# Summary for WG2 Friday Session

## Reference approaches to modelling for management and remediation of NORM and legacy sites

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EMRAS II meeting, Vienna HQ
24-28 January 2011

# Outline

- General Assessment Methodology Process ready
- Progress on the Gela phospogyspsum site and the U mining and milling site of Bellezane
- Presentations on new features of RESRAD-OFFSITE and a new support system for risk assessments of U sites
- Possible site visits for an interim meeting

# General Assessment Methodology Process

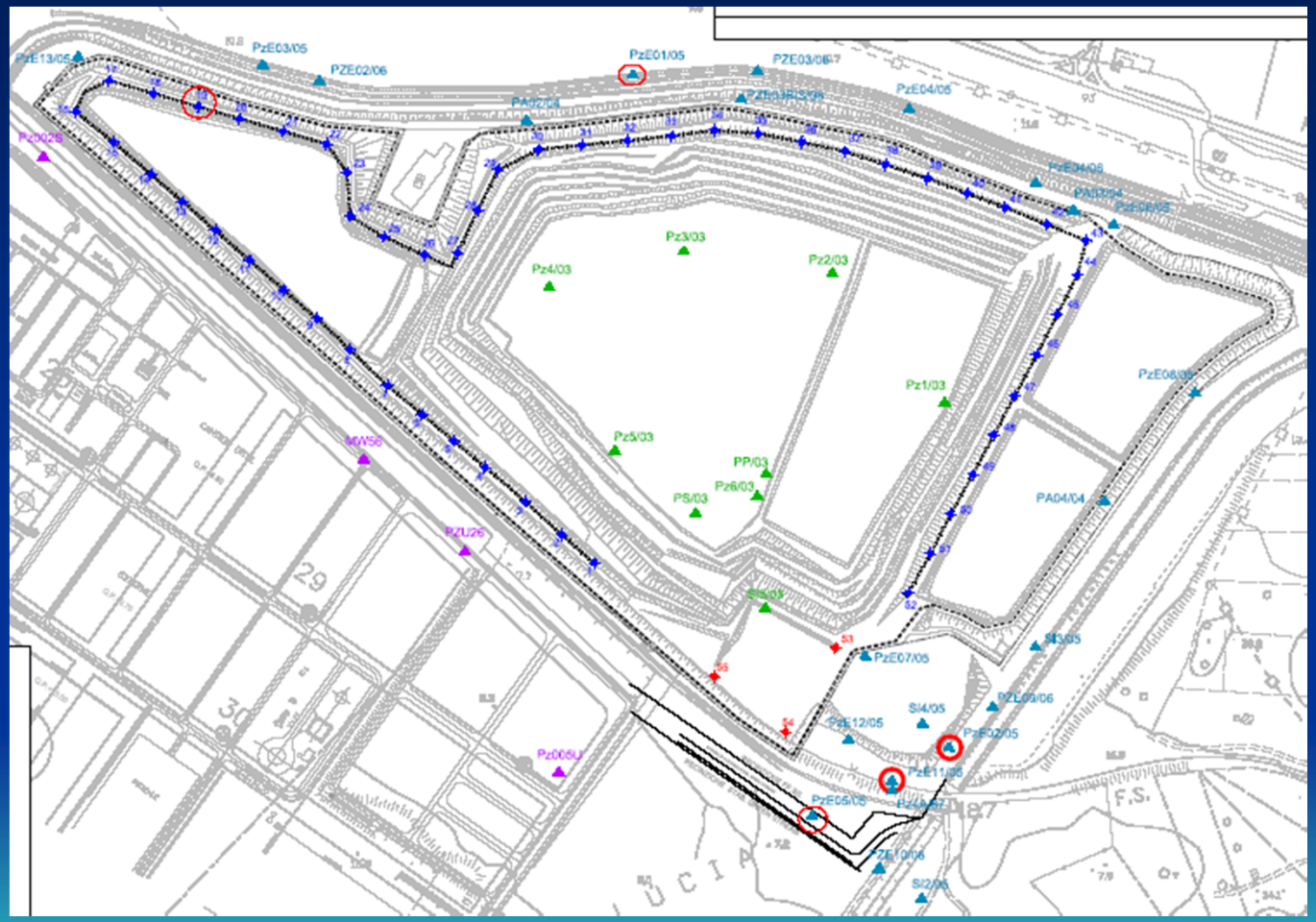
The main stages in the overall process are:

1. *Identify the problem*
2. *Carry out a preliminary site investigation and characterisation*
3. *Establish screening criteria*
4. *Carry out a screening assessment*
5. *Estimate the impact using conservative assumptions and exposure scenarios; the model used for this estimation may be quite simple*
6. *If the screening criteria are satisfied, notify the decision maker(s)*

7. *If the screening criteria are not satisfied, carry out a more realistic assessment*
8. *Use more realistic assumptions and exposure scenarios*
9. *Collect more data to improve the estimation of transfer parameters and the estimation of the source term*
10. *Use more complex models if appropriate*
11. *If the screening criteria are still not satisfied, carry out a detailed assessment*
12. *Use assumptions and exposure scenarios that are as realistic as possible*
13. *Collect the data needed to improve the estimation of transfer parameters and the estimation of the source term*
14. *Use more complex models if appropriate*
15. *If the screening criteria are satisfied, notify the decision maker(s)*

16. *If the screening criteria are exceeded, take remedial action*
17. *Define the objectives of the remedial action and establish cleanup criteria*
18. *Collect additional data if necessary*
19. *Establish appropriate exposure scenarios, both for the workers involved in the remedial action and for the future use of the site and surrounding area*
20. *Carry out an assessment of the different remedial options available, and select the option that gives the optimal result, taking into account not only reduction in dose to the public and non-human biota but also the doses/risks to workers, public and non-human biota while the work is being carried out*
21. *Carry out the remedial action that is required to meet the cleanup criteria*
22. *Collect data from the remediated areas, to verify that the cleanup criteria have been satisfied*
23. *Continue this process (iteratively) until the cleanup criteria are satisfied*
24. *Good communication with decision maker throughout the process*

# Gela (Sicily) - phosphogypsum



- Available data for Gela
  - Radionuclide concentrations in phosphogypsum, leachate
  - Meteorological, hydrological
- Modelling
  - Three models
    - (RESRAD, DOSDIM, ReCLAIM)
  - Model-model intercomparison
  - Modeller-modeller intercomparison
    - (RESRAD)
  - Validation against measurements

# Overview of the Bellezane site

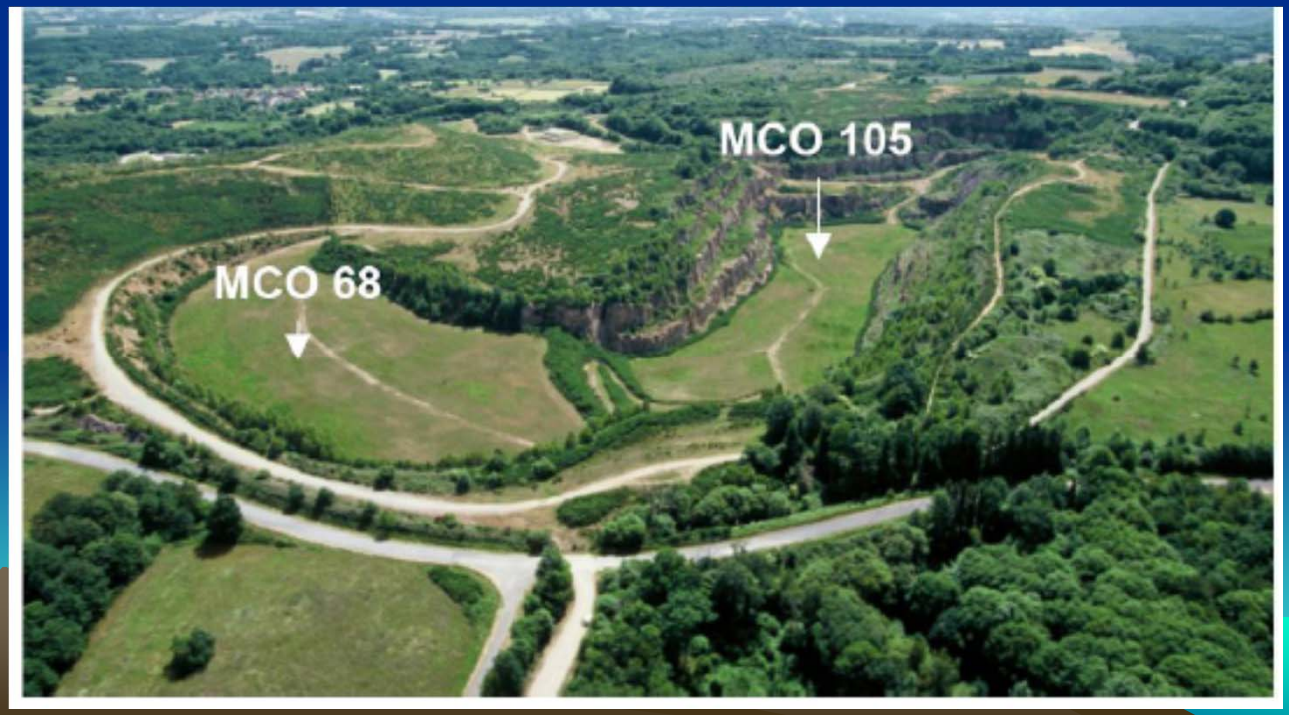
Uranium mining (underground + open pit) between 1975 and 1992

⇒ two millions tons of rock extracted

⇒ open pit mines (MCO 68 + MCO 105) filled with U tailings (1.5 Mt) between 1988 and 1992

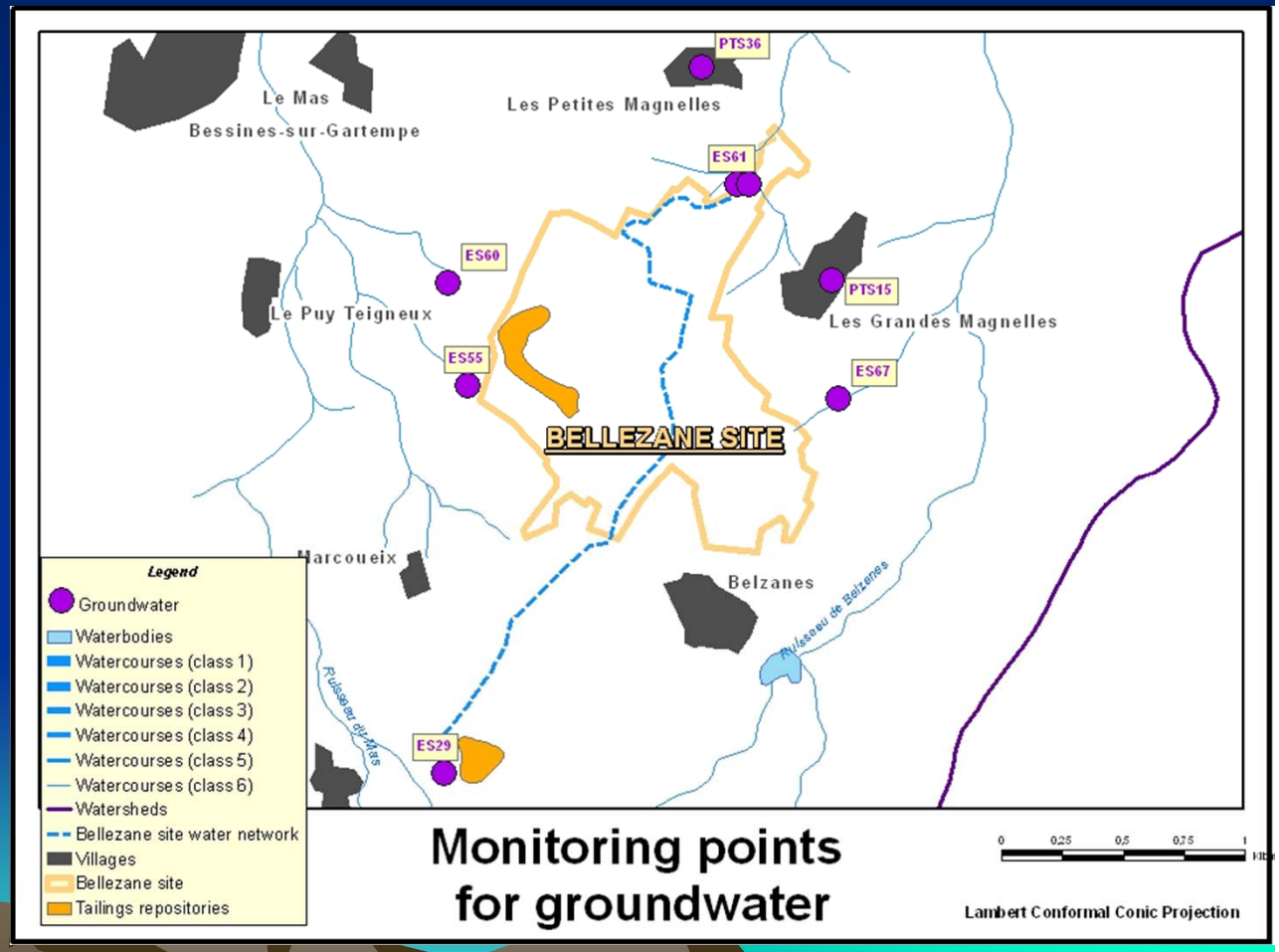
⇒ end of mining works in 1992

⇒ coverage of U tailings with waste rocks and a vegetal layer in 1995-1996



# Dataset available from the environmental follow up

- Groundwater
- Surface water
- Air
- Fish
- Sediment
- Milk
- Soil
- Vegetable



# Exposure scenarios

## 1. Current impact


Representative person: inhabitant of village

# Exposure scenarios

Radiological impact on an **adult living and working in the village**

- Walking on site **half-an-hour/day**
- **Quarter** of diet: locally grown products

⇒ Total dose ? Most important exposure pathways ?

⇒ Radionuclides concentration in groundwater and surface water ?

# Exposure scenarios

## 2. Intrusion scenario

**Dwelling on site**

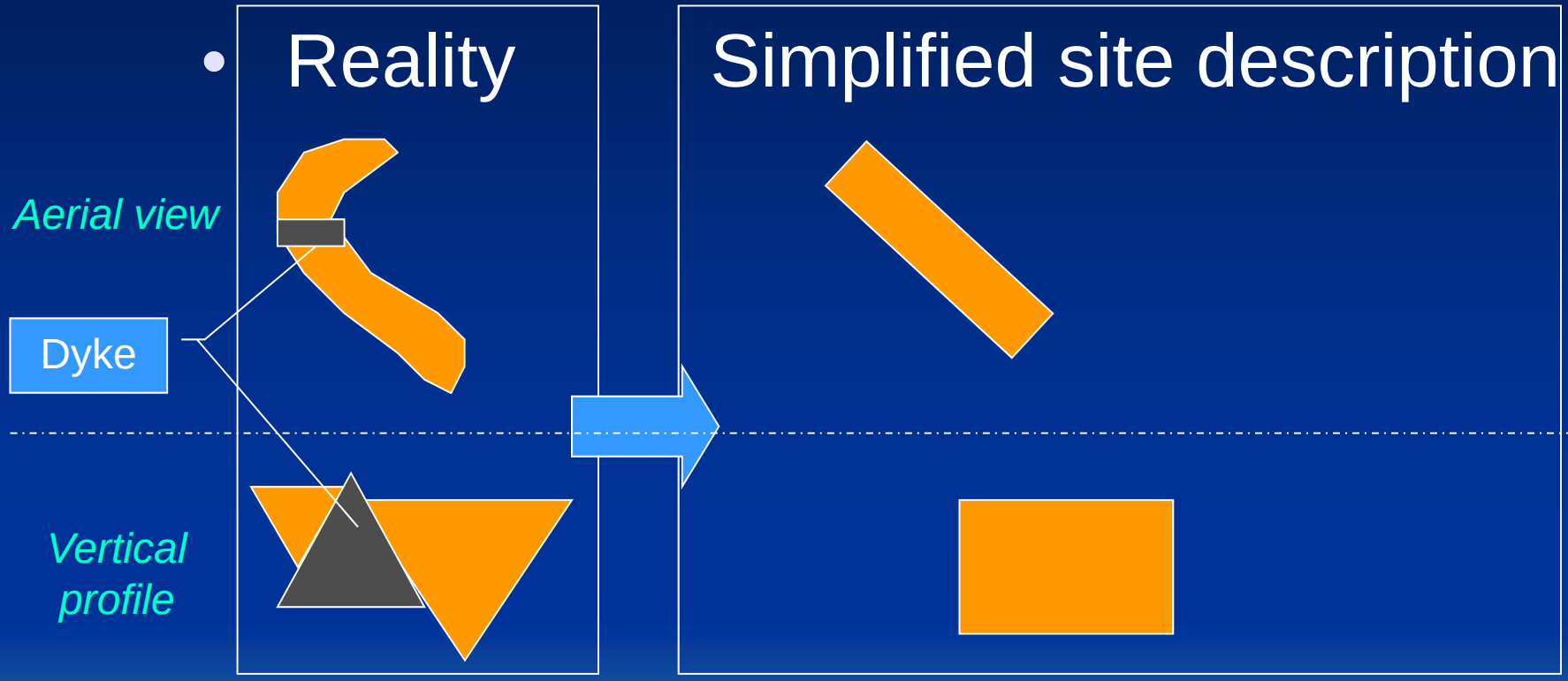
Family lives and works on site, grows some vegetables in their own garden (quarter of diet)

⇒ Total dose ? Most important exposure pathways ?

⇒ Radionuclides concentration in home-grown vegetables ?

# Work done so far about the Bellezane site

- Reality




- Identification of the most relevant input parameters

# Added features of the RESRAD-OFFSITE

- Argonne National Laboratory is tasked by NRC to expand the source term model in RESRAD-OFFSITE so that the code can be used for waste disposal facility performance assessment

- The code is being modified to model transport (by water) within the contaminated zone and to provide 3 additional release options
  - "Solubility rate-controlled" release
    - A constant fraction of the source material is released over a user specified release duration
      - Release occurs over the entire depth of contamination

- "Solubility equilibrium" release
  - A user specified constant aqueous concentration of the isotope is released over time
    - Release occurs from the top of the contamination
- "Adsorption-desorption equilibrium" release
  - The aqueous concentration in the release is proportional to the concentration in soil
    - Release occurs from the top of the contamination

http://web.ead.anl.gov/resrad/home2/

# **S**upport System for **A**ssessmen**T** of Risks to the Public and the Environment from **UR**a**N**ium Mining Activities

**SATURN**

# The SATURN Tool

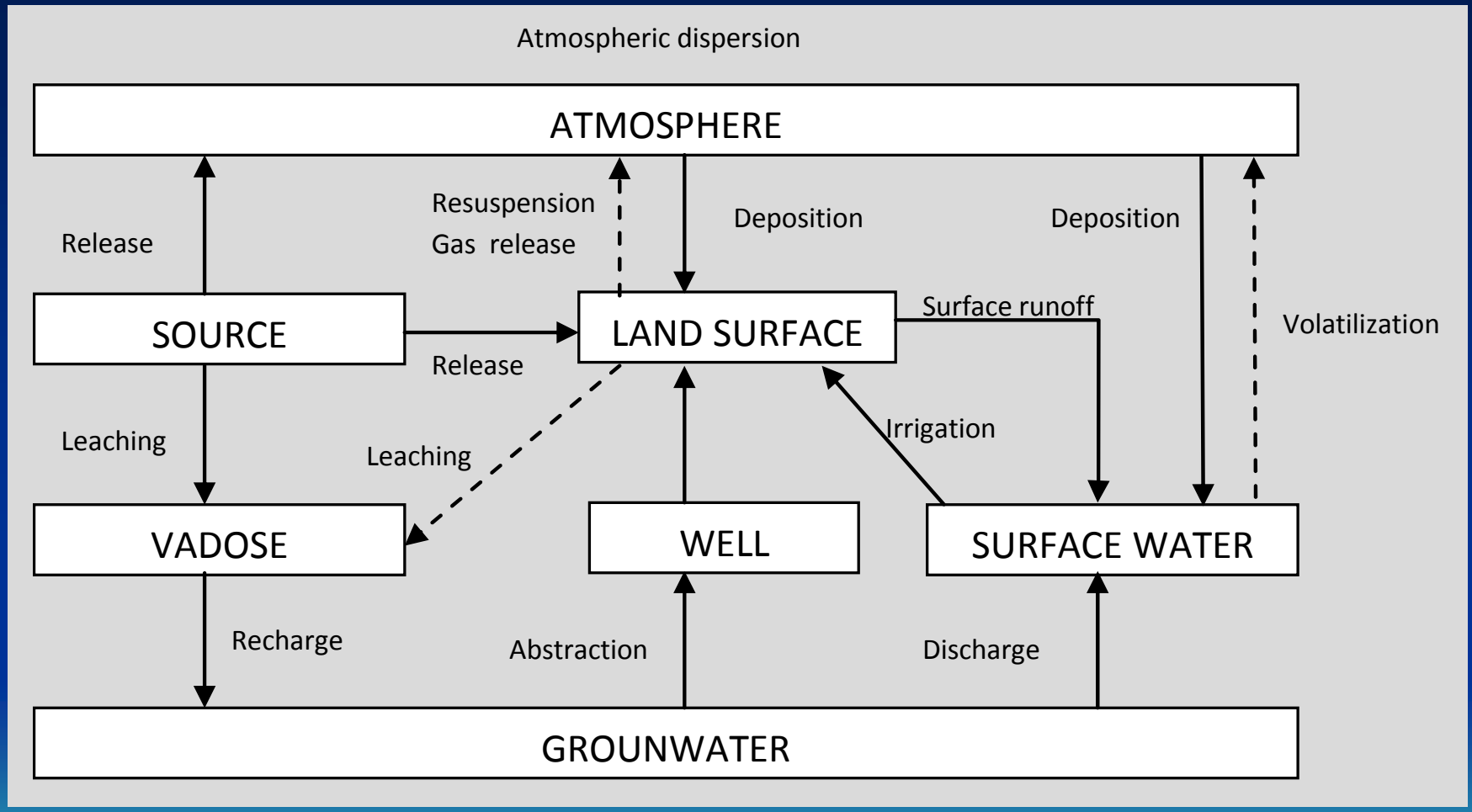
- Web based support system (SATURN) for assessment of risks to the public and the environment from contaminated lands (focused of lands contaminated from uranium mining and milling activities)

**Will be distributed free of charge by the IAEA – starting from October 2011**

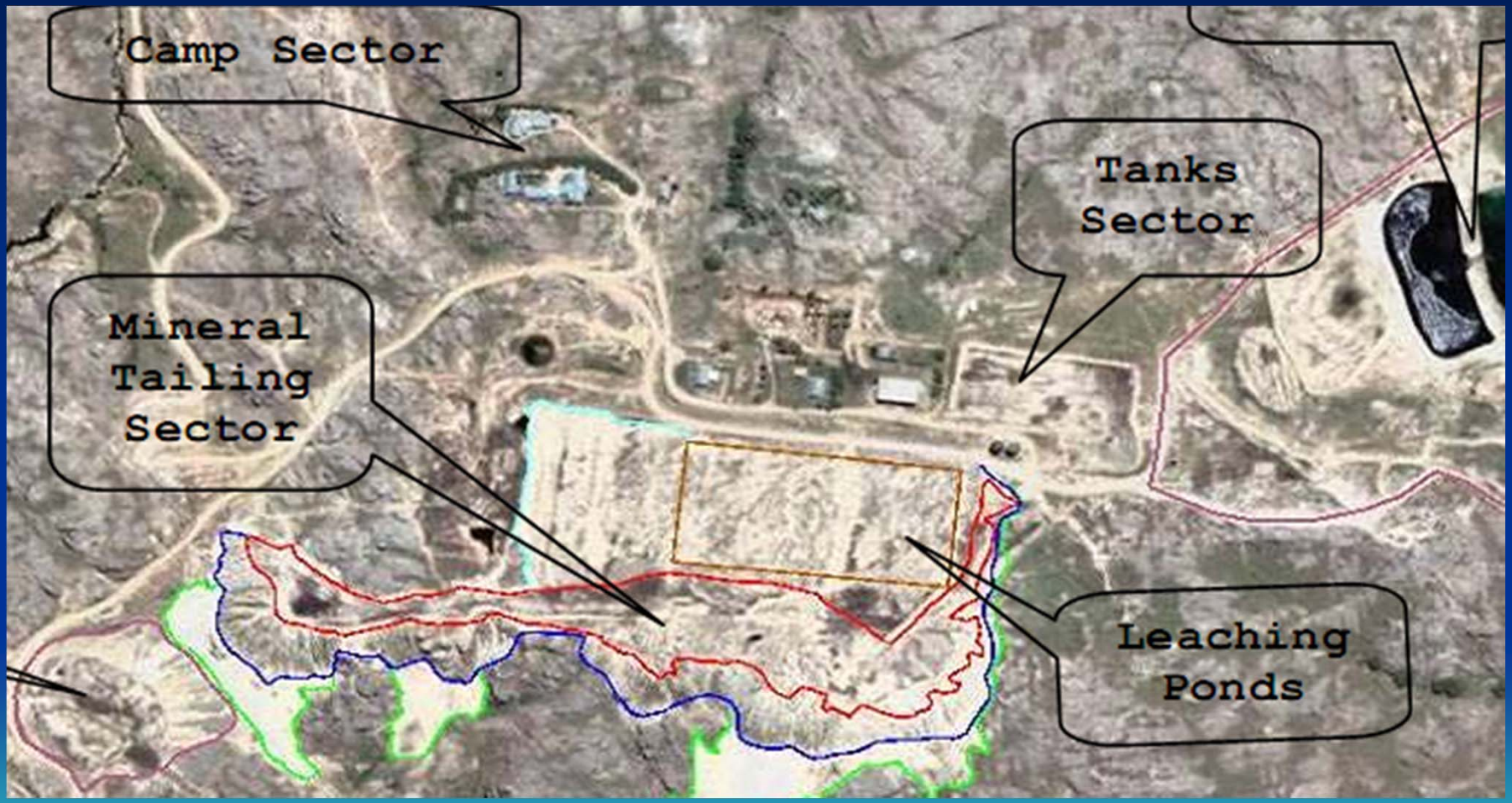
# SATURN components RA1

- **Website – www.saturn.facilia.se (from April 2011)**
- Set of relevant **methodologies** (Wiki Style)
- An internationally agreed list of Features Events and Processes (**FEP**)
- **Set of modules** implementing generic assessment models which can be used for developing site-specific assessment models and applying these in risk assessments.
- **Databases** that collate monitoring data and parameter values needed for assessments with models.
- **Training material** covering basic knowledge, methodologies and assessment models.

# Toolbox of simple Assessment Models



# Possible venues for interim meeting




**Uranium mining and milling site Los Gigantes, Argentina**

# Possible venues for interim meeting


**Former dumpsite (slags) of ferro-niobium extraction Ghent, Belgium**

# Possible venues for interim meeting

**Uranium mining and milling site Buhovo, Bulgaria**

# Possible venues for interim meeting

**Iron and steel refining, rare earth metals processing, China**

# Possible venues for interim meeting


**Abandonned uranium mines, Navajo, USA**

# Possible venues for interim meeting