CORE MELTDOWN ACCIDENTS; LESSONS LEARNED FROM FUKUSHIMA

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Rensselaer Polytechnic Institute

RPI History

The Rensselaer School was established in Troy, New York, in 1824 by Stephen Van Rensselaer, along with educator and scientist Amos Eaton, "for the purpose of instructing persons ... in the application of science to the common purposes of life."

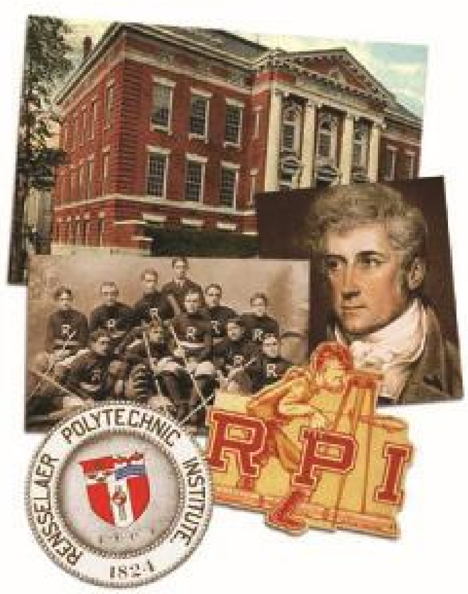
It is "...the first school of science and school of civil engineering, which has had a continuous existence, to be established in any English-speaking country" according to Palmer C. Ricketts in his preface to the second edition of his History of Rensselaer Polytechnic Institute (1914).

In 1833 the school became the Rensselaer Institute, and in the 1850s its purpose was broadened to become a polytechnic institution.

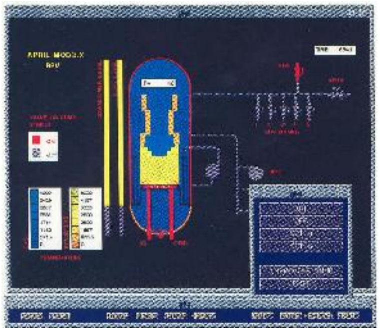
The Institute's name was changed in 1861 to Rensselaer Polytechnic Institute.

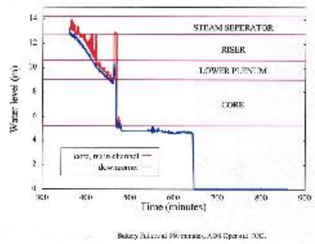
Rensselaer maintains an online archive of five rare books covering the Institute's early history.

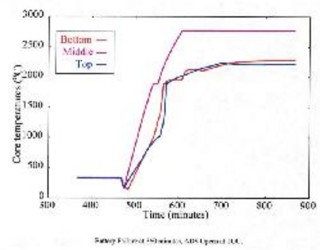
Published between 1855 and 1968, the books detail Rensselaer's founding and development, and place the school in the context of scientific and technological education in the 19th and 20th centuries.



APRIL.MOD3X: BWR Severe Accident Analysis Code

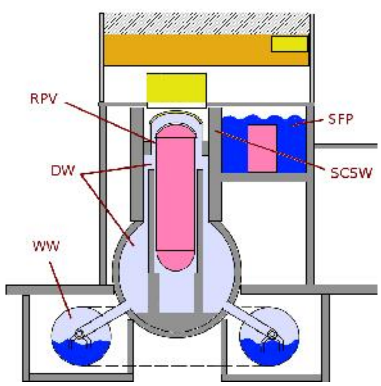


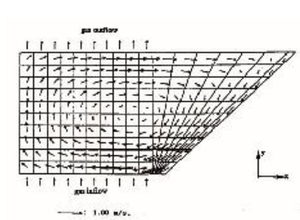


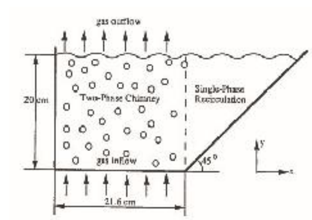


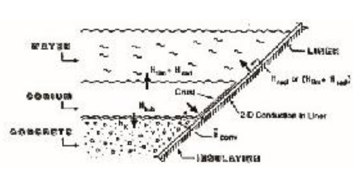
Predictions of Fukushima-type accident using RPI code, APRIL.MOD3X (1998)

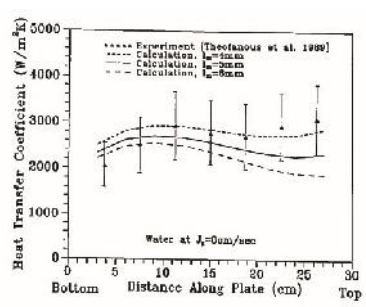
Corium-Liner Heat Transfer in MARK-1 Containment [Lopez et al.]











Podowski Engineering Consulting (PEC)

- PEC performs consulting services in the area of thermal systems engineering and safety, including:
  - model development and computer simulations,
  - nuclear reactor thermal-hydraulics, dynamics and stability,
  - severe accident analysis
- Fukushima-Daiichi accident issues:
  - How to maximize lessons learned from post-accident examination
  - Importance of enhancing international collaboration

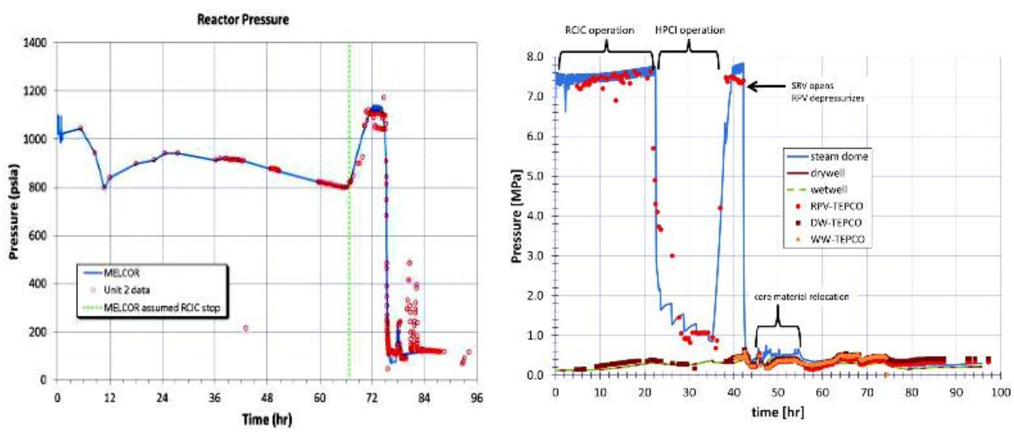
Importance of Post-Accident Examination

- Post-test and post-accident examinations provide valuable insight into the state of material relocation, distribution of individual components and accident history
- Combining ‘end-state’ findings with recorded instrument readings should provide information directly applicable to model corrections and/or updates
- US Department of Energy already initiated efforts to identify most useful recommended inspections at Fukushima

Recommended Post-Accident Inspections at Fukushima

- Both ex-vessel and future in-vessel inspections should include information about spatial distributions of the damage/failure zones:
  - RPV penetrations around the vessel,
  - degree of instrumentation damage at different locations,
  - azimuthal distribution of relocated in-core materials,
  - local debris distribution inside lower plenum and on lower head,
  - signs of the impact of single RCIC loop operation on in-vessel phase distribution and nonuniform core cooling.

Unresolved Multiphase Flow Issues arising from Accident Progression Analysis at Fukushima Daiichi



(a) Unit 2 (b) Unit 3

Pressure history in two reactor units following tsunami (Gauntt et al., 2012)