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Nucifer Project

Nucifer detector versus safety and security in nuclear reactor

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For the Nucifer collaboration

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Osiris Configuration

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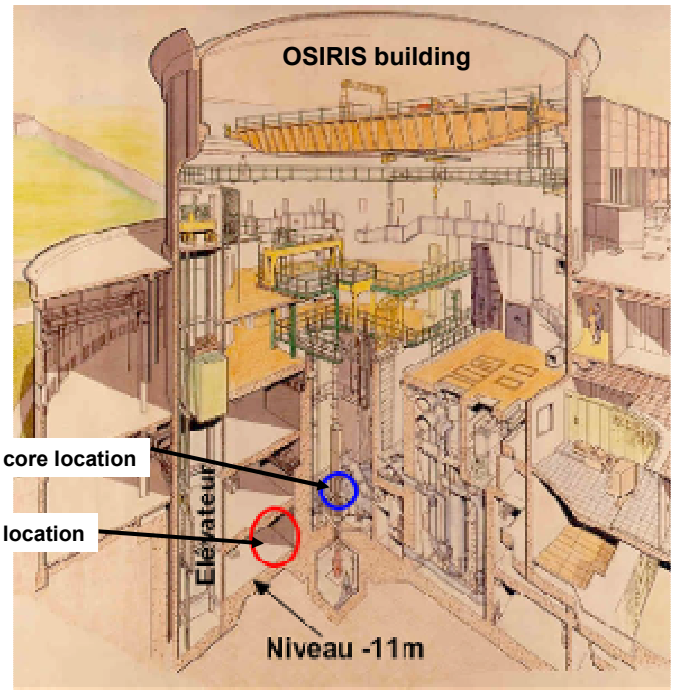

Nucifer

What to remember

- Nucifer inside reactor building
- Nucifer nearest reactor core

Osiris reactor location

Reactor core <-> Nucifer detector distance is around 7 meters

Osiris Configuration

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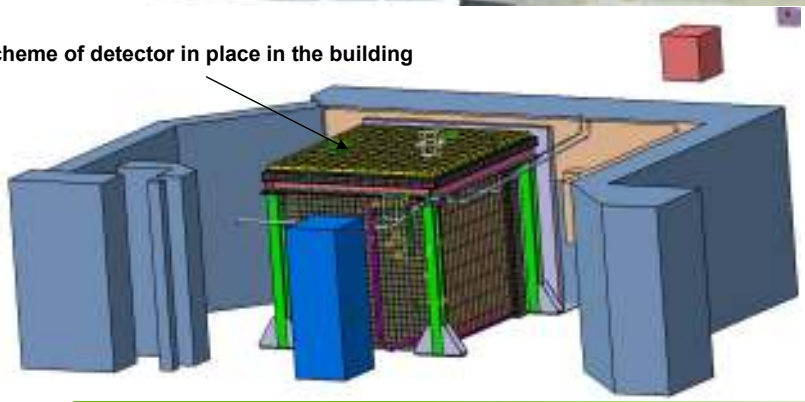
Scheme of detector in place in the building



What to remember

- Reactor facilities in the area

Risk identification

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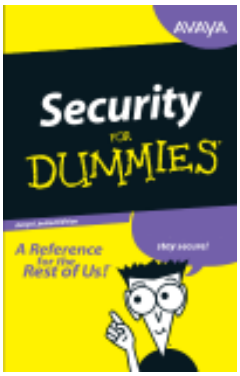
This installation in this kind of area need to care about security and safety
at the beginning of development

Security and safety are related concept

Safety : protected against event which could be considered non-desirable
Security : it take in account the actions of people



First step : identification of all probable risk

- **Fire**
- **Detonation**
- **Earthquake**
- **Anoxia**
- **Mechanical handling**
- **Liquid leak**
- **Materiel activation**
- **People irradiation**

Etc…..

Very probable or not ?
It's not the matter ….

Risk analysis

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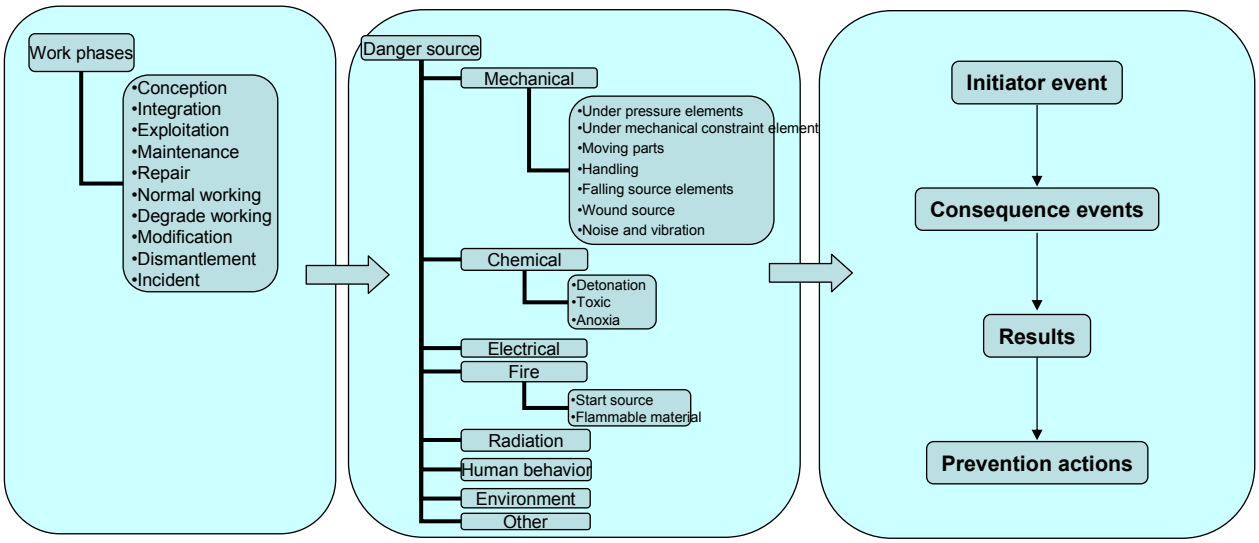
Second step : detailed risk analysis

CEA specialized division **Safety and security experts** + ***Nucifer project team*** **Designer** → **Risk analysis**

Law and rules *Detector design*



Impact study (French rules)

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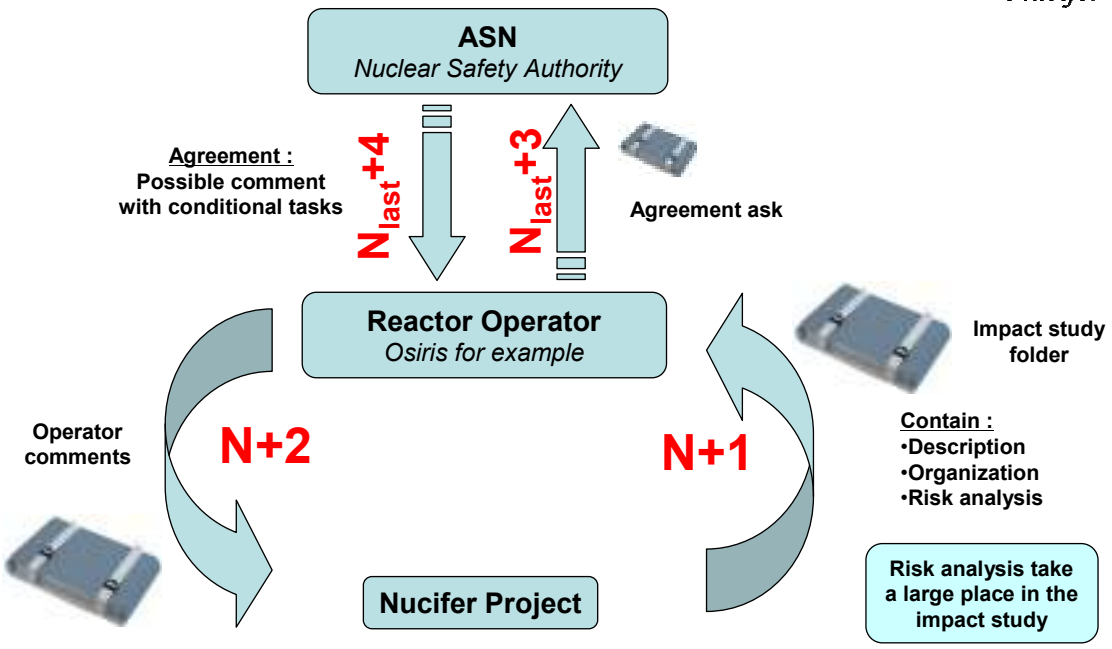

N iterations between Nucifer & Osiris

Security in Nucifer Design

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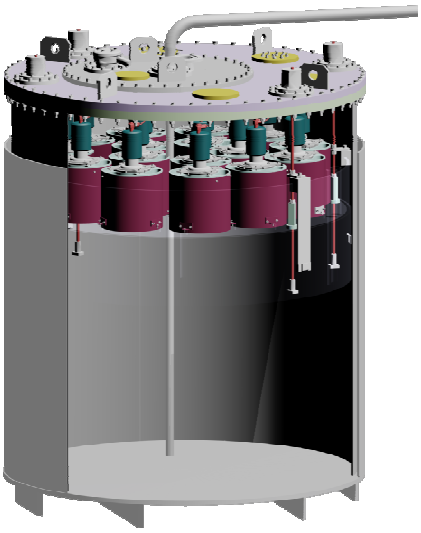
Scintillator liquid

- Thermoplastic coating
- Level monitoring
- Partial double tank with liquid detection
- Liquid detection on the floor
- Additional retention zone for filling



Fire

- Only front end electronic inside the tank
- Oxidizer free atmosphere (nitrogen gas)
- Leakproof tank (with monitoring)
- Temperature monitoring inside and outside tank
- Distant acquisition electronic
- Dedicated filling system to avoid electrostatic discharge
- Fire detection

Security in Nucifer Design

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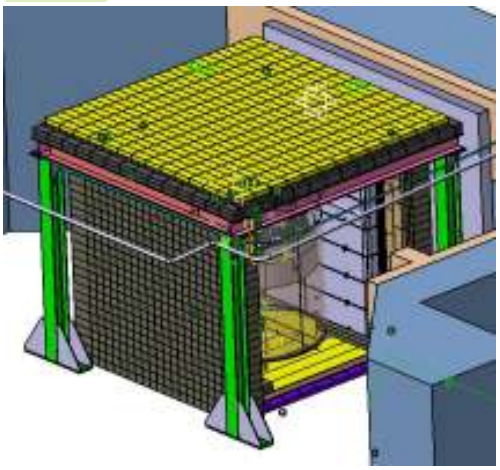

Anoxia	• Anoxia detection
Radiation	• Calibration source utilization procedure and management
Earthquake	• Study of tank with earthquake data • Study of shield structure with earthquake data
Environment	• Study of structural resistance of the building due to the shielding load (~40 tons) • Installation of fire passive protection on reactor and experiences facility

The monitoring system is directly in connection with reactor control room

Fire detection are directly in connection with security of the building

Difficulties

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Technical difficulties :

Rules could ask to use specific kind of material

→ **Not always exist for research development**

Rules could ask to have agreement from qualified company

→ **Difficult to obtain for a prototype**

Management difficulties :

COMMUNICATION

Reactor operator constraints and objective ≠ project objective

Interpretation of rules could be different from people then other

Information about reactor environment difficult to obtain

Conclusion

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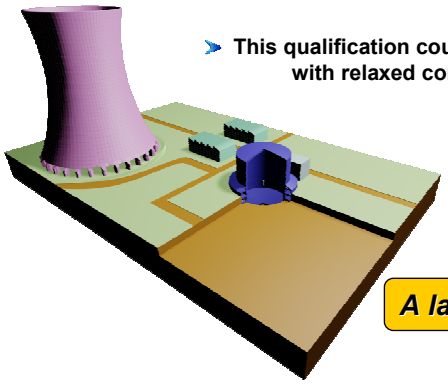
Nucifer

- Nucifer is designed to allow best performance within the smallest allowed footprint with the best security and safety
- It has been a important amount of work qualify a 850L LS detector to be operated at 7 meters from reactor core

  → On way but not completed yet
- The qualification process has been done in parallel with the development of the detector
- This qualification could be use as benchmark for the Nucifer installation in other research reactor
- This qualification could be use qualify a detector like Nucifer to be operated at a nuclear station with relaxed constraints. Distance detector-reactor core : around 20 or 25 meters



A large part of this study could be apply for other reactor sites