

PAUL SCHERRER INSTITUT



Wir schaffen Wissen – heute für morgen

**Paul Scherrer Institut**

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**Modelling of Fukushima Block 4 Spent Fuel Pool  
using MELCOR 1.8.6 (SFP version)**

- **Power: 2381 MW<sub>th</sub>**
- **Shut down: November 30<sup>th</sup> 2010**
- **Whole Core discharged into Spent Fuel Pool**
- **Decay Heat at March 11<sup>th</sup>: 2.9 MW (ANS 0.125% at 10<sup>7</sup>s)**
- **Number of Fuel Elements 1331 inclusive 548 of core**
- **Additional 1.5 cores old fuel**
- **Decay Heat guess 2MW (ANS 0.06% at 10<sup>8</sup>s)**
- **Volume of Pool: 1425 m<sup>3</sup>**
- **Starting conditions: Pool full, 30° C**

**Combustion after 4 days**

**Upper reactor building structures destroyed**

**2 fires observed after combustion**

**Release of fission products possible**

**Input deck developed from for generic spent fuel pool  
(Ginna NUREG/CR-0649)**

**Available data from Fukushima I Block 4 used**

**Pool geometry**

**Axial and radial power distribution unknown**

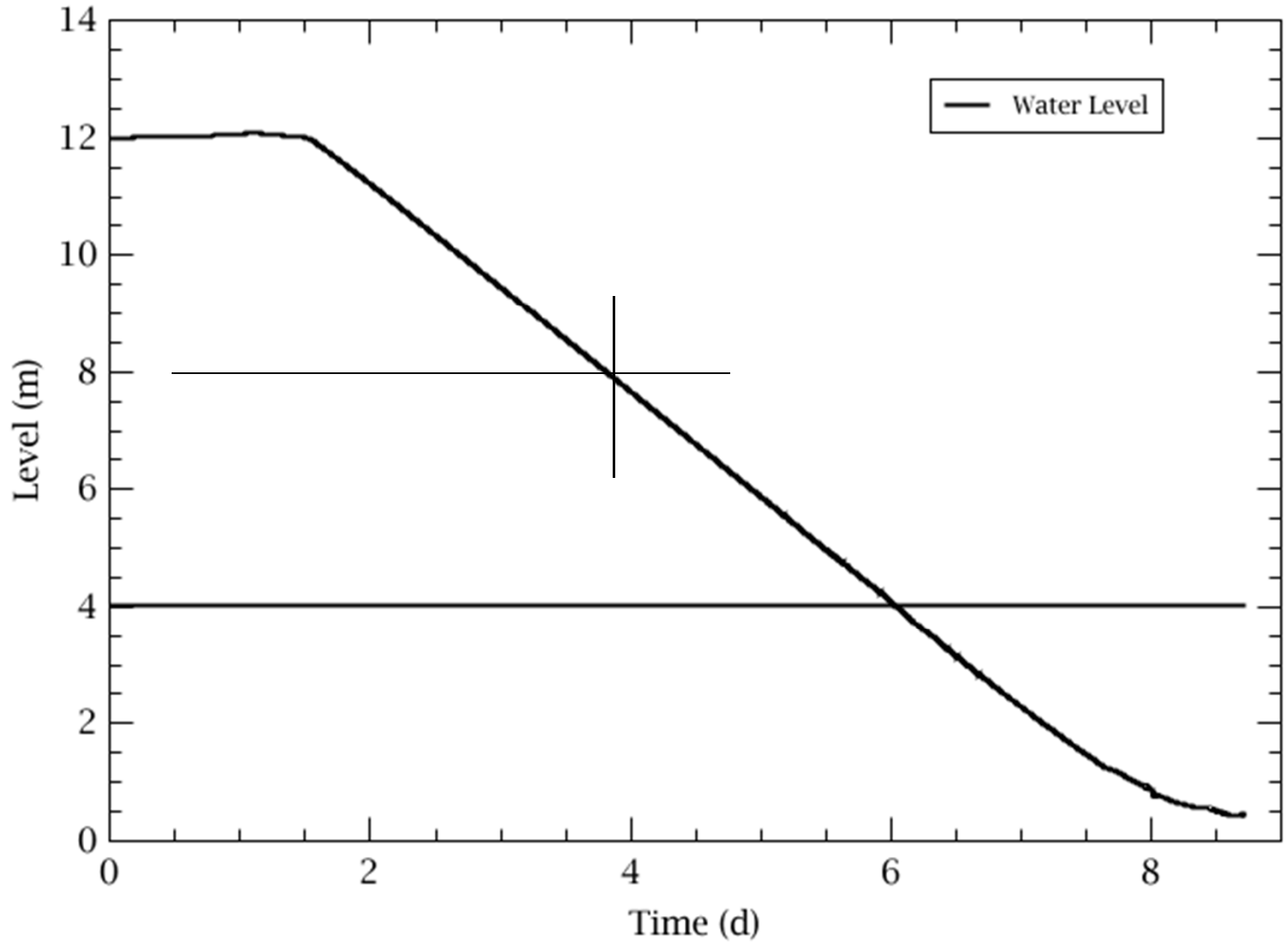
**10 axial nodes, 5 radial nodes**

**Nuclide inventory unknown**

**Burnup history unknown**

**Assumptions of heat load**

# Water Level, 5 MW, full pool



**Mass distribution taken from nuclide card (Karlsruhe)**

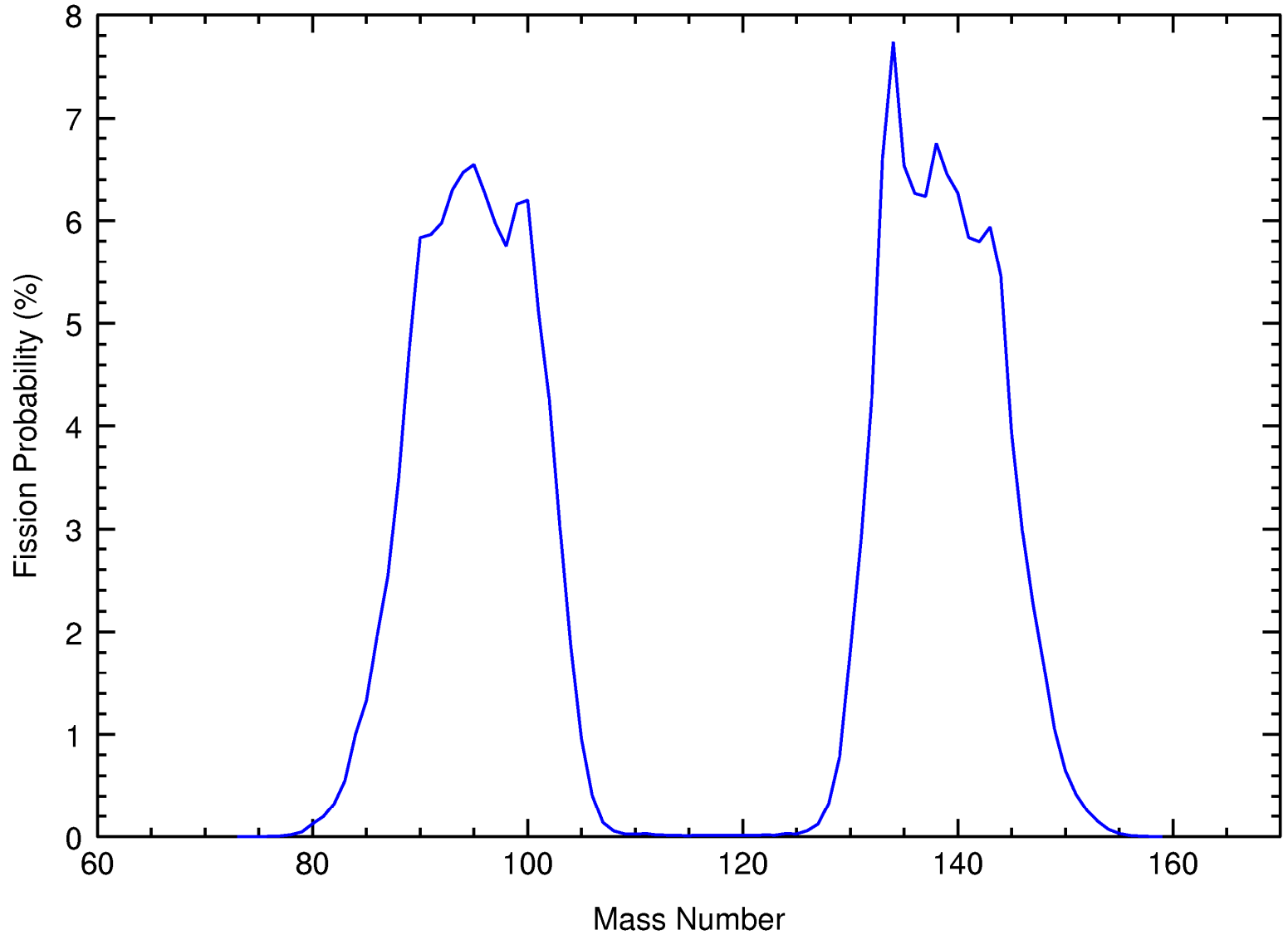
**Position of N/Z values from fission products taken from Bethe-Weizsäcker formula (Minimum Potential Energy)**

**Neutron evaporation of fission products calculated from equal temperature assumption in fission products**

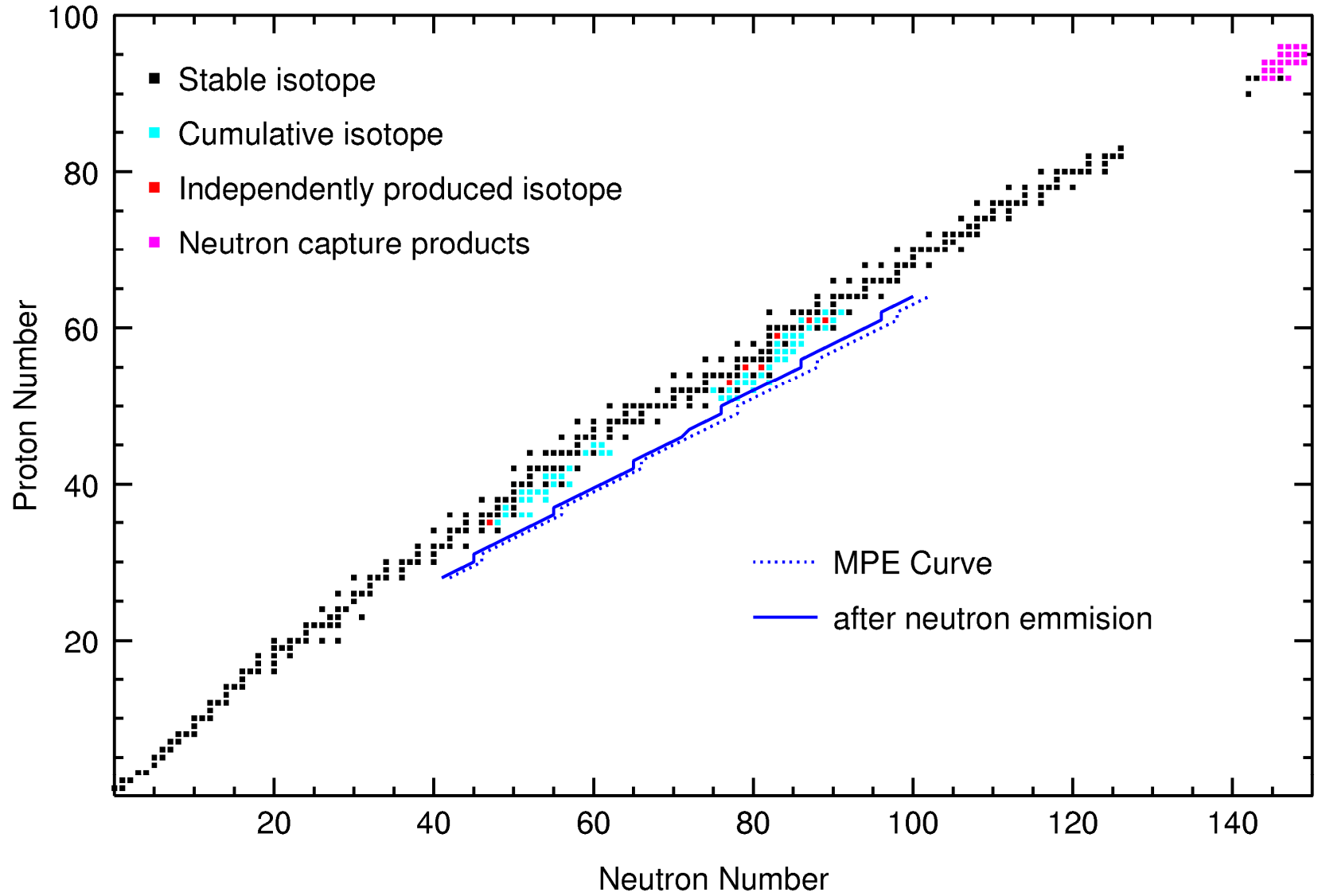
**Number of fissions per second calculated for 200 MeV energy release per fission for a 1 GW<sub>th</sub> reactor**

**Energy release of fission products from NDS**

# Fission Product Mass Distribution

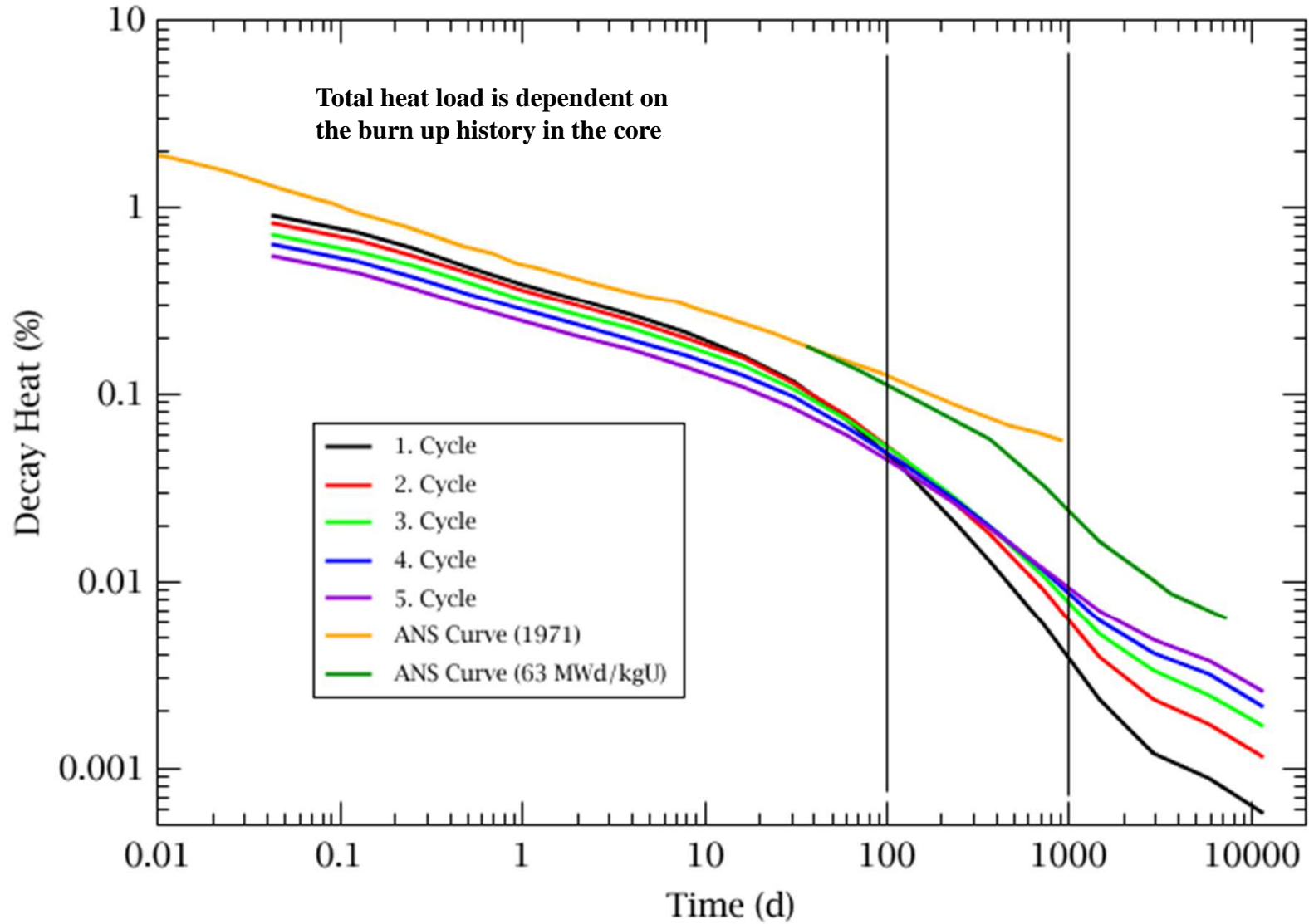


# Fission products and Trans Uranium products

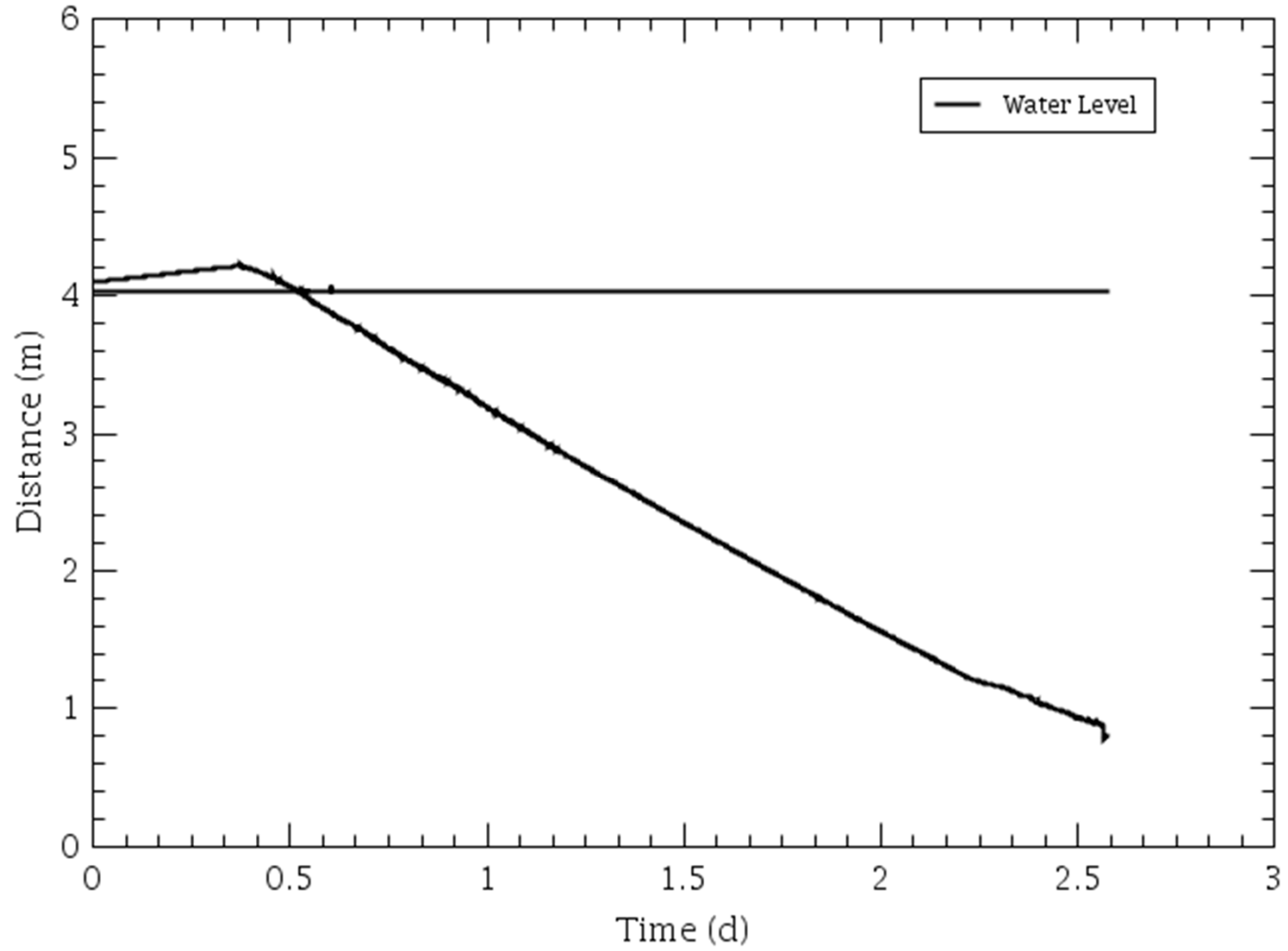




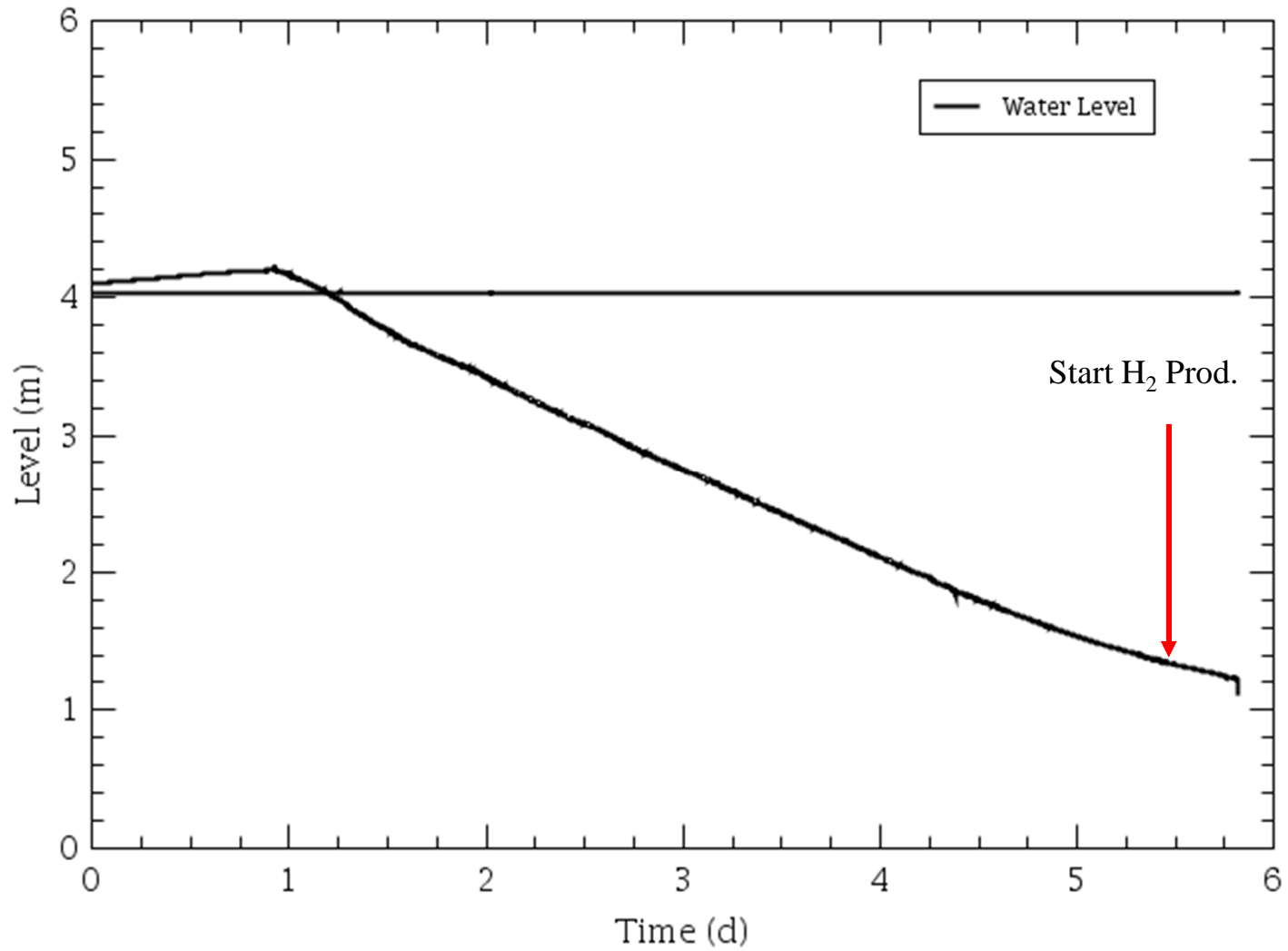
# Heat Load in SFP



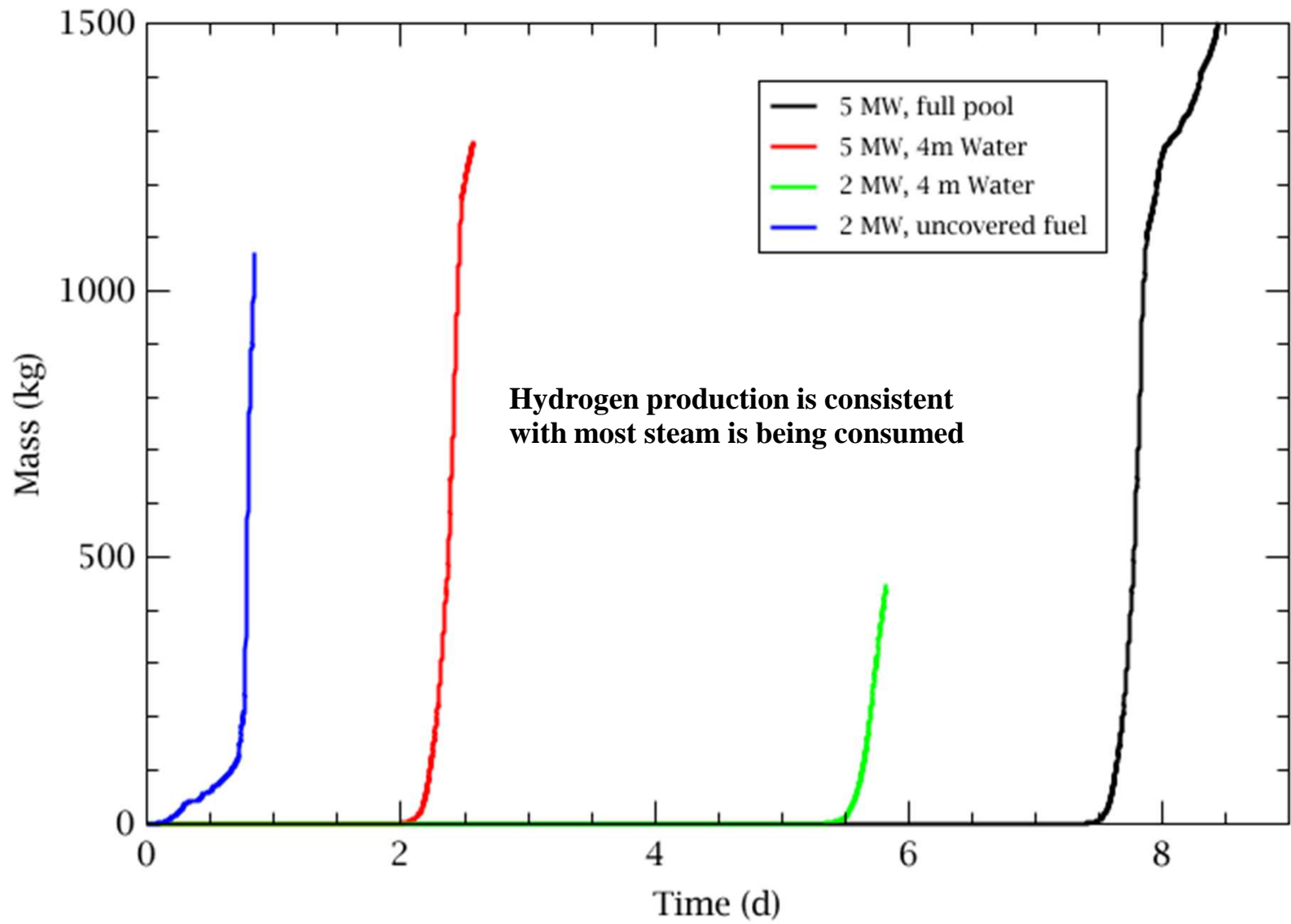
# Water Level, 5 MW, 4 m



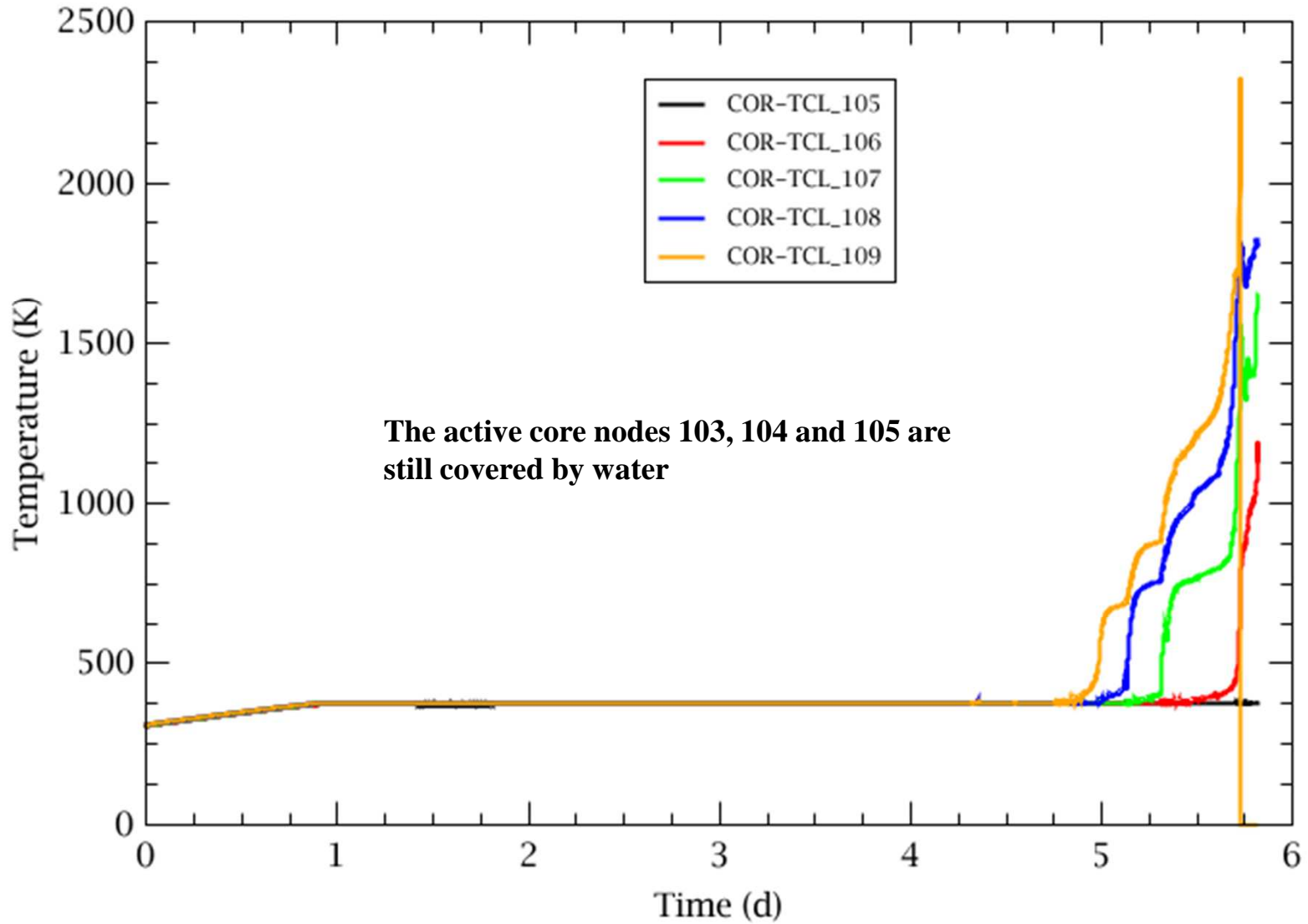
# Water Level, 2 MW, 4 m



# Hydrogen Generation

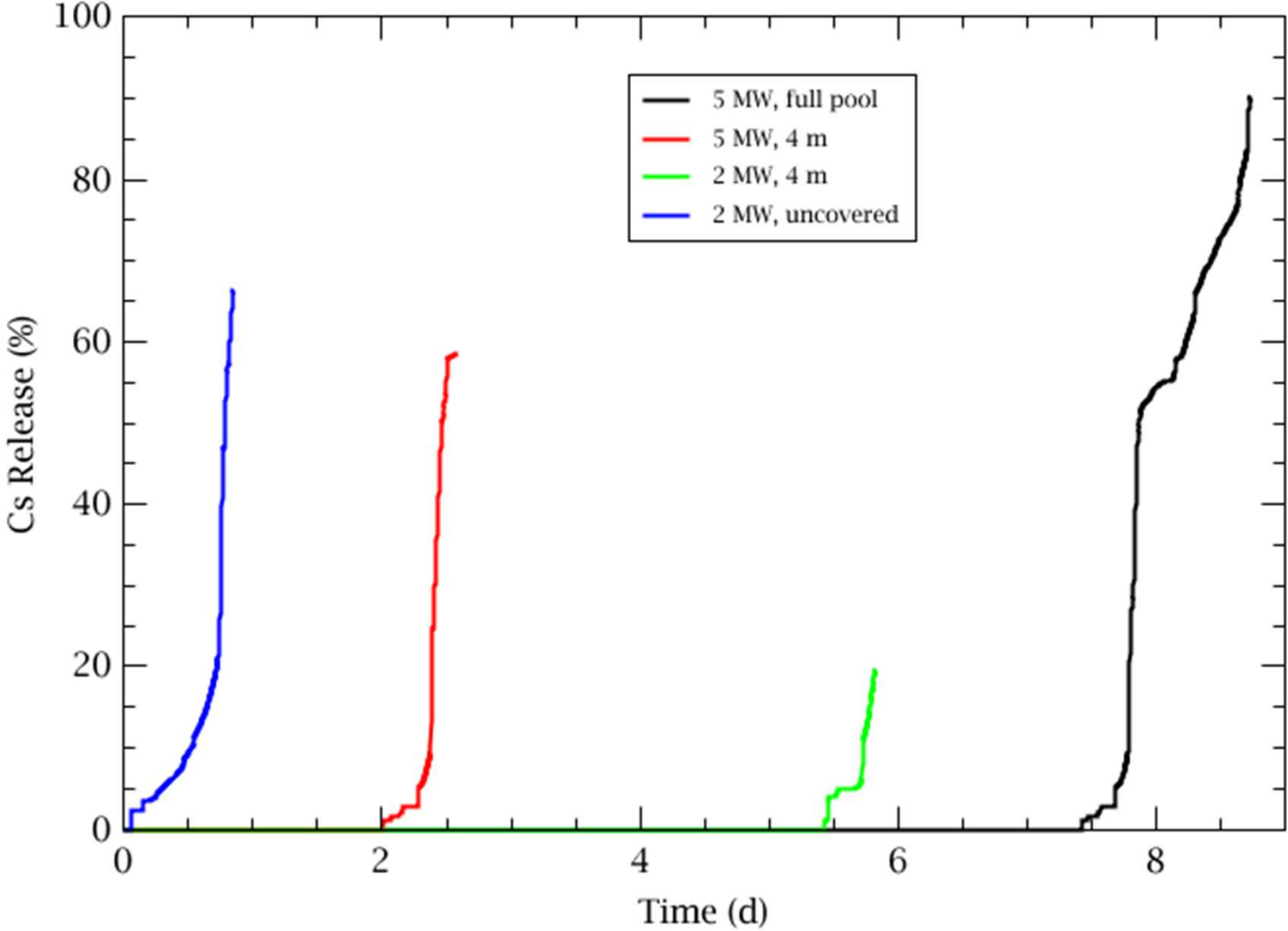


# Axial Temperature Distribution

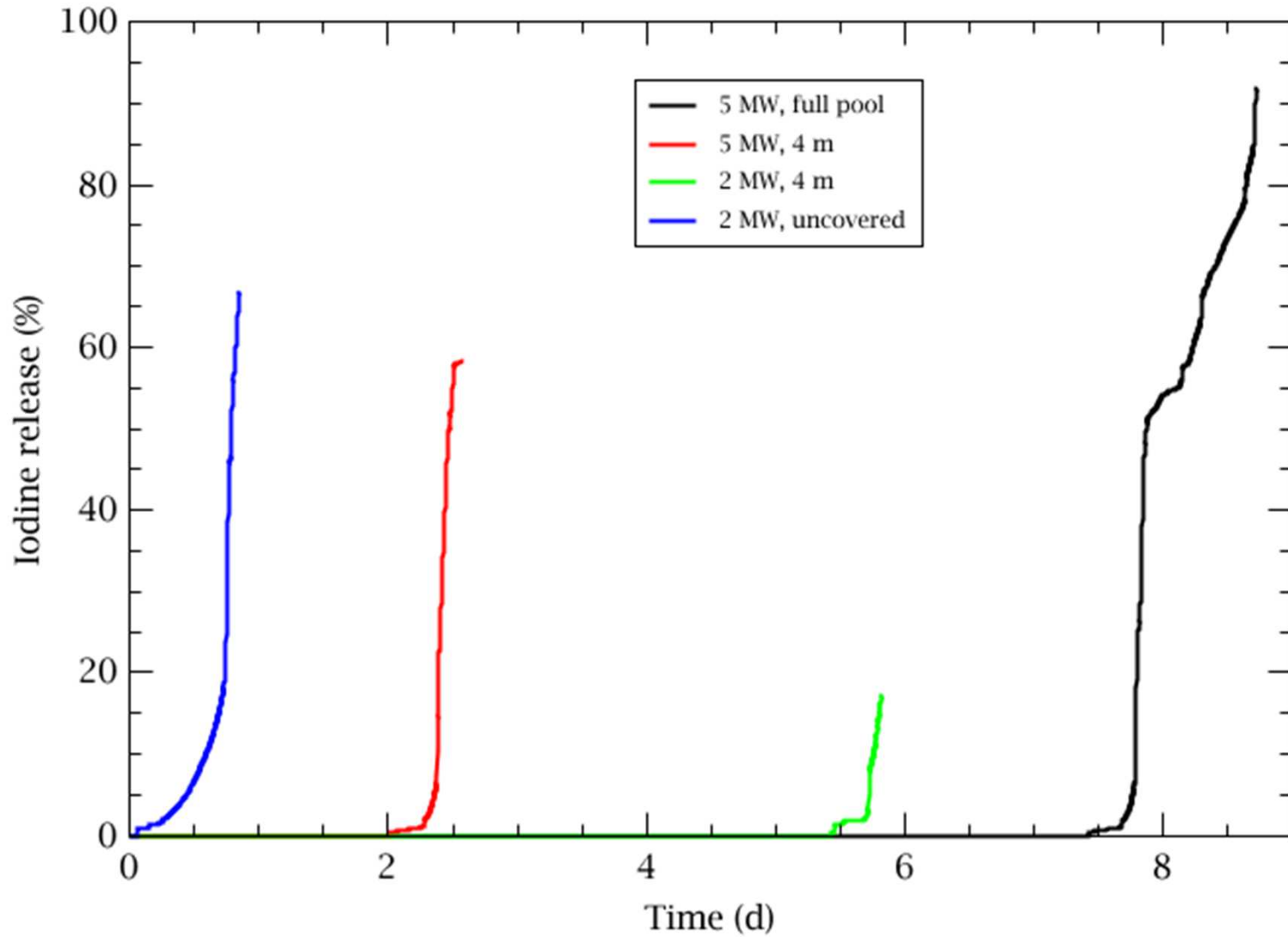


# Caesium Release

predominantly Cs-137



# Iodine (127 and 129) Release



**The observed explosion (due to generated H<sub>2</sub>?) can only be explained with a massive loss of coolant from the spent fuel pool, but then massive release of radioactivity should be observed (Cs-137 but no I-131).**

or

**Was the explosion due to flammable vapour (diesel fuel) under the conditions of about 100° C in the upper reactor building?**

or

**Is there a possibility of sufficient H<sub>2</sub> formation from radiolysis to drive a deflagration?**



Thank you for your attention

