**Form 2**

Technology Information	
Area	Management of contaminated water inside the buildings / Decontamination device after removing contaminated water (Point 5.3)
Title	**METHODS AND TECHNIQUES TO IMPROVE DECOMMISSIONING AND DISMANTLING SCENARIOS**
Submitted by	CEA

1. Overview of Technologies

Functions

Methods and techniques **to help operators who have to choose for best** scenarios (decontamination or not, cutting on site or not, different cutting devices, etc.), depending on the parameters to optimize; integrated doses, outlets, wastes, man power hours, schedule, costs, etc.

- validate intervention scenarios, by simulating at scale one,
- verify accessibility by virtual reality (immersive room),
- show scenarios in a more user-friendly way,
- validate task ergonomics,
- communication support ex: 3D views and scenes for communication with safety authorities, public, etc. ,
- help defining the needs, making bids, analysing quotes with respect to the data structure.

Summary Descriptive

1. **Software for dose rates:**

   Radiological modeling

   - add radiological information (sources, protection screen, measurement points) from an initial inventory
   - Use software to calculate dose rate before and after dismantling operations
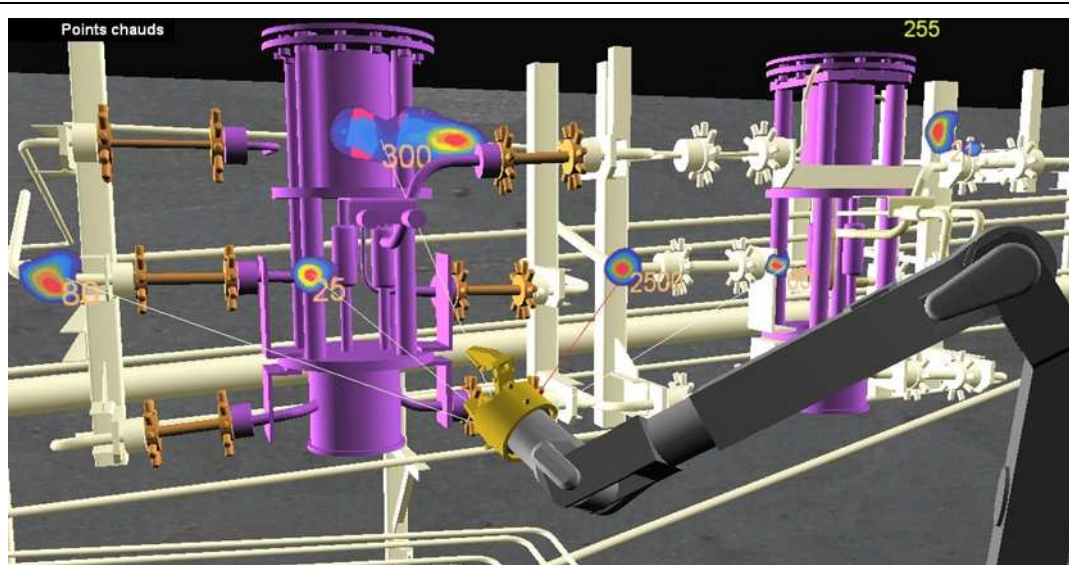
2. **Immersive room for simulation**

- 3D modeling of facilities
- 3D modeling of means involved and simulation of the kinematics
- 3D modeling of human operators wearing different protection clothes

3. **Software DEMPlus** :

First of its kind, innovative 3D simulation software for nuclear operations; the user may simulate different scenarios, evaluate their robustness and finally make a choice considering the variability of input data. DEMplus is based on a complete ALARA.

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Creating the scene

The scene is created from imported or 3D CAD models on which the user adds all data from inventory studies.

Project characterization

The user defines the project parameters by entering the information regarding the waste, the staff and the profile of the team, the equipment which will be used onsite and

the operating conditions.

Scenarios

The user simulates successive operations and then updates the scene to observe several results as the cumulated dose, quantity and characteristics of the waste, estimated due time and costs. Different waste management strategies can be used to simulate the relevance of clean-up operations. The accessibility for the material and operators are checked at the environmental level and at the radiological level. With DEMplus the user may simulate different scenarios and evaluate their robustness.

Features & Specifications

1°) **Software for dose rates**

Interactive dose rate computation based on straight line attenuation and build-ups
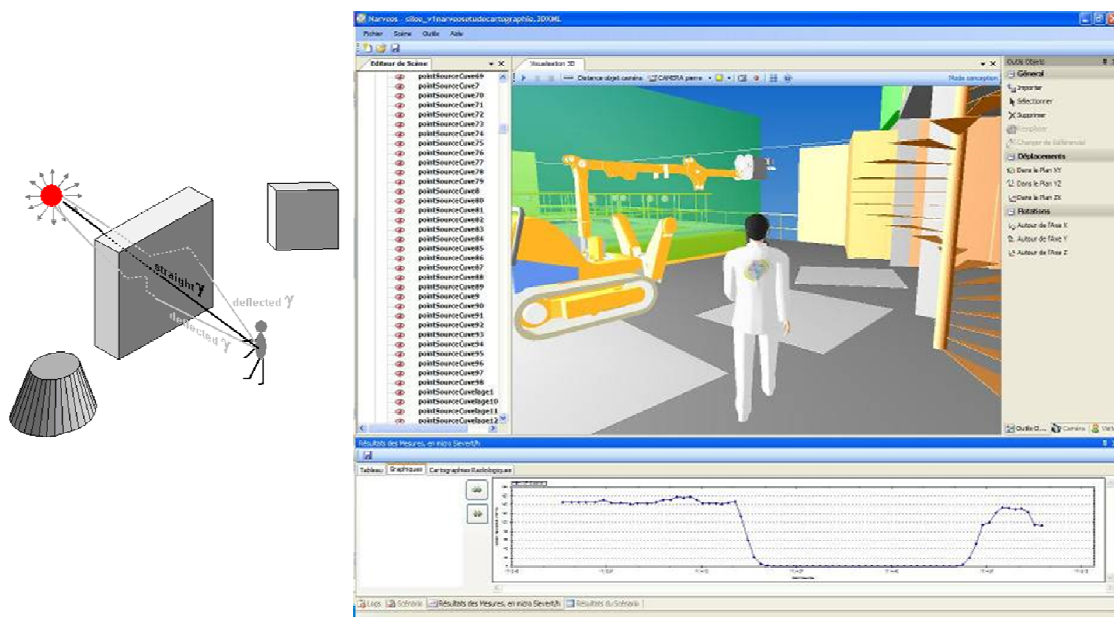
2°) IMMERSIVE ROOM

- The screen covers the entire wall and is equipped with a stereoscopic visualization

system. This allows 3D vision with stereoscopic glasses to simulate on life size situations .

- MOCAP system follows the motion of the user who is wearing the special glasses recognized by the cameras in the corners of the room.

- a motion capture system (4 IR cameras and specific targets placed on glasses) follows user head motion

- the haptic interface provides a force-feedback system and allows to manipulate virtual objects and touch or collide with the virtual environment.

- software
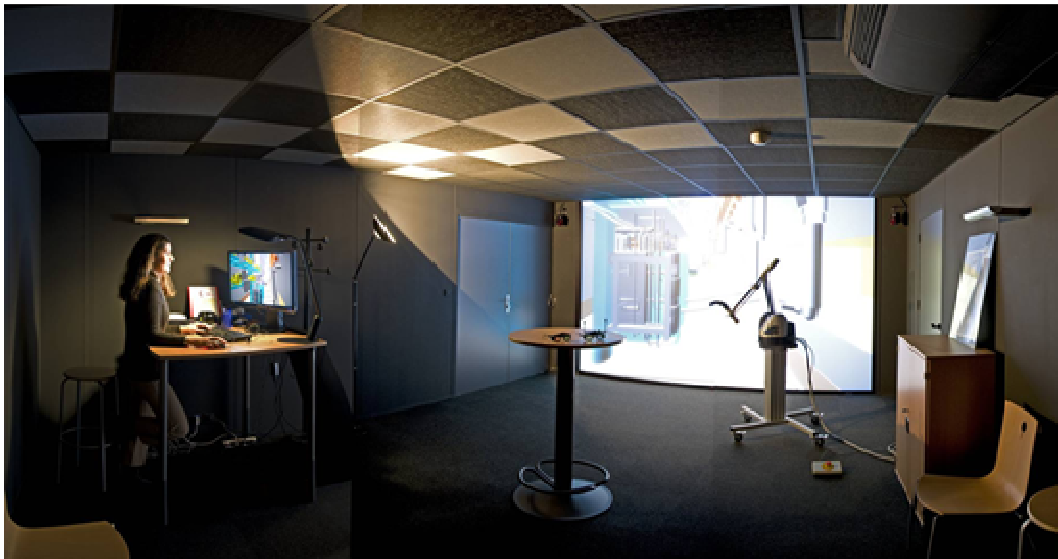
3°) DEMPlus

- CAD import.

- Real time calculation.

- Pooling resources.

- Secure exchange platform to share and update information with all actors (coworkers, nuclear safety authorities…)

- Microsoft Office export :Automatic report editor (Word), Results & inventories (Excel)

Nota : DEMplus is delivered in French, English and Japanese.

Advantages of the Technology

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1. Software for dose rates:

- better representation and knowledge of facility
- verify means suitability
- have a global approach to a decommissioning scenario : dose rate, remote handling
- modifiable scenario in real-time

2. Immersive room for simulation

- Validate the design of equipment
- Test dismantling scenarios and retain the best
- Initial training of operators in the use of equipment
- Film for communication internal project and external

3. Software DEMPlus :

- Rapidity: permits to select a great number of scenarios to be simulated
- Concentration of numerous applications in the same software+ (dosimetry, Tools or processes simulations, wastes, manpower and costs calculation, etc.)

  Facility of comparison between answers to calls for bids

Owner

1. **Software for dose rates:**
   - CEA owner

2. **Immersive room for simulation:**
   - CEA owner

3. **Software DEMPlus :**
   - DEM + is a software developed and commercialized by OREKA Sud in Bagnols sur

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Cèze. The calculation engine used in DEMplus has a proven technology coming from CEA (National French nuclear research center) R&D department.CEA (national French nuclear research center) is Oreka Sud major partner for both technical and financial aspects

4. Notes

Technology readiness level

1. **Software for dose rate**

The present version is already used for CEA workshops by companies working in D&D.

2. **Immersive room for simulation**

Industrially used for CEA workshops by companies working in D&D.

3. **Software DEMPlus :**

The system software DEMPlus was used on pilot workshop and is being validated by CEA on 3 real workshops.

Challenges for future applications

- **CEA Software for dose rates:** constant evolutions.
- **Immersive room for simulation**: constant evolutions.
- **Software DEMPlus**: Connection with other software or equipment (immersive room, CEA Software for dose rates , etc.)