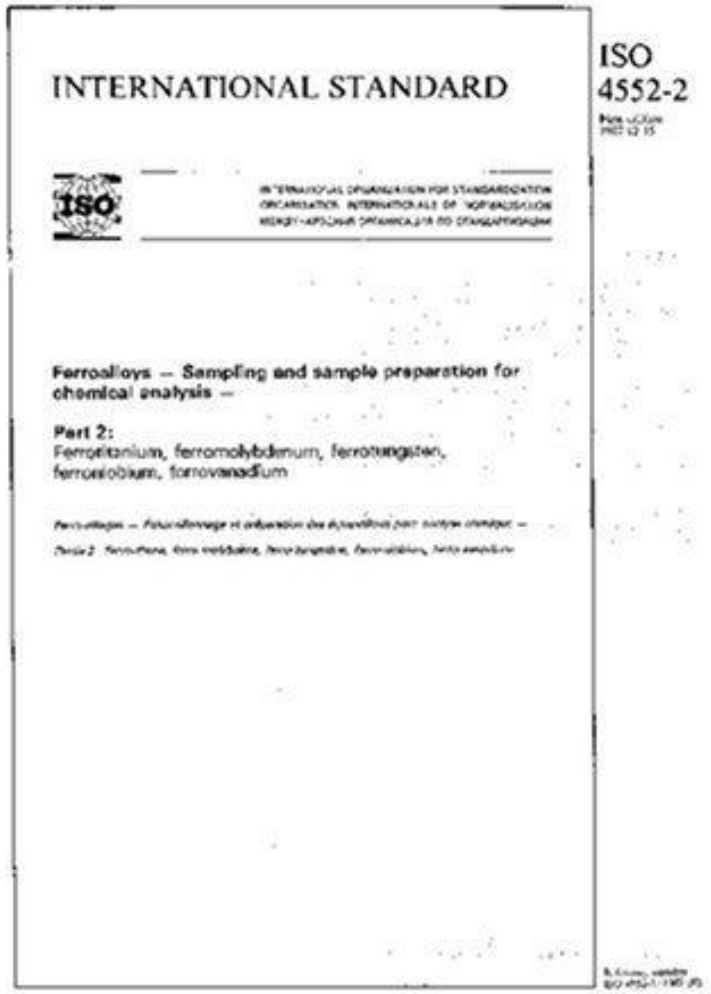
COVRA NV

ISO: sampling and preparation for analysis of Ferroalloys

INTERNATIONAL STANDARD

ISO 3713

Ferroalloys — Sampling and preparation of samples — General rules



INTERNATIONAL STANDARD

ISO 4552-2

Ferroalloys — Sampling and sample preparation for chemical analysis —

Part 2:
Ferrotitanium, ferromolybdenum, ferrotungsten, ferroniobium, ferrovanadium

ISO 3713

- The methods given are applicable to increment sampling of consignments supplied both in bulk and in packed form during loading or unloading, and to sampling of consignments in stationary stockpiles. Specifies the methods of both manual and mechanical sampling. Should be read in conjunction with the relevant International Standards for individual types of ferroalloys.

ISO 4552

- ISO 4552-1 specifies the methods of sampling, sample preparation and sieve analysis for the determination of the size distribution in a consignment or a lot af all types of ferroalloys
- ISO 4552-2 specifies the methods for sampling and sample preparation for the determination of the chemical composition of a consignment of ferroalloys

Overall precision of the determination of the chemical composition of a consigment

- Method of increment sampling
  - 0,5 tonnes: 5
  - 40 tonnes: 28
- Gross sampling, sample division and crushing
  - Oxider powder: sampling spear
  - Oxide briquettes: scoop
  - in accordance with ISO 3713
- Precision of sample preparation
  - 95 % confidence level with the overall precision (± 1 %) at different mass (0,5–40 tonnes) at different top size <10 en >50 m
  - In accordance with ISO 4552

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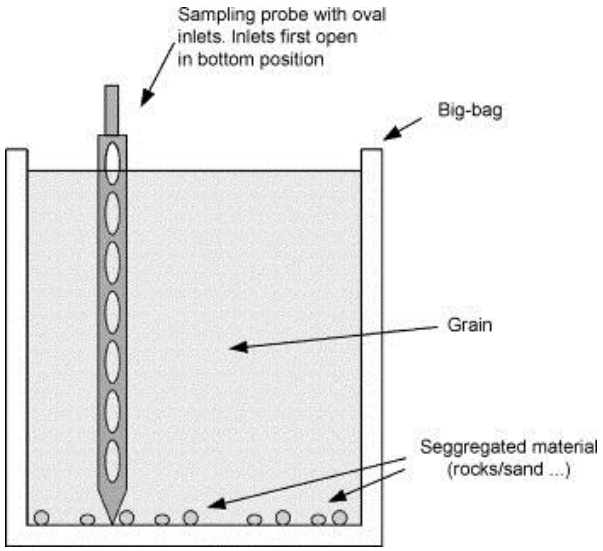
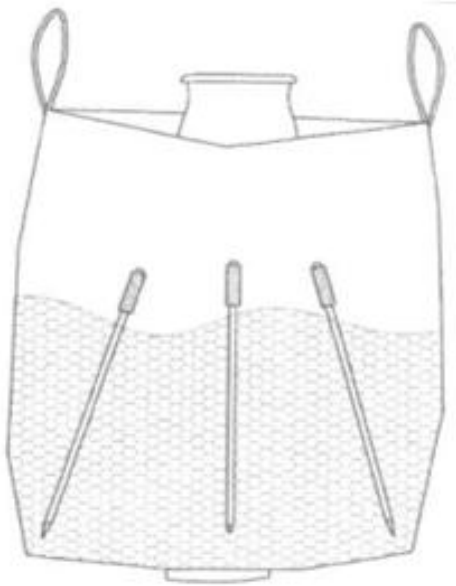
Sampling (coring) by a thief or spear





By a scoop

Sample division

Consigment, 5 T

↓

Gross sample, 55 kg

↓

Crushing to -10 mm

↓

Division with a riffle divider (3 times)

Sample division

Divided sample, 7 kg

↓

Crushing to -2.8 mm

↓

Division with a riffle divider (3 X)

↓

Divided sample 0.8 kg

Sample division

Grinding – 1.0 mm

↓

Division

↓

Divided sample 300 g

↓

Pulverizing to 160 µm

↓

Test sample, 50 g each

From gross till fine sample

Gross

Fine

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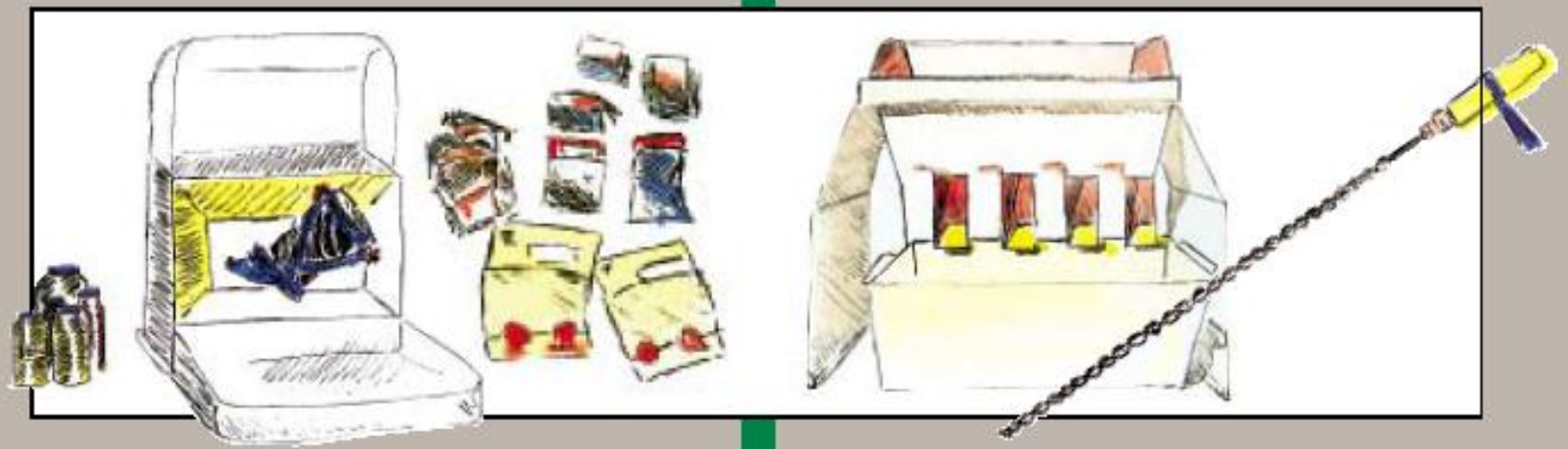
Procedure for the Weighing and Sampling of

MOLYBDENITE CONCENTRATES



Guidelines from the
INTERNATIONAL MOLYBDENUM ASSOCIATION

Published by the International Molybdenum Association (IMOA)
Unit 7 Hackford Walk, 119 - 123 Hackford Road, London SW9 0QT, England
Tel: + 44 171 582 2777 Fax: + 44 171 582 0556
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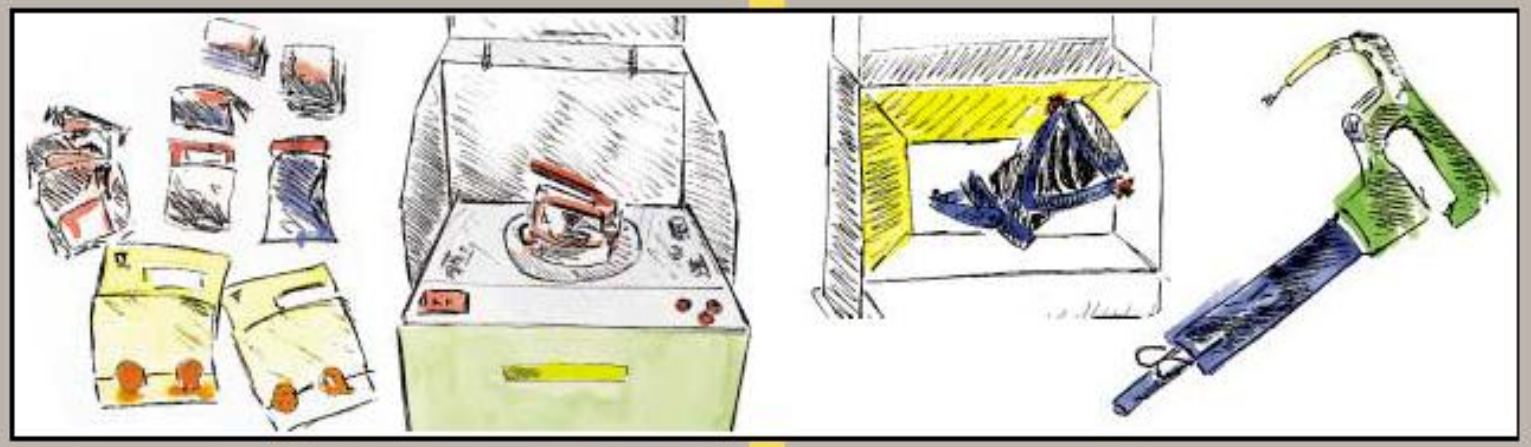
Procedure for the Weighing and Sampling of

TECHNICAL GRADE MOLYBDENUM OXIDE



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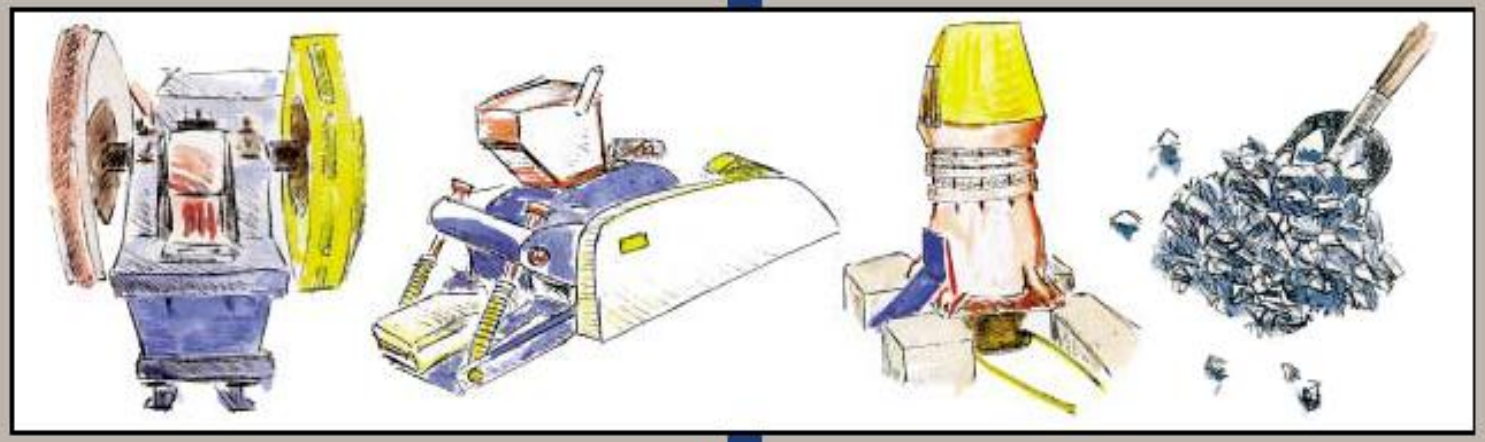
Procedure for the Weighing and Sampling of

FERROMOLYBDENUM



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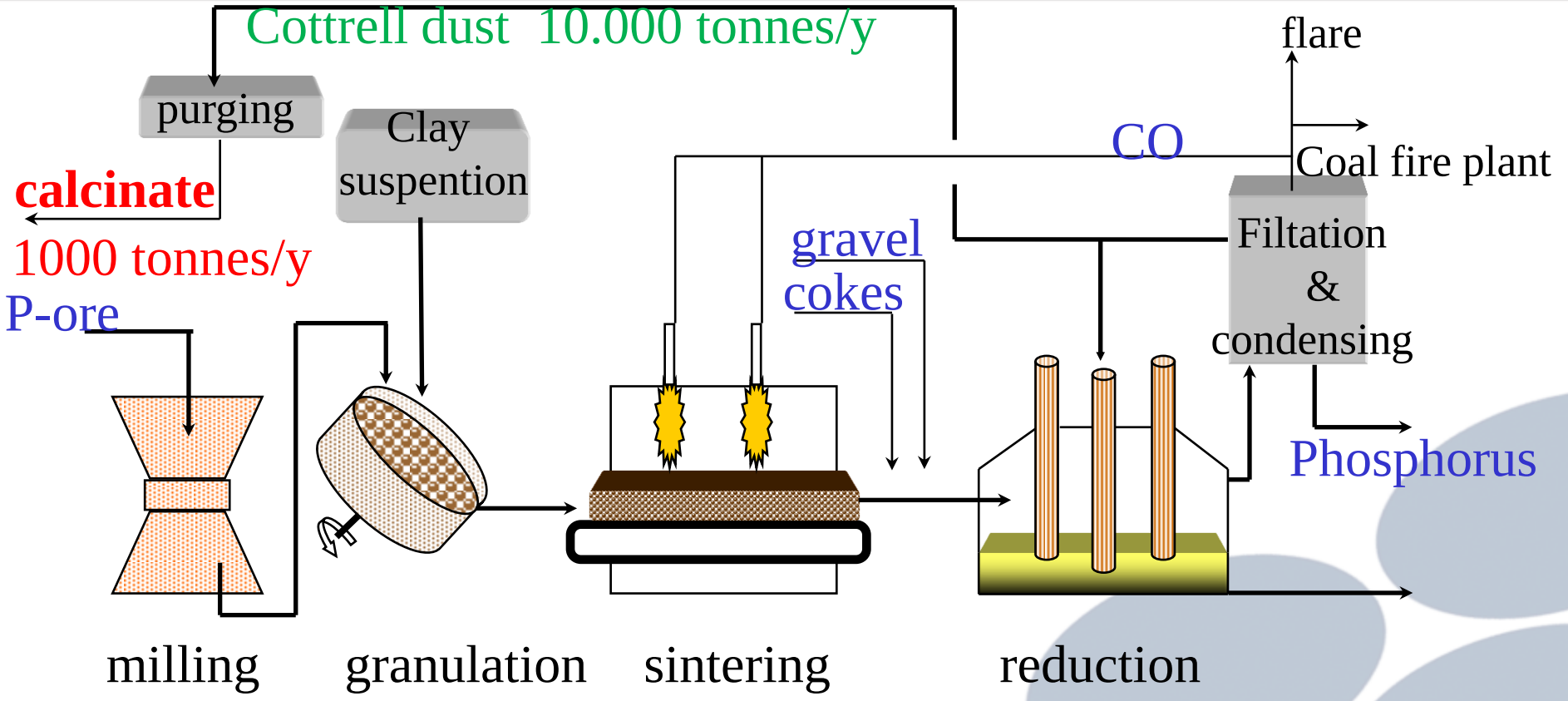
ALARA?

Thermal Phosphorus Plant (TTP)

Process



Phosphate ore + gravel + cokes => slag + Carbon monoxide+ Phosphor

$$2Ca_3(PO_4)_2 + 6SiO_2 + 10C \Rightarrow 6CaSiO_3 + 10CO + P_4$$

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NORM waste from TPP

- Cottrell dust is being recycled (4-5 x)
- Concentrated Cottrell dust is purged
- Calcined at 400 ºC
- ± 1000 tonnes per year
- Po-210, Bi-210 and Pb-210
- ± 500 Bq/g (each)

Filling a 20 ft container with 30 t

Sampling of Calcinate

Dosage apparatus

Sampling (20 ml/140 l)

Calcinate

Calcinate picked up by COVRA


HEEREMA

Storing containers with Calcinate

Sample preparation

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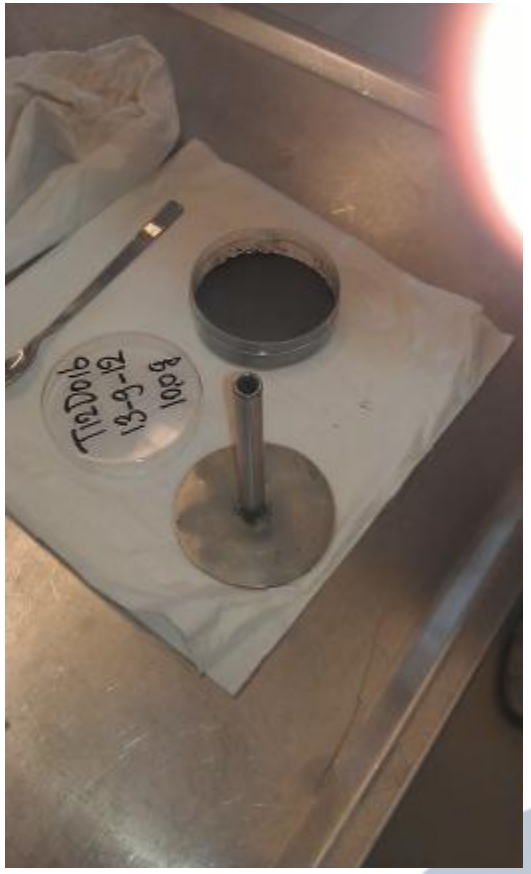
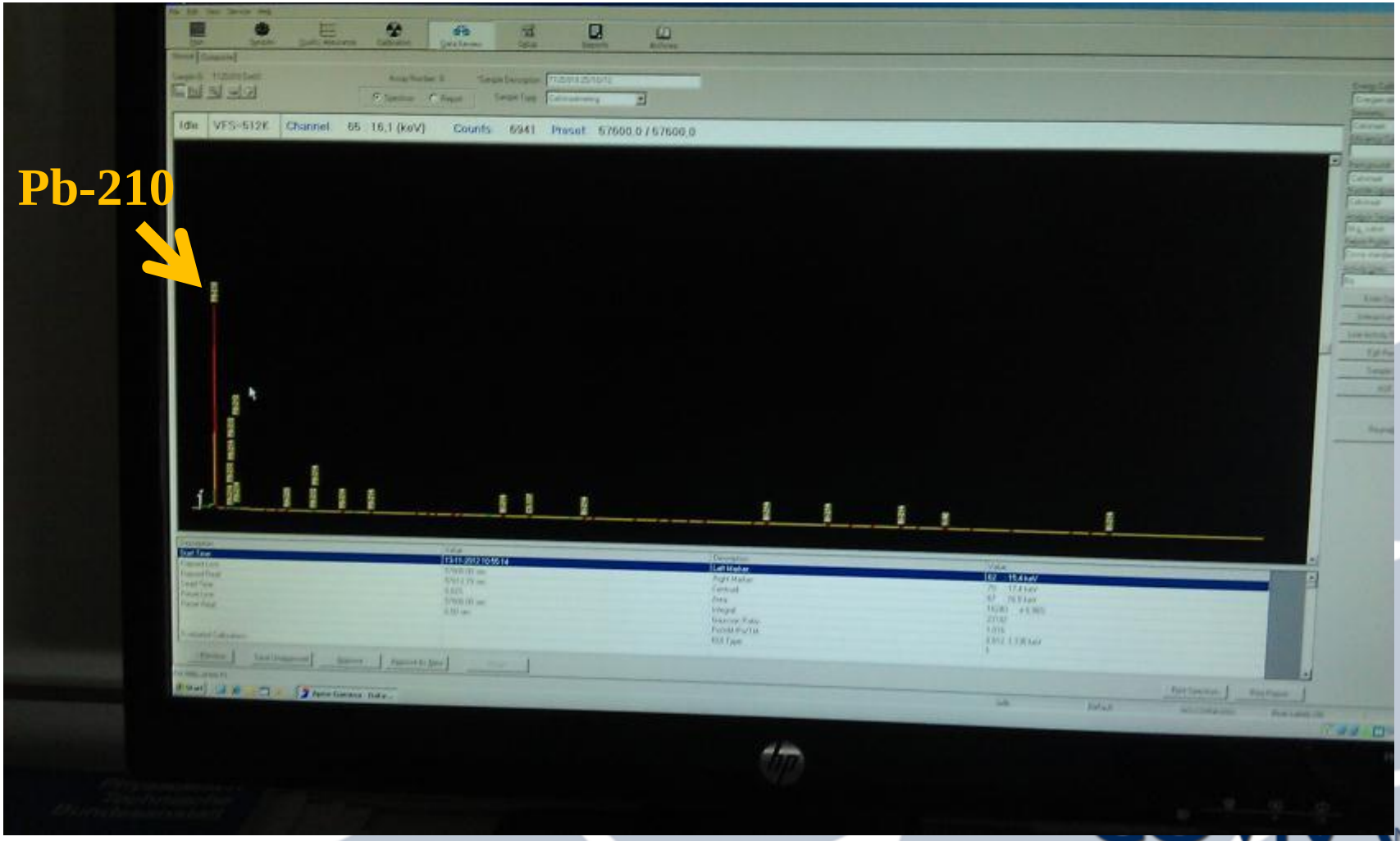
Gamma spectrometry



Gamma spectrum of calcinate



Results radioactivity in Calcinate

- 2011: 981 Tonnes
- Pb-210 : 150 GBq
- T½ Pb-210 = 22,3 y
- EL Pb-210 = 100 Bq/g
- EL Ra-226 = 1 Bq/g
- Free release after 100 - 130 years of storage at COVRA ?

Pb210 [Bq/g]	Ra-226 [Bq/g]
179	0,42
76	0,52
98	0,32
98	0,42
117	0,37
103	0,46
123	0,52
90	0,54
103	0,55
157	0,48
125	0,45
129	0,63
135	0,40
124	0,51
268	0,48
209	0,57
183	0,68

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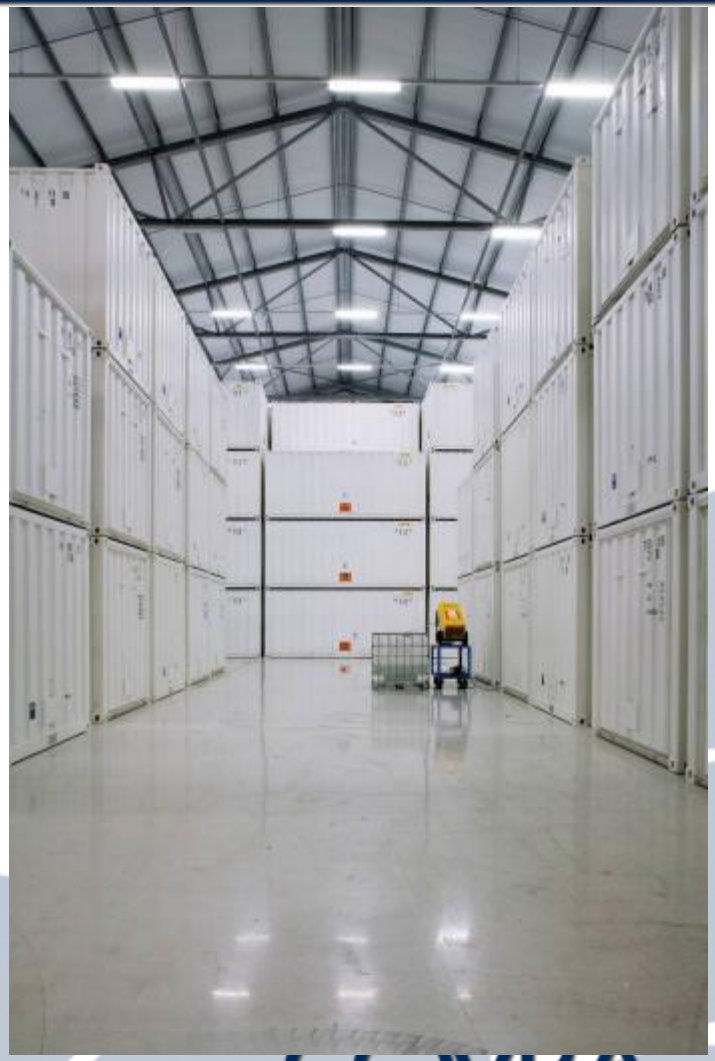
Free release

- **TABLE A Part 2: naturally occurring radionuclides**
- Values [illegible] for natural [illegible] solid materials
- **secular equ[illegible]eir progeny:**
- Natural r[illegible]U-238 series 1 Bq [illegible]
- Natural [illegible]clides fro[illegible]-232 series 1 Bq g-1
- K-40 10 Bq g-1

- **TABLE B: Total activity values for exemption and exemption values for the activity concentration in moderate am[illegible]nts [illegible]f any type of material**
  - Pb-210: [illegible]q and 1 × 10 Bq/g
- **Building material:**
  - ACI = C_{Ra226}/300 Bq/kg + C_{Th232}/200 Bq/kg+ C_{K40}/3000 Bq/kg
  - ACI = 0,34/300 + 0/200 + 3,4/3000 = << 1
  - **But what about Pb-210??**

Decay Storage

- For NORM waste
- In 20ft containers
- Decay of Calcinate
- For disposal in Landffill
- Or for reusing ?



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Landfill near Rotterdam

As depleted sinters in road construction

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.....and in dykes ?

Danke Schön