# Site visit EMRAS II working group & OVAM - *5/10/2011*

# AGENDA

| | |
|---|---|
| 10h30 – 12h15 | : Introduction to Umicore |
| | History Radium production in Olen |
| | Summary radiological data – overview Ra-legacy sites |
| 12h15 – 13h | : Lunch |
| 13h – 14h | : Site Visit |
| 14h – 15h | : Further exchange & discussions |
| 15h | : end of visit |

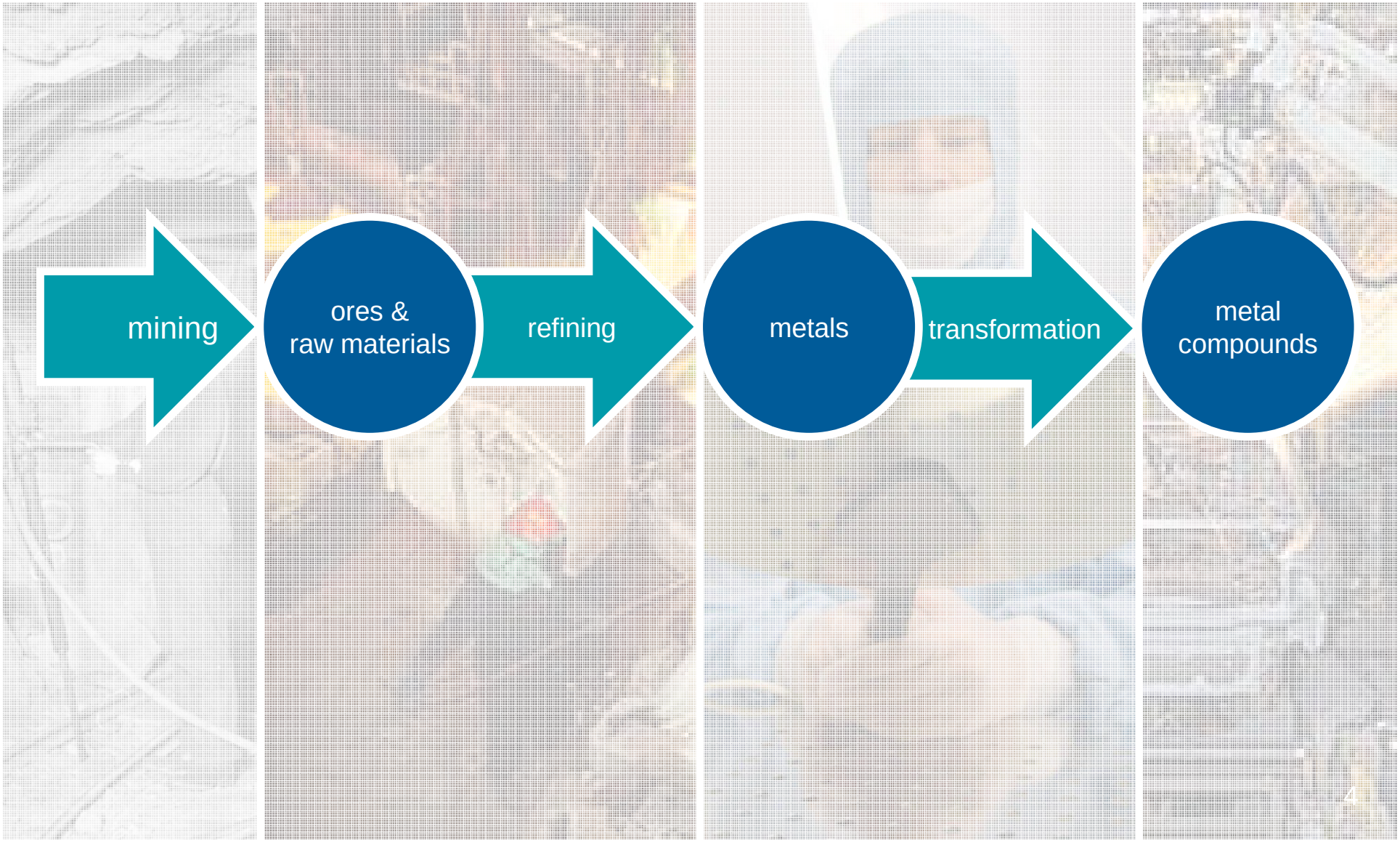
# Overview

Introduction to Umicore

Umicore in Olen / Belgium

History of Radium production in Olen

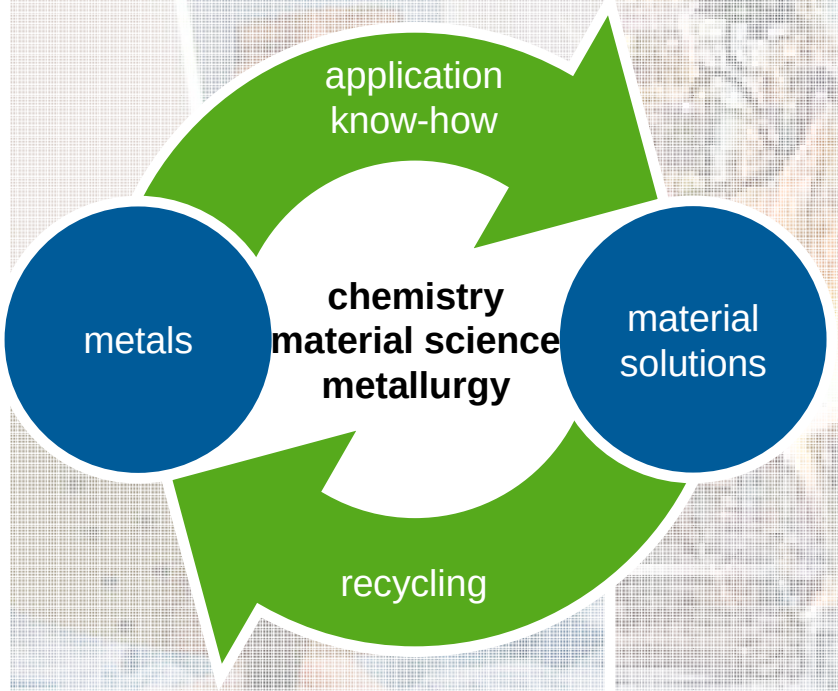
# Umicore in the past - a bit of history …



# Umicore today- a materials technology group

## “Less is more”

Metal related materials can be efficiently and infinitely recycled, which makes them the basis for sustainable products and services



# Today, our company is…


- … one of the world's biggest producer of automotive catalysts for passenger cars
- ... is the world's largest recycler of precious metals from old mobile phones, laptops, electronic scrap or spent catalyst materials
- … a world leader in the production of key materials for rechargeable batteries used in laptops and mobile phones
- Umicore's germanium substrates for high-efficiency solar cells are used in the bulk of the satellites launched today

# Umicore today: global footprint

## Umicore

| | 1999 | 2010 |
|---|---|---|
| **Revenues** | 0.9 billion € | 2 billion € |
| **Number of sites** | 32 | 85 |
| **Workforce** | 8,065 | 14.400 |

# Focus on clean technologies

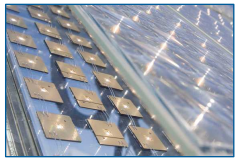
# Umicore's objective is to grow in "clean technology" applications

**Elektrification carpark** → Materials for rechargebale batteries for electric cars

**Scarcity of raw materials** → Focus on recycling

**Stringent emission limit values** → Catalytic convertor development for new sectors

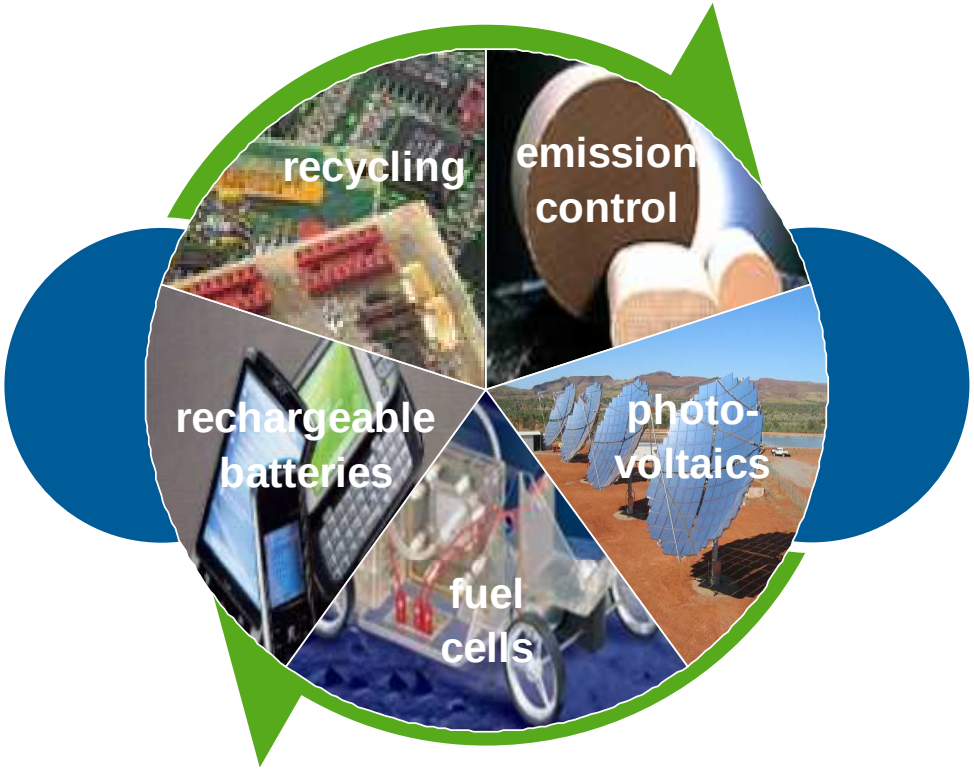
**Renewable Energy** → Solar Energy



Vision 2015

materials for a better life

# 80% of R&D expenditure in clean tech domain




innovative technologies specifically designed to optimise
the use of natural resources and to reduce environmental impact

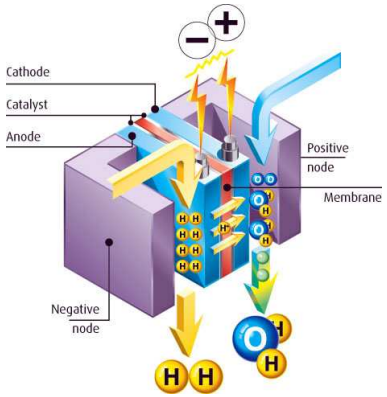


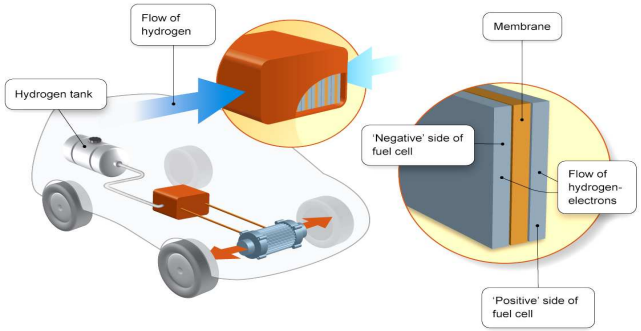
materials for a better life

# Clean technologies & cars

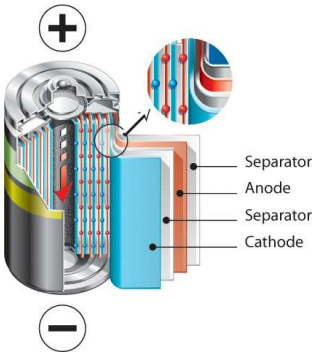
Energy Solutions

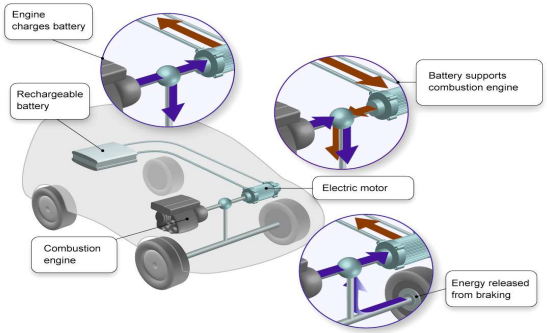
## Fuel Cells



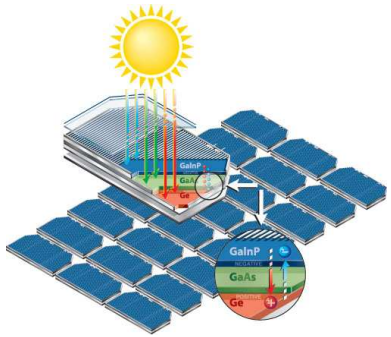




## Hybrid cars: batteries

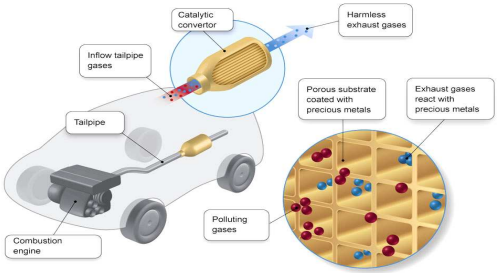



## Solar Energy

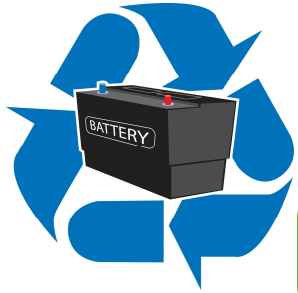



## Catalysts to reduce emissions




Environmental solutions

## Recycling of batteries




Recycling solutions

# Umicore in Belgium

*(31-12-2010)*

**Hoboken** 1399

**Olen** 1022

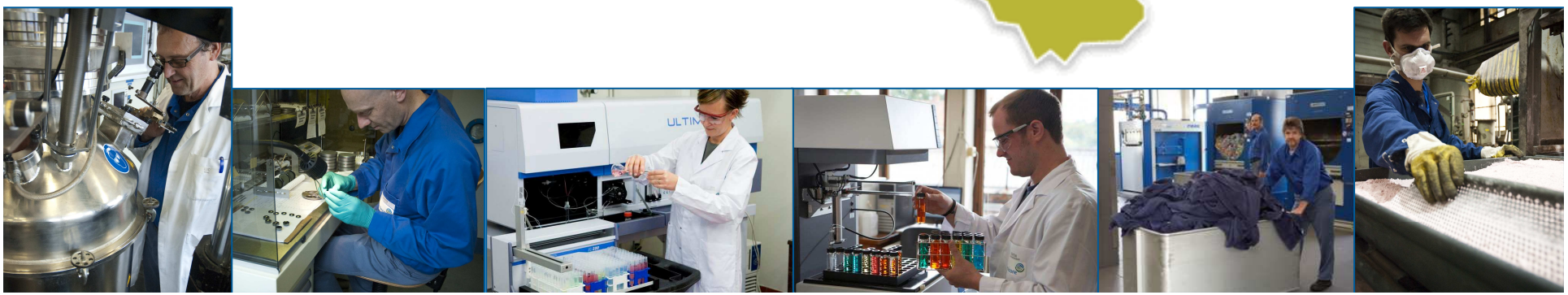
**Overpelt** 56

**Brugge** 73

**Heusden-Zolder** 33

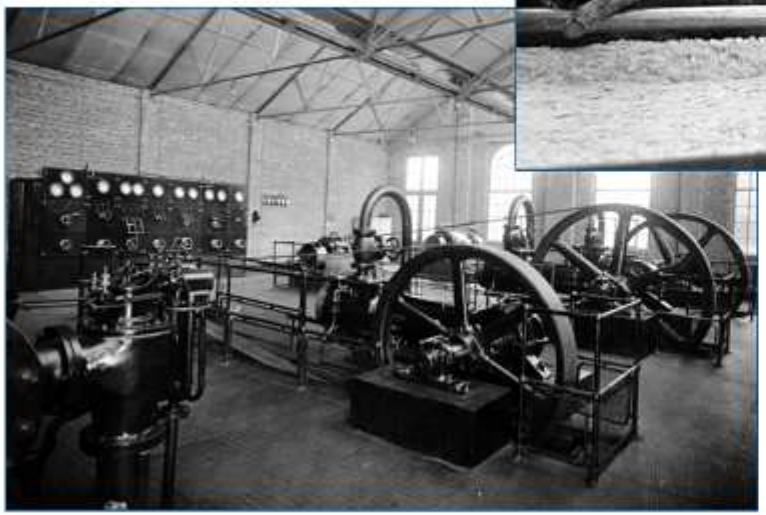
**Angleur** 114

**Brussel -** 212
**& Vilvoorde -** 39

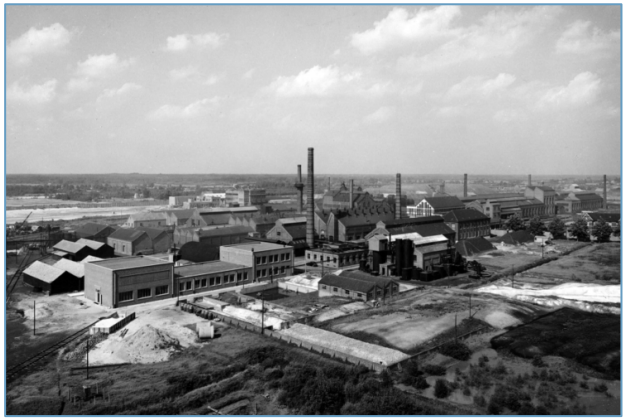
# Umicore Olen

# 2008: 100 years Umicore Olen



# Umicore Olen:
## >100 years production of non-ferrous metals

### Early Days ...



- Environmental impact of materials handled was often not known at that time

Historical contamination of Olen site

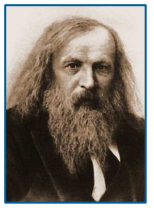
### Today

- Compliance with strict legal limits
- Extra: Corporate sustainable objectives

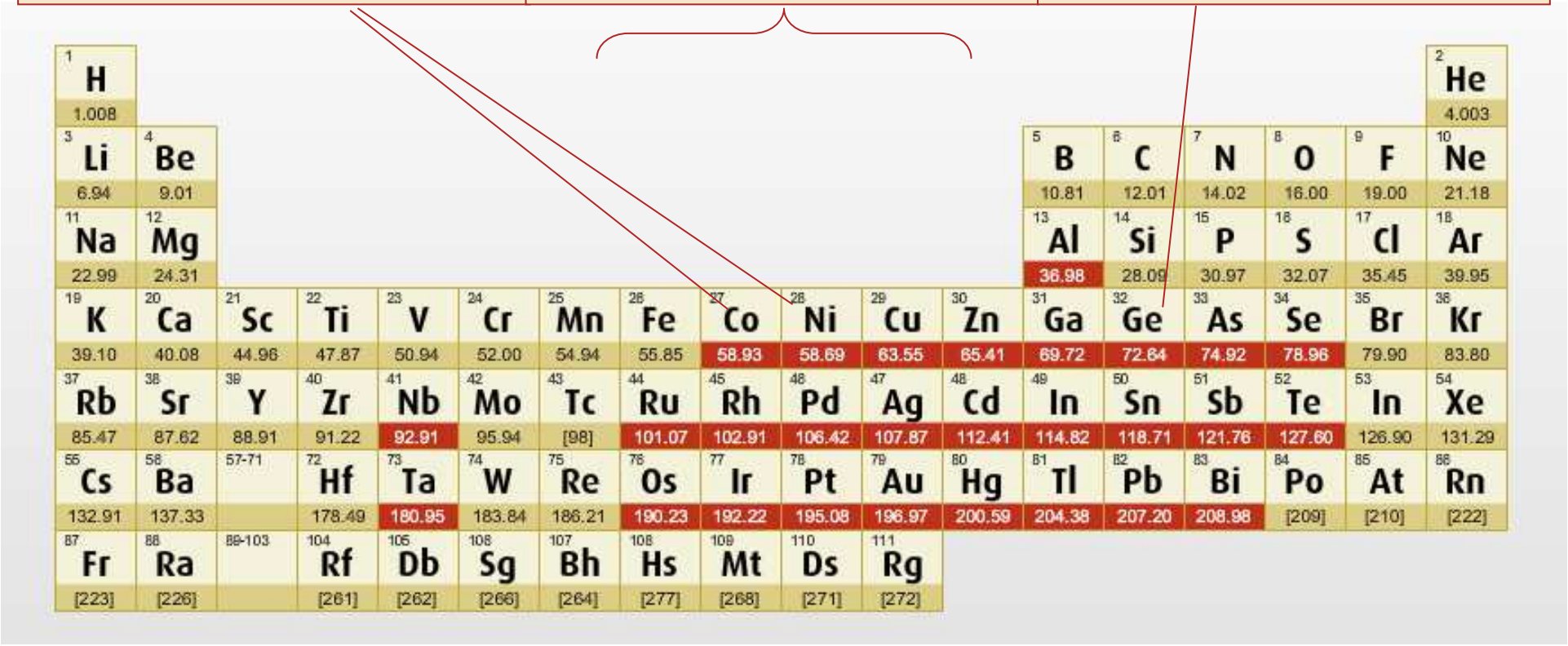
**Umicore engages itself to clean-up these "historical legacies"**

- Soil remediation convenant with Flemish government & Flemish Waste Agency (OVAM)
- Execution of several remediation projects ongoing

# Umicore Olen & the table of Mendelejev



| Cobalt & Nickel *(Business Unit Cobalt & Specialty Materials)* | Research & Development *(Group Research & Development)* | Germanium *(Business Unit Electro-Optic Materials)* |
|---|---|---|



# Germanium

*(Business Unit Electro-Optic Materials)*

Solar Car

LED lighting

Optic lens

Satellite

Recycling of
residus of zinc industry

Damping out germanium
in ovens (1150℃)

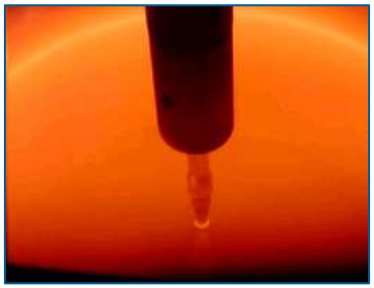
Purifiying into germaniumchloride

Germaniumdioxide

# From raw material to purified germanium

Powder melting

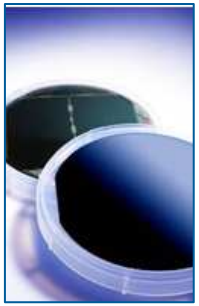
Germanium'metal'
or semi-conductor



Cristal pulling

Germanium-cristal

# From powder to cristal



***Substrates:***
***solar cells, LED-lighting***

***Optics***
***Lenses & blanks***

# EOM WorldWide

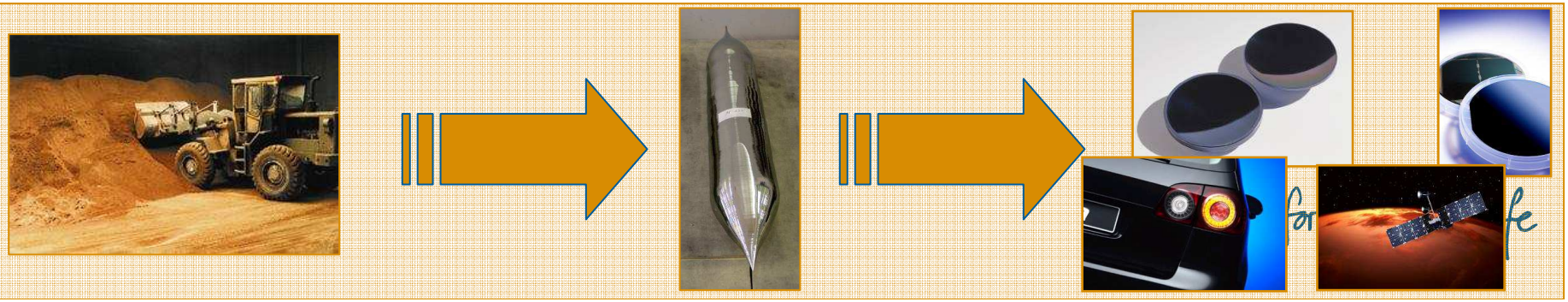
Total Employees: 351 *(31/12/2009)*

**Dundee**
**(Groot-Brittanië)**

**Olen**
**(België)**

**Quapaw**
**(Verenigde Staten)**

**Acigné**
**(Frankrijk)**



# Cobalt

*(Business Unit Cobalt & Specialty Materials)*

Tools

Rechargeable batteries

Hybrid car

Ceramics

**Cobalt Refinery**

Raw materials

Purified Cobaltchloride

Supply cobalt production

**Cobalt oxides**

Cobalt metals

Cobalt oxides

Ceramics & rechargeable batteries

**Cobalt powders**

Cobalt metals

Extra-fine cobalt powder

Tools

**Hydro & nickel purification**

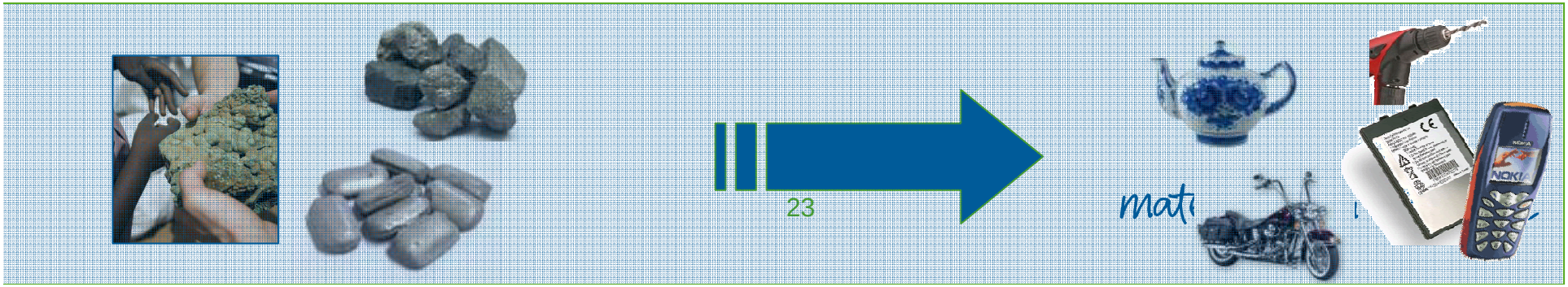
Raw materials containing arsenic, nickel & copper

Nickel sulfate

Electronics, plating, …

# CSM WorldWide

## Total Employees: 2289 *(31/12/2009)*

# Research & Development

*(Group Research & Development)*

**Fijnedeeltjes-technologie**

Ontwikkeling van nano- en microngrote materialen, zoals gedopeerde of gemengde metaaloxiden, metaalpoeders en legeringen.

**Analytische competenties**

Antwoorden geven op analytische vragen en diensten leveren aan Umicore-klanten wereldwijd.

**Technische en wetenschappelijke ondersteuning**

**Competentie milieu, gezondheid en veiligheid**

Processen en de nodige kennis ontwikkelen om de impact van de activiteiten van Umicore op het milieu te helpen minimaliseren. Ondersteunen van de business units op vlak van rapportering over chemische risico's, ecotoxiciteitsonderzoek, evaluatie van de levenscyclus, ...

**Recyclage- en extractietechnologie**

Uitgebreide kennis van extractieve metallurgische processen en technologieën met de nadruk op duurzame, groene en milieubewuste technologieën om de ambitie van Umicore om de metaalkringloop te sluiten, waar te maken.

# GRD WorldWide

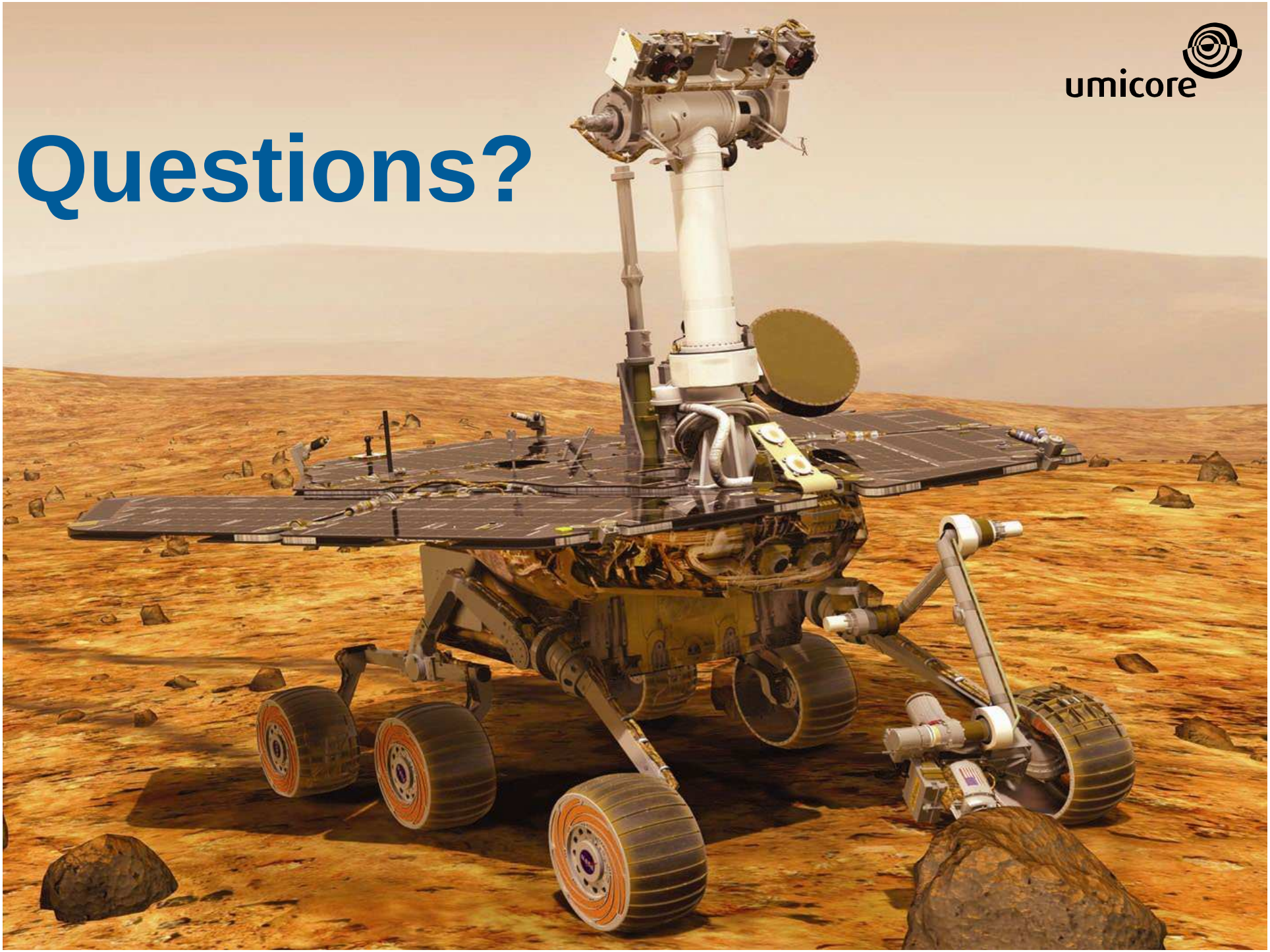
Total Employees: 258 *(1/04/2010)*

**Olen**
**(België)**



**Hanau**
**(Duitsland)**

# Questions?



# Radium production : history

- Discovered 1898 by Pierre and Marie Curie
- First production in France (mineral ex Joachimsthal – Bohemia)
  - Costprice : 150 000 $/g
- 1913 – 1922 : US  Colorado and Utah mines
  - Production 10-20 g/y
  - Costprice : 110 000 $/g
  - Use : medical, luminiscent dials
- 1922 : ca. 150 grams of Radium produced since its discovery

  Start of production in Olen - Belgium

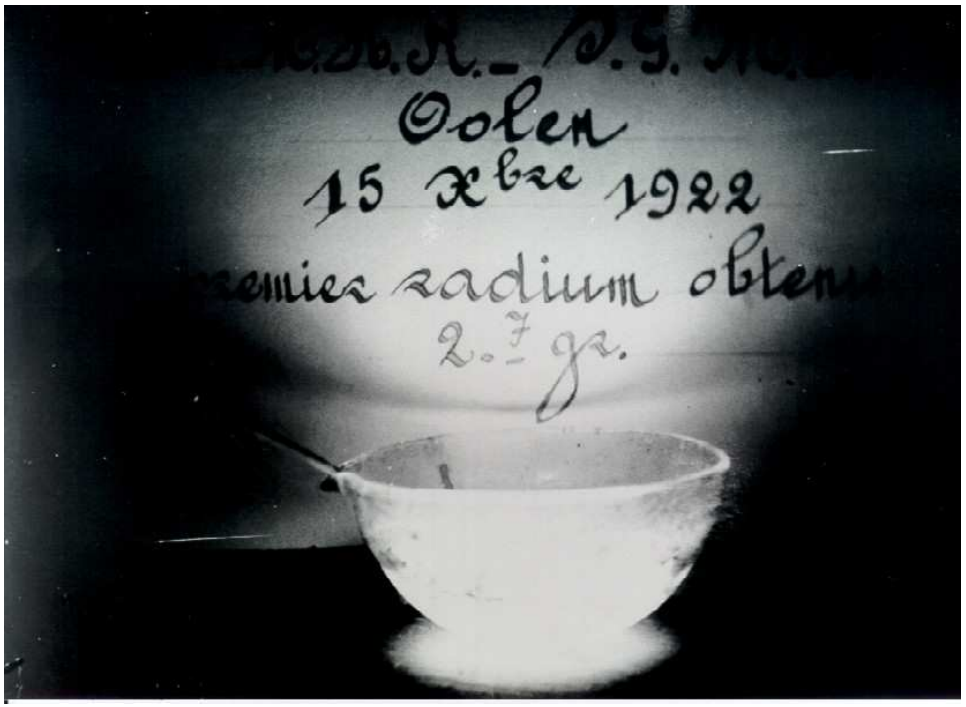
# Radium production : history

- Union Minière : Shinkolobwe mine - Katanga – Congo
  - March 1921 : systematic prospection and sampling
  - December 1921 : first 100 tons of mineral (curite, kasolite) with >54% of U3O8 sent to Belgium
  - Extraction procedures and refinery of radium developed by J. Leemans (founder of the Olen site in 1908)
  - Flowsheet finalised in march 1922
  - Production installations constructed :
    - May 1922 : grinding, leaching, precipitation
    - July 1922 : extraction, crystallisation..

# Radium production : history

**First grams of Ra-226 produced in Oolen** !

Costprice : 70 000 $/g






materials for a better life

# Radium production : flowsheet Olen

- Leaching sulfuric acid (elimination of U, Fe and Cu)
- Leaching NaCl solution (Pb)
- Residue treated with Na2CO3 (H2SO4)
- Leaching HCl (Si)
- Ra-precipitation with H2SO4

- Radium is then separated from the only remaining ‘contaminant’ Barium by a series of transformations sulfates/carbonates/chlorides and subsequent crystallisation steps

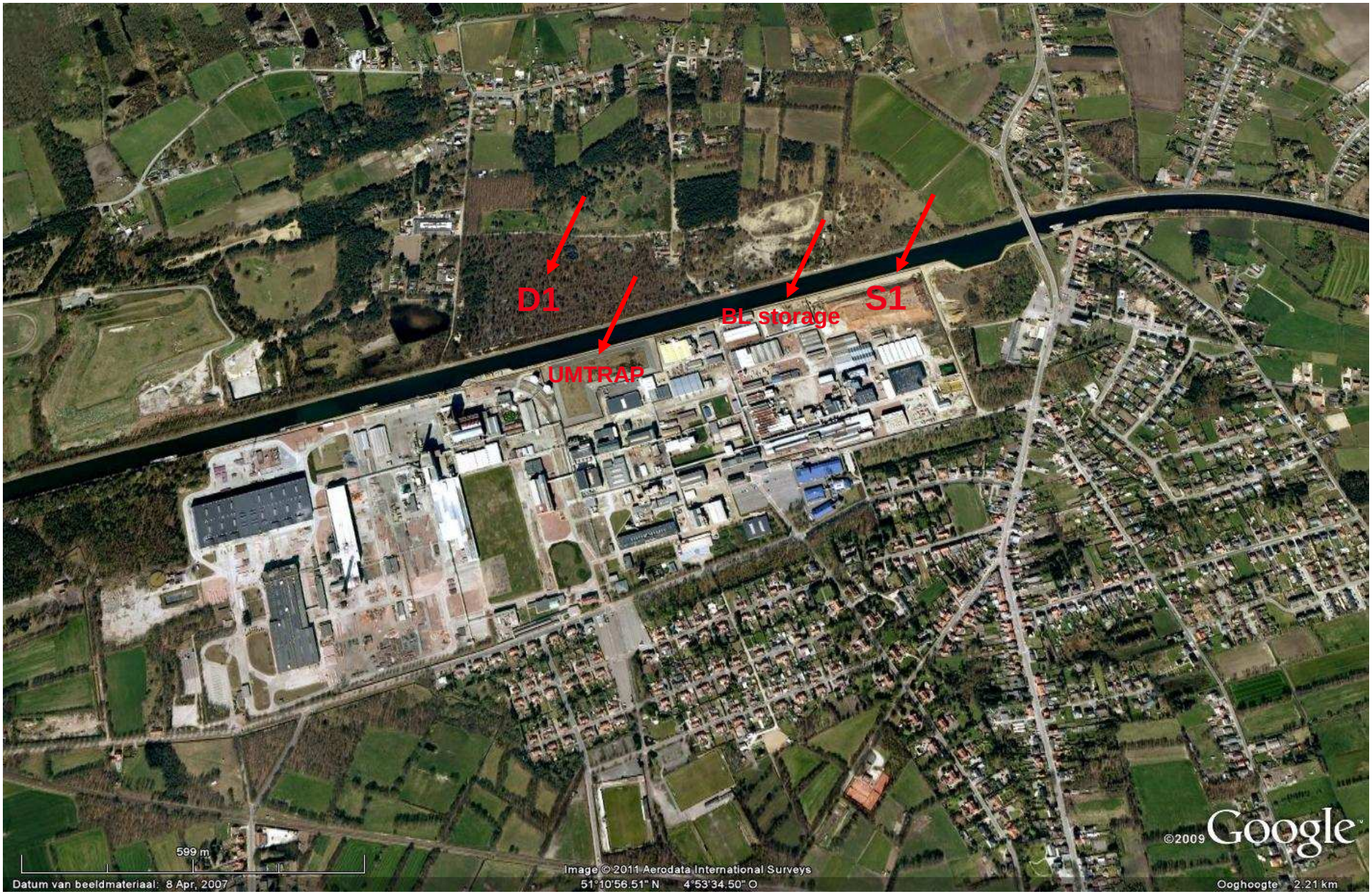
- See movie

# Radium production

| Radium production in Olen period 1922 - 1940 | | | | | |
|---|---|---|---|---|---|
| **Campaign** | **Ore (ton)** | **Radium content** | | **Radium valorised** | |
| | | g | ppm | g | % |
| 1922-1925 | 865 | 160 | 0.18 | 488 | 96.6 |
| 1927-1933 | 3123 | 345 | 0.11 | | |
| 1935 | | | | 93 | |
| 1937-1939 | | | | 183 | |
| Period total | | | | 764 | |

# Radium production : history

- 1932 : start of Ra production by Eldorado Gold Mines in Canada
- 1934-1938 : severe competition and price fall :
  - 1934 : 50 000$/g
  - 1936 : 30 000 $/g
  - 1938 : 25 000 $/g
- After the second worldwar production declines in Olen and was completely stopped around 1970.
- First specific legislation concerning radiation protection dates from 1958; 1st general legislation ARBIS dates from 1963
- Production buildings were dismantled in early eighties by SCK
- UMTRAP was built in 1985


D1
UMTRAP
BL storage
S1
599 m
Image © 2011 Aerodata International Surveys
51°10'56.51" N 4°53'34.50" O
Datum van beeldmateriaal: 8 Apr, 2007
©2009 Google
Ooghoogte 2.21 km