

IRSN

INSTITUT
DE RADIOPROTECTION
ET DE SÛRETÉ NUCLÉAIRE

Faire avancer la sûreté nucléaire

The nuclear safety evolutions after the accident at Three Mile Island (1979):
focus on the risk of core meltdown.

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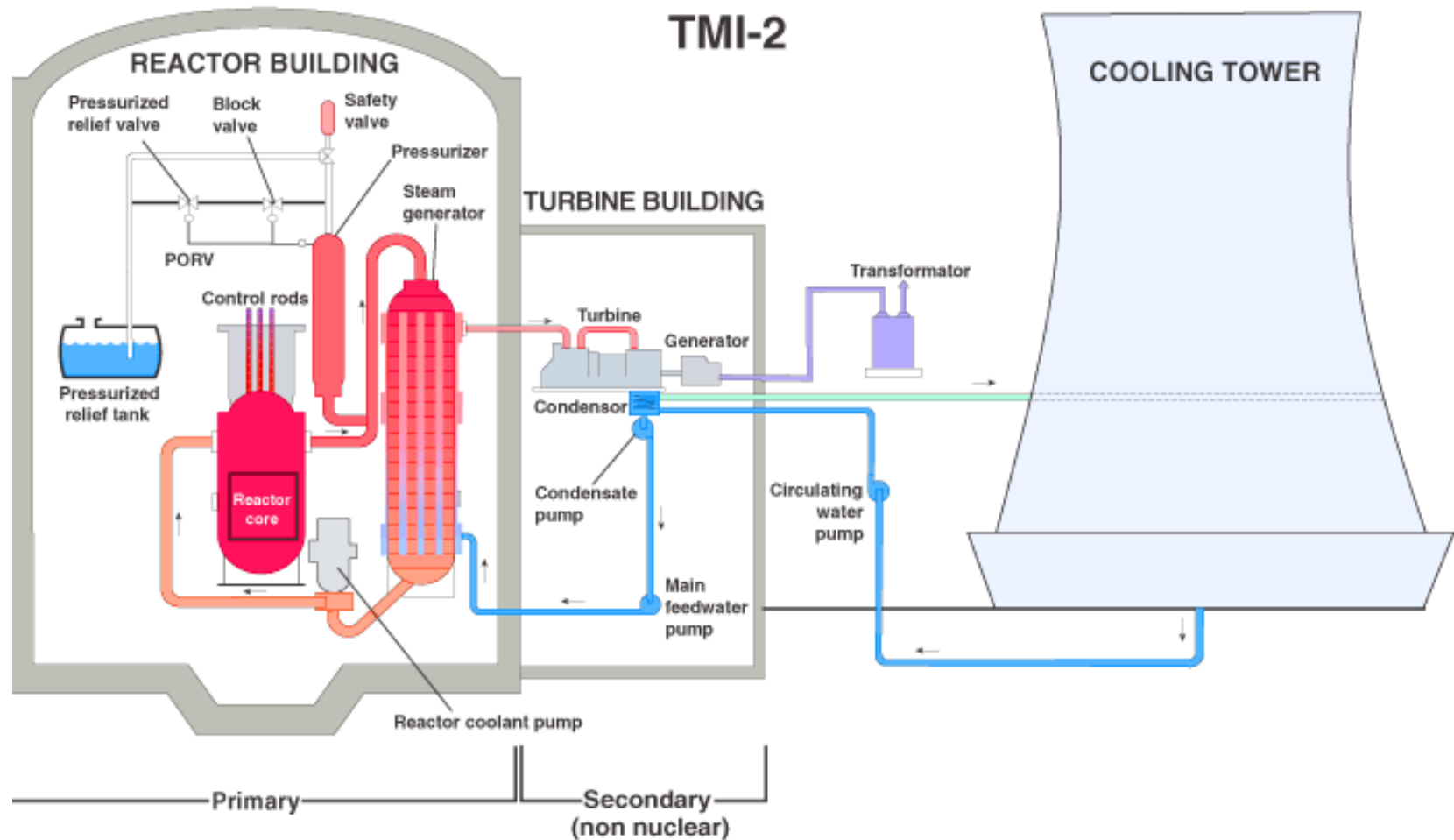


March, 16th
1979

March, 28th
1979



The facts about the accident



Source: NRC, february 2013 – Backgrounder « Three Mile Island »

How TMI accident changed the way to assess safety in France?

- 1. Improvement of the safety assessment methods with the TMI Accident feedback
- 2. Production of new scientific and technical knowledges to better understand the severe accidents phenomenon
- 3. Introduction of social sciences reflections into nuclear safety regulation system

The Rasmussen Report (1974/1975)



- A core meltdown is more likely to occur after a small break in the primary circuit ($8 \cdot 10^{-5}$ per reactor year) than after a large break ($4 \cdot 10^{-5}$ per reactor year)
- This conception stressed the “envelope accident” approach which based the design on the “maximum credible accident”
- The realization of the “multiple failures” scenario lead experts to reexamine the ways to assess the safety

1. Improvement of safety assessment methods at IPSN

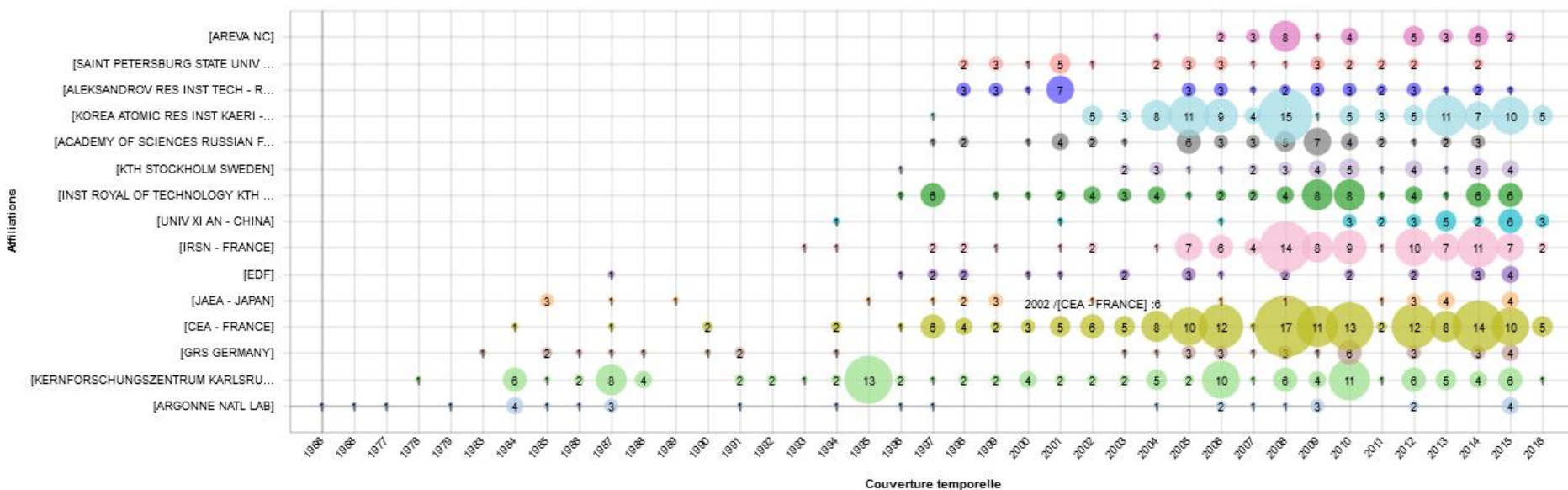
Improvement of the deterministic approach:

- Completion of the envelope scenario with a probabilistic approach,
- Development from 1981 of U procedures in cooperation with IAEA in case of overdesigned accidents,
- Retrofitting of nuclear powerplants to permit a mitigation of the accident (sand filters).

Development of probabilistic methods in France, in addition to the deterministic approach:

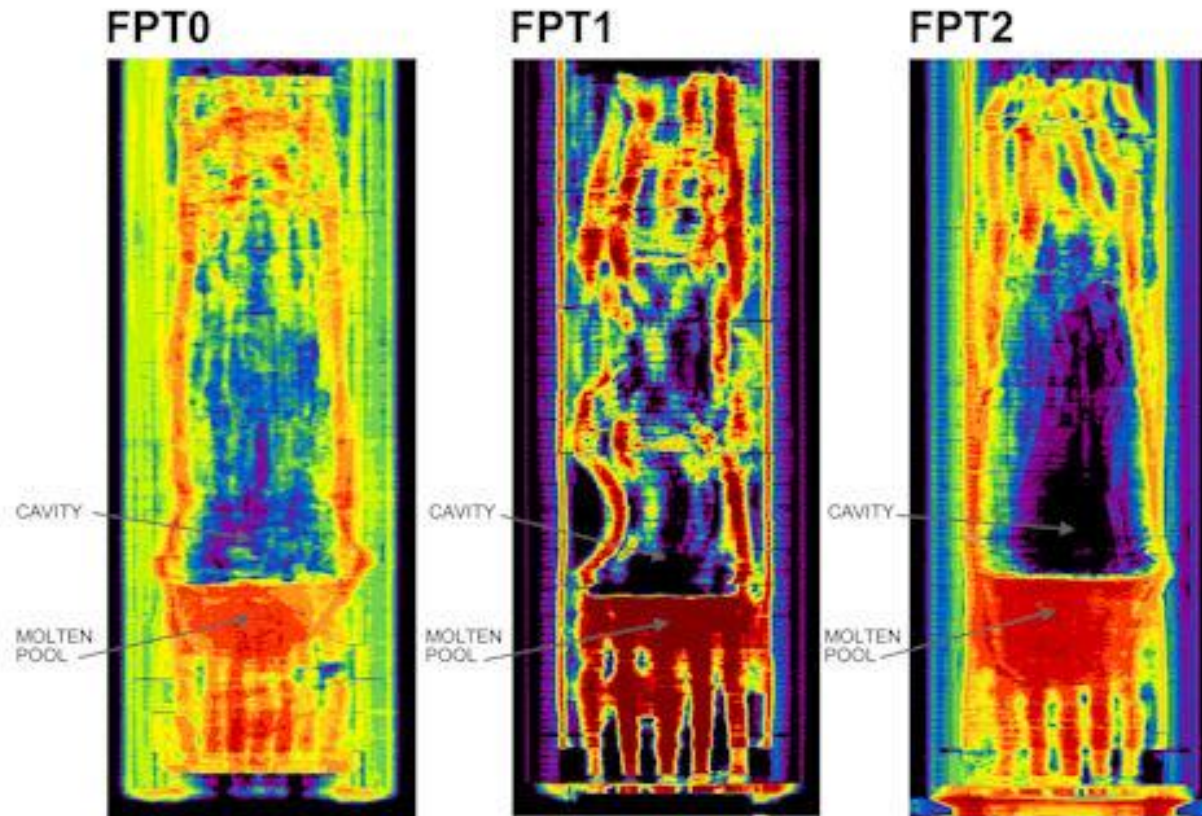
- 1982 : beginning of the first French PSA, published in 1990,
- Progressive introduction of probabilistic methods of safety assessment to understand the accident scenarios and the way to reduce their probabilities,
- Creation in 1982 of a probabilistic analyses division which became transversal to work with all the experts to take into account all the lessons learned with the PSA.

2. Production of new knowledges about severe accident

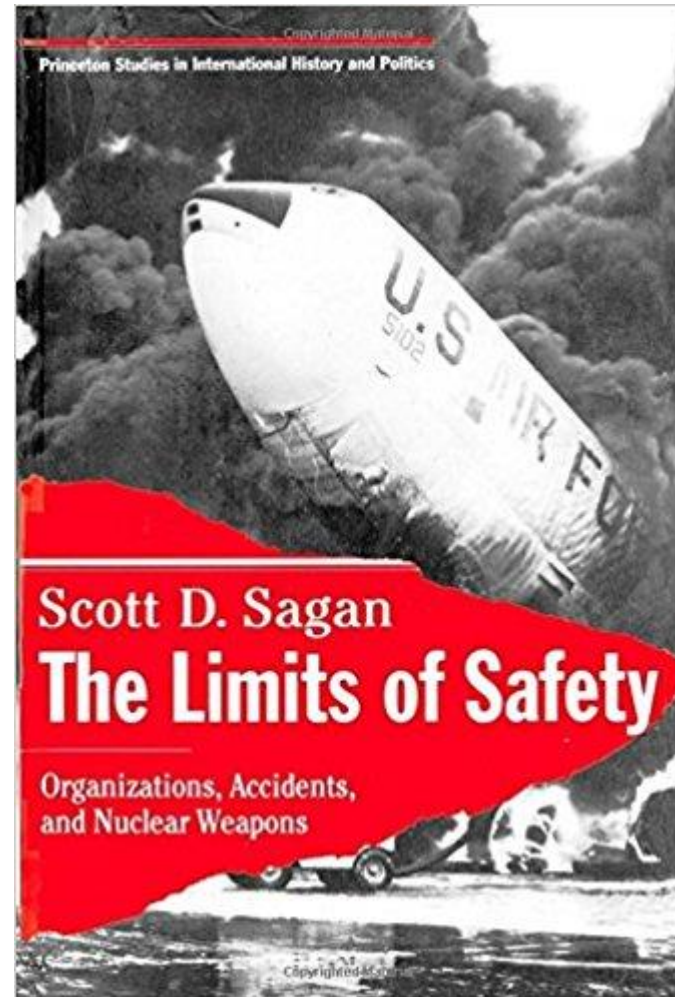
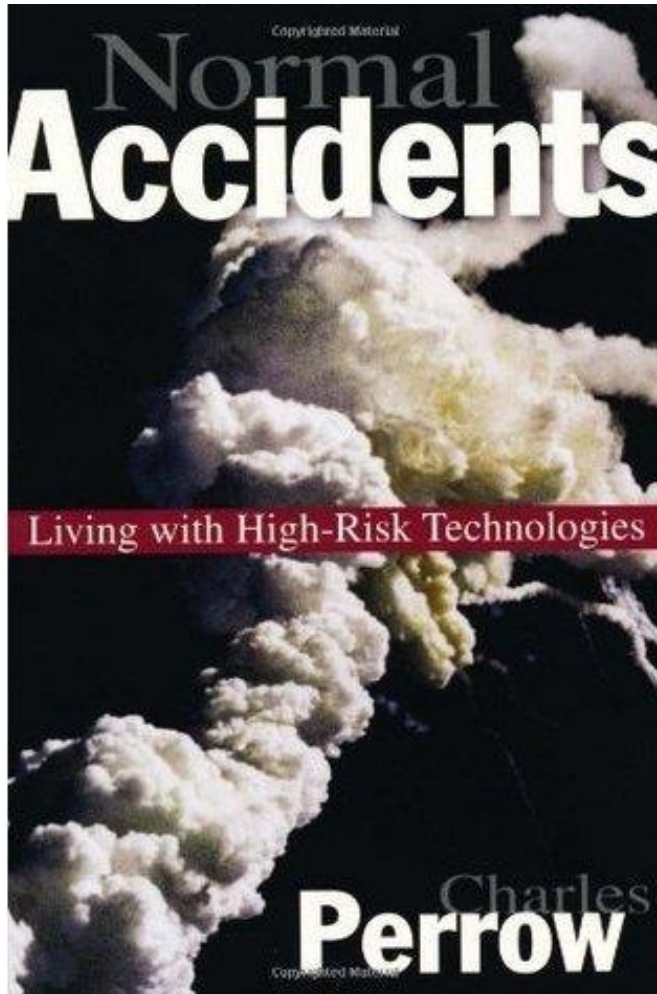


Bibliographic research on Scopus and Web of Science (2016) with « core meltdown » and « corium terms »

Development of experimental programs: Phébus PF in France

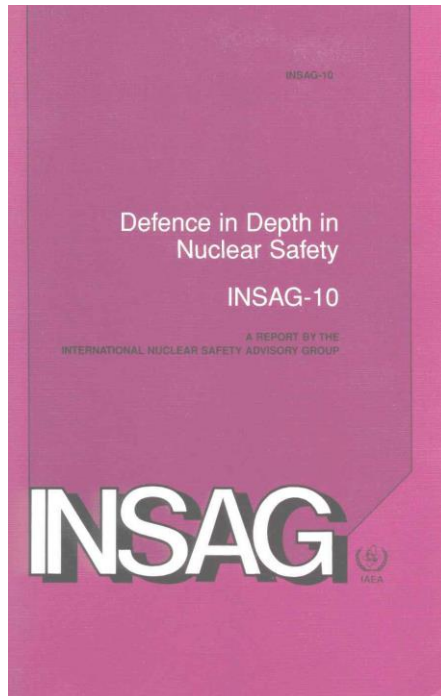


3. Reflections of social sciences



A process reinforced by Chernobyl accident (1986)

- AIEA task force in the 1990s which lead to INSAG-10 and INSAG-12 reports
- Core meltdown management remains nowadays an R&D issue: ex. IVRM



**In-Vessel Melt Retention strategy
for high power nuclear reactors
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Conclusion: Why making the History of nuclear safety?

- Better understand the trajectory of the core meltdown risk treatment to reconstitute the long term issues,
- Provide recommendations to improve the expertise of IRSN by highlighting the underpinning economic and political aspects involved in the expertise process to manage them.

Thank you for your attention!

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