Radioactive and Nuclear Wastes

2014 GeopolymerCamp

Nuclear Decommissioning Authority

Nuclear Decommissioning Authority June 2014

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Innovation investment bears fruit

Ceramic technologies could polish up sites

A unique technology has been developed that could help to treat radioactive waste at lower cost and more effectively in the future.

Current methods rely on immobilising both liquids and solids by blending them with a cement-based grout before packaging the mixture for storage and eventual disposal.

The approach being pioneered by Lucideon (formerly CERAM), a materials consultancy company whose expertise emerged from the ceramics industry of Stoke-on-Trent, involves pouring a slurry of mineral-like materials, or a ***geopolymer***, onto the waste which hardens the material into a resilient solid.

One key advantage of the *geopolymer* over conventional cement-like encapsulating material is the potential to seep effectively into gaps or awkward spaces, while working equally well with solids, liquids or a mixture of both – avoiding the need to drain off liquid.

The slurry can be poured into waste containers, or pumped into the bottom, to solidify any liquids and also encapsulate solid Intermediate Level Waste (ILW). Control can also be exercised over the viscosity (or "flow") of the encapsulant, offering more versatility than standard treatments and with potential for a wider range of applications.

Ian Buckley, Lucideon's project lead, said:

"*The study exceeded our expectations and the experimentation results provided advantages we had not foreseen. The nature of the* ***geopolymer*** *means the encapsulant product can be pumped into the skips either from the top or the bottom, whilst still permeating the entire waste volume and successfully immobilising it.*"

1994

-

1997

Brite EuRam

GEOCISTEM

European Research Project:

*GEO*polymer *C*ement for *I*nnocuous Stabilization of *T*oxic *E*le*M*ents

Partners : European Commission, CORDI-Géopolymère

Geology : B.R.G.M. (France), Univ. Barcelona (Spain), Univ. Cagliari (Italy)

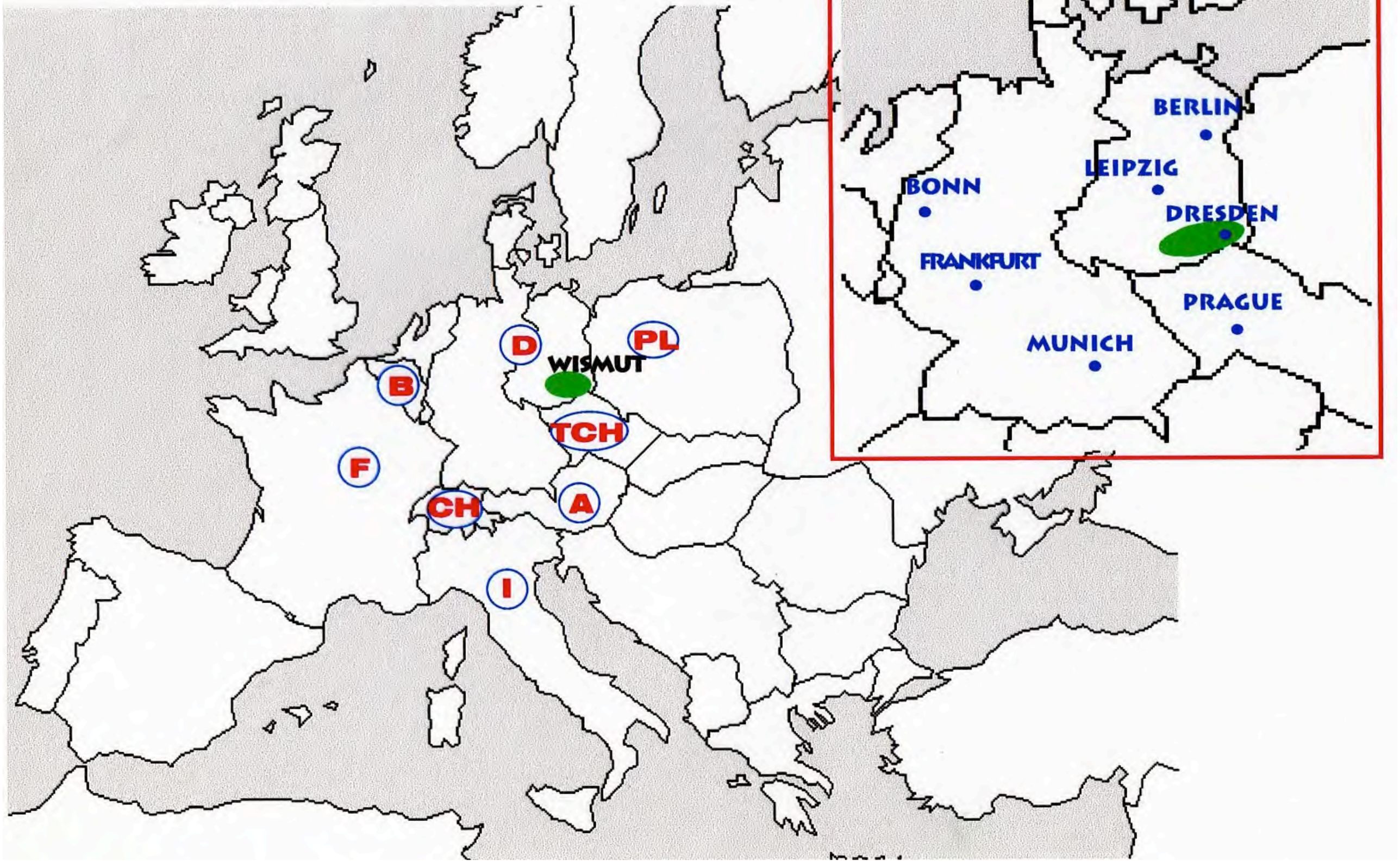
Industry : Cement : Cementi Buzzi (Italy)

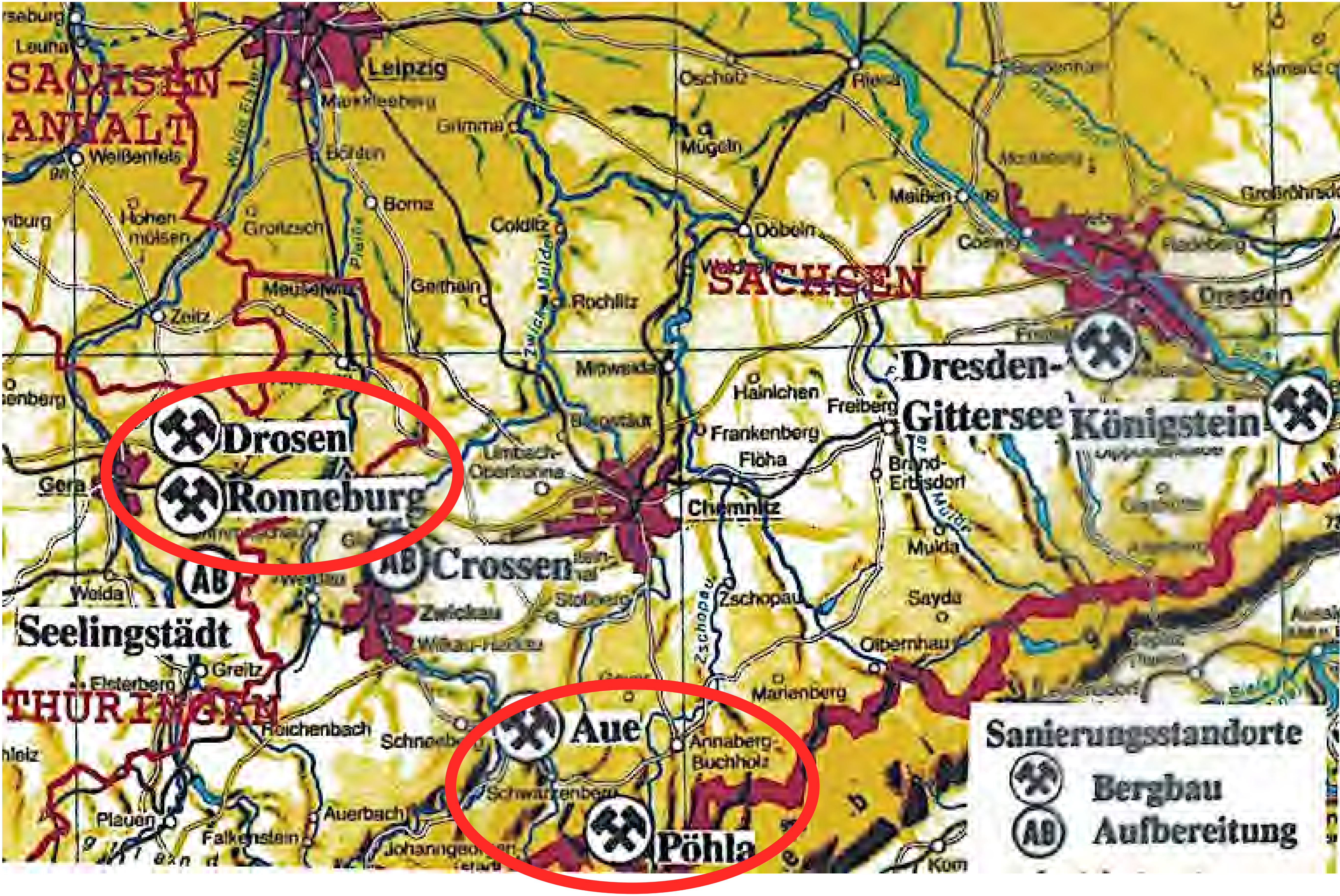
Toxic waste : Laviosa (Italy),

Mine tailings : Wismut GmbH (Germany)

1998-2000 : Pilot experimentation with WISMUT (Germany), Uranium mine tailings

WISMUT SACHSEN/THÜRINGEN




SACHSEN-ANHALT
Leipzig
Oschatz
Riesa
Grimma
Mügeln
Weißenfels
Borna
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Coswig
SACHSEN
Dresden
Zeitz
Rochlitz
Mittweida
Hainichen
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Dresden-
Gittersee
Königstein
Drosen
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22 SOLIDIFICATION OF VARIOUS RADIOACTIVE RESIDUES BY GÉOPOLYMÈRE® WITH SPECIAL EMPHASIS ON LONG-TERM-STABILITY

SOLIDIFICATION DE DIFFÉRENTS RÉSIDUS RADIOACTIFS AVEC LE GÉOPOLYMÈRE POUR UNE STABILITÉ À LONG-TERME

PART I: LABORATORY INVESTIGATIONS
PART II: PILOT-SCALE EXPERIMENT

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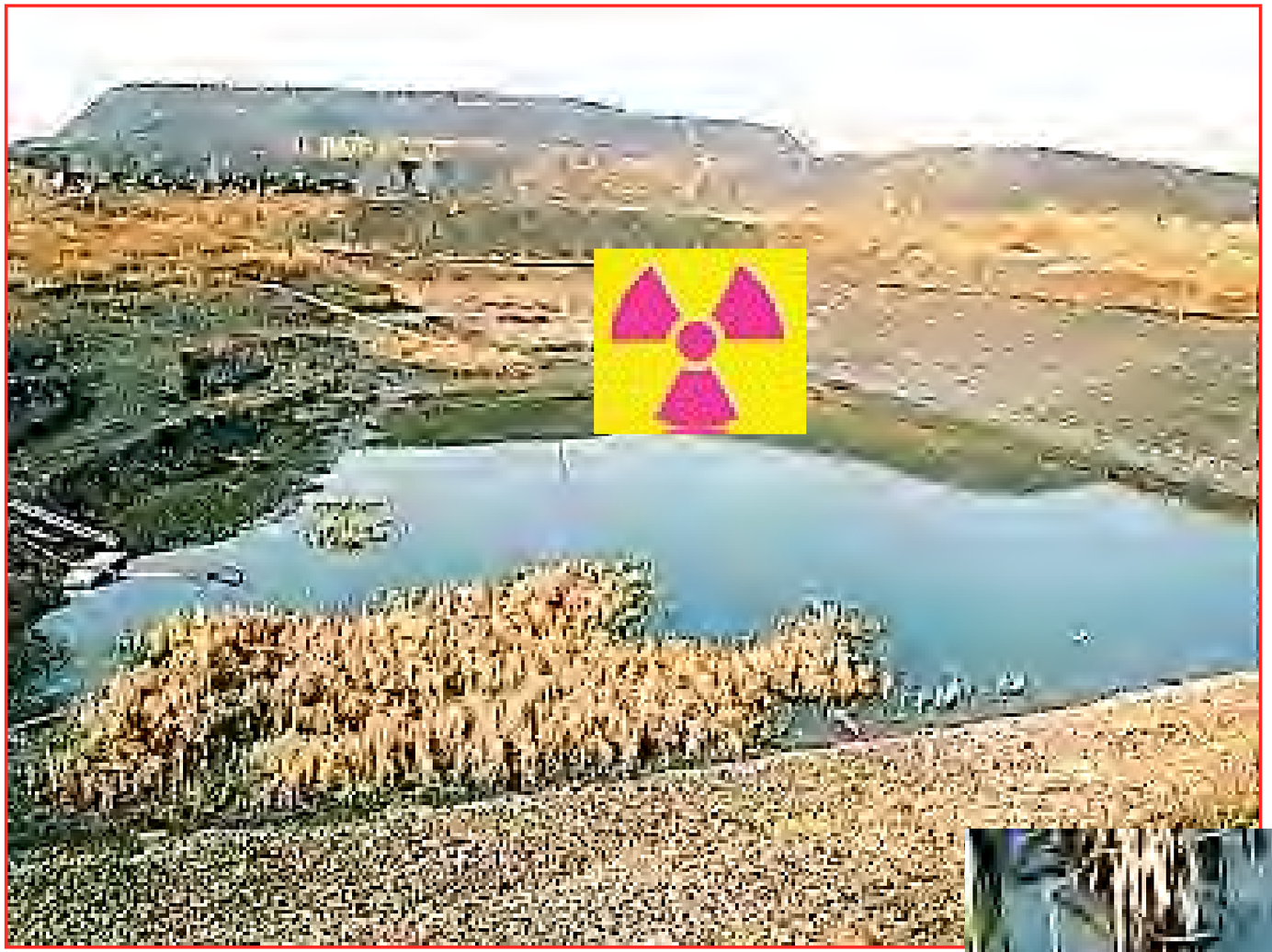
B.P.S.

WISMUTH, Germany



Safe encapsulation of sludge from decantation pond

- hydrocarbon +
- radioactive +
- Arsenic +
- heavy metals

AUE, mine water,
450 m3/h
treatment plant

Filter cake with:

- radioactive +
- Arsenic +
- heavy metals

- 3.5 - 4 tons cake per day

20 big-bags
30 tonnes

CONCLUSION

« The new method for the solidification of sludges containing radionuclides and heavy metals as well as organics has been developed and shown to meet high standards with respect to long-term stability and contaminant retention.

The innovative technology which is based on the use of geopolymer binder is very easy to handle and requires basically the same equipment as conventional cement mortar methods.

It fills the gap between concrete-based solidification methods which do not satisfy the requirements of long-term structural stability, and vitrification which is too expensive for most cases in which larger amounts of sludges have to be treated. »

HOW LONG WILL IT LAST ?

video

Geopolymer for Newcommers #7

Low-energy cement
Mega Joule / 1 tonne

Portland

3430 MJ

Geopolymer

990 to 600 MJ

rock

fly ash