ALARA assessment of a decommissioning activity with VisiPlan

- Characterization of the site
- Model building
- Development of the geometry and source changes in the project
- Trajectory definitions
- Scenario definition
- Scenario comparison

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- Radiological
- Geometry and materials
- Validation of the model
- Evaluation of shielding strategies
  - Evaluation of source reduction techniques
- Dose evaluation on trajectories
- Scenario dose evaluation
- Scenario selection
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General methodology

- Model building stage
- General analysis stage
- Detailed planning stage
- The follow up stage
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Model building stage

Geometrical input
- From technical drawings
- Survey techniques
- Photogrammetry
- Laser scanning

Materials input
- Technical data
- Experts on site

Radiological input
- Technical data
- Survey
- Site history

Primitive volumes
Materials dataset
Source dataset

Take
Visiplan

“Take” definition
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Take definition Capabilities

Basic volumes
- Box
- Tilted box
- Cylinder
- Hollow cylinder
- Tube
- Sphere
- Hollow sphere

Standard Materials
- Concrete
- Iron
- Lead
- Water
- Zirconium
- Aluminum
- Uranium
- Tungsten
- Tin

Source Definition
- Single isotopes
- Mixed isotope sets
- Photon spectrum at standard energies
- Point, Line, Box, Cylinder, spherical sources

• Now extended with
  - cone
  - bend
  - triangular shapes
Screen interface of Visiplan
The geometry can be changed to simulate future events

Descriptions of a site at different moments during the job

1. Basic situation
2. Filter housing decoupled
3. Filter out of the housing
4. Filter on the floor

Filter replacement work Almaraz NPP
Radiological Characterization of a site

Traditional

- Site history
- Dose rate measurements ($4\pi$) at different locations in the work area
- Spectral Analysis on samples (sweeps, fluids, resins,....)

New Technologies for source location and source strength evaluation

- Gamma scanning
- Gamma cameras
Source Strength inference from a measured dose rate set

Dose rate measurements at different locations in the work area (3D position + Dose rate)
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*General planning stage*

- First Evaluation based on calculated dose maps
- Evaluation of possible shielding solutions

Take 1 *Basic situation*
Take 2 *Shielding solution 1*
...
Take n *Shielding solution n*
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General Analysis - Mapping Capabilities

- x-, y-, z-grid on screen definition
- Isodose, Pattern or grid dot display
- Dose rate determination at pointer position on the grid
- Display of the source contribution at the pointer position on the grid
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Tools for Dose mapping on grids

Grid tool

Dose calculation tool
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Detailed planning stage

Trajectory definition
- Position
- Task description
- Task duration
- Uncertainty on task duration

Trajectory Results
- Accumulated dose vs time
- Dose rate at task location
- Dose and dose rate per task
- Contribution of the different sources to the task dose
- Minimum, maximum dose estimate based on the time uncertainty
- Bias with source sensitivity analysis set
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Trajectory tool

Trajectories define:
- Work position
- Work duration
- Uncertainty in work duration
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Calculate Trajectories

Accumulated dose as a function of time
Dose contribution per source to a task
Scenario definition
• Selection of trajectories in different takes
• Selection of Source sensitivity Analysis file
• Dedicate a worker or a group of workers to a trajectory

Scenario Results
• Collective dose
• Collective dose per trajectory
• Accumulated dose per worker per task
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Scenarii

Scenario building tool

Scenario result tool
Scenario Comparison Results

- Collective dose (man*Sv)
- Max individual dose (mSv)
- Intervention time (h)
- Collective time (man*h)
Easy and clear communication of the results through VRML files

Simple or complex geometries in full interactive 3D, readable with standard VRML tools from the internet.
Shielding calculation
Point kernel with buildup correction

Standard ANSI materials for attenuation and Buildup calculations.
Calculations on grids, trajectories and measured dose sets
Gamma Scanning
Range 69 to 600 cps, from purple over blue to red, cut-off at 600 cps
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Developments

- VRML Convertor
- HTML-VRML web-site generator
Visiplan tools

*The convertor*

Take: geometrical and radiological environment

Trajectory
Visiplan tools

Ambiant changes

Evolution of the dose debit to different actions
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**Grids**

- **Pattern**
- **Isodose line**

- Hot spots
- Risk areas
- Dose evolution
Source contribution

- vessel 1 crud
- accbend
- pump
- waste
- tube T1
- tube T8
- tube T3
- tube T9
- tube T2
- tube T5
- tube T6
- Vessel 2 bottom

Visiplan tools
Source contributions