Current results of the ISTC project #2916 (CHESS)

(Part 1: Input data and general approaches to modeling)

Content

- Current results on Task 2 (Database)
- Current results on Task3 (Uranium and Zirconium in melted metal)
- Practical task definition for modelling

(Next report – abilities of modelling at present and first results obtained)

PROJECT OBJECTIVE: DEVELOPMENT OF THE MODELS FOR NUCLEAR FUEL BEHAVIOR DURING ACTIVE PHASE OF CHERNOBYL ACCIDENT

This model has to make it possible to:

- explain current physical and chemical state as well as spatial location of fuel containing materials (FCM) and radioactive substances inside the damaged Unit;
- evaluate possibilities of modeling and find out “bottle necks” within the existing computational programs while modeling Chernobyl type accidents;
- determine directions of future research into the problem.

Database structure

1. Construction and materials of Unit #4 before the accident

2. Layout of constructions and
following the accident

3. Heat sources involved into la

4. Physical and chemical proce

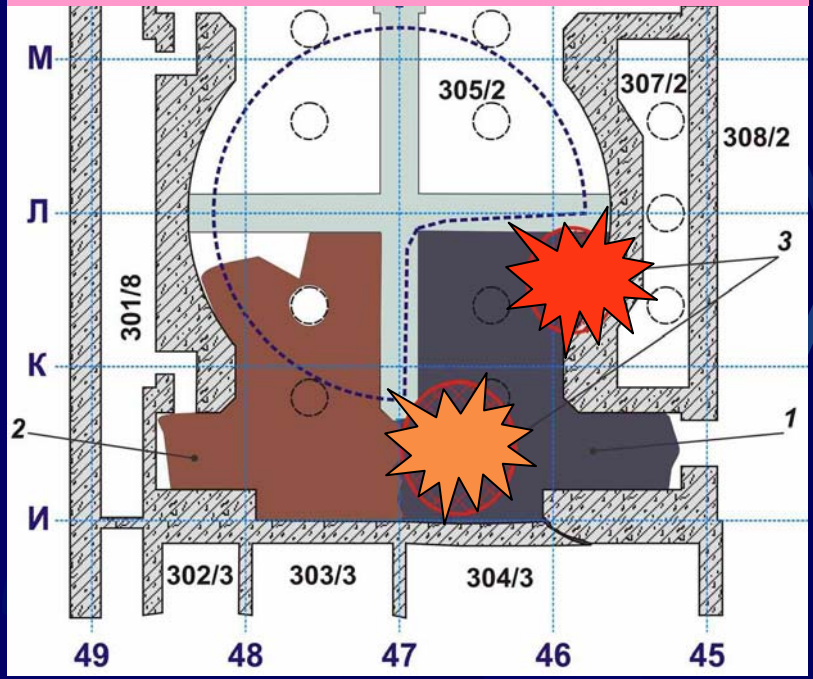
5. Lava spreading

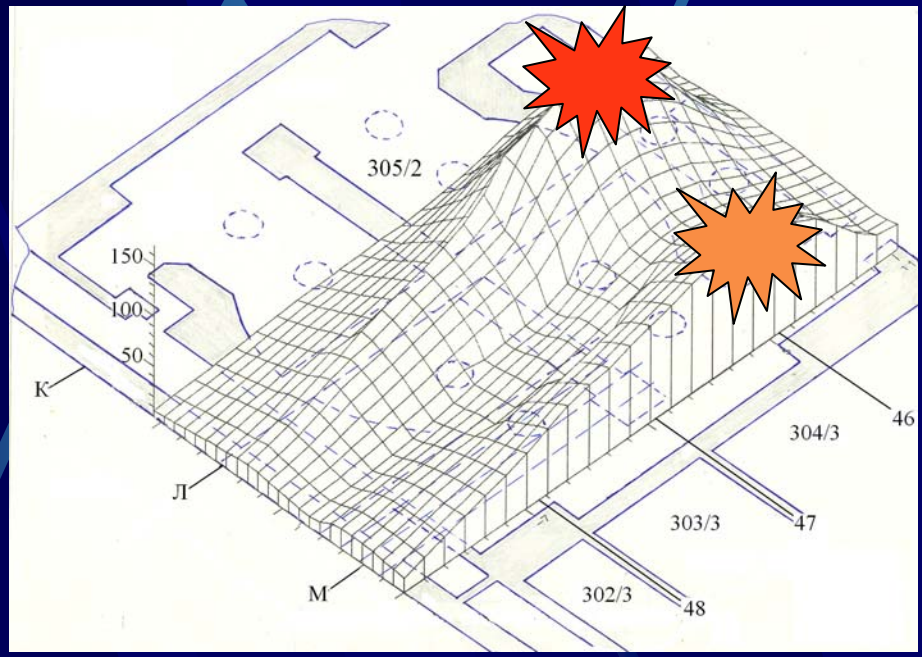
- Characteristics of nuclear fuel in Unit #4 before the accident
- eral view of the reactor
- Lava generation (FCM in Room

- Horizontal lava flow. LFCM at +9 m level mark and in Rooms 217/2 and 017/2
- Large and minor vertical flows
- Metal spreading
- Lava spreading

New vision of lava homogeneity

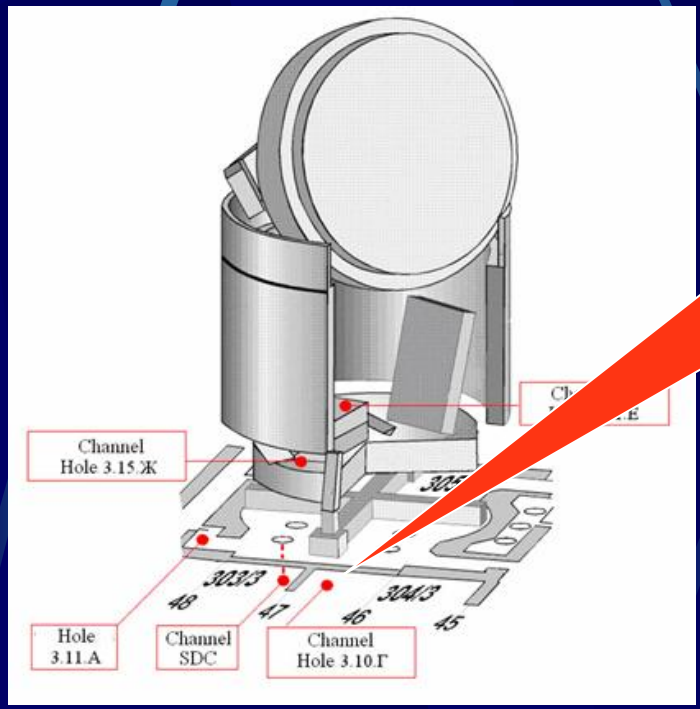
Expected location of areas containing FCM accumulations with high uranium concentration

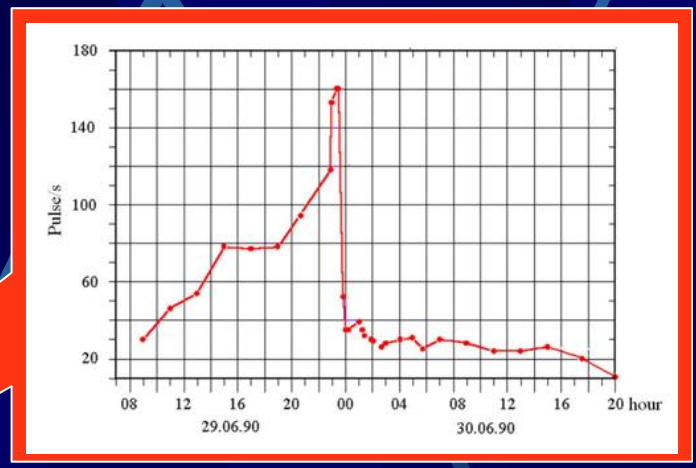


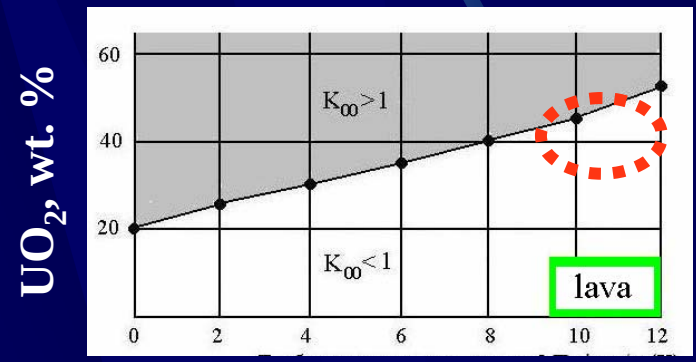


Temperature field in reactor plate according to the results of investigations (1988-1989)

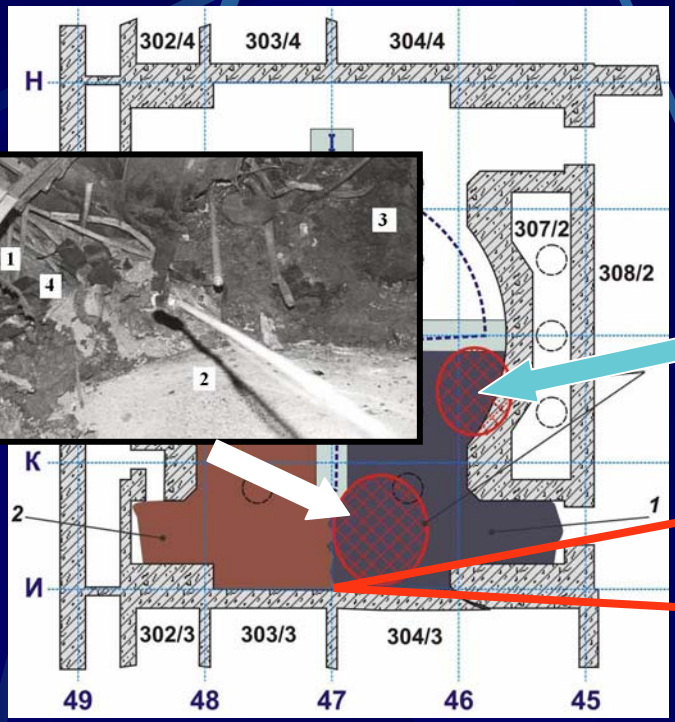
Incident in 1990

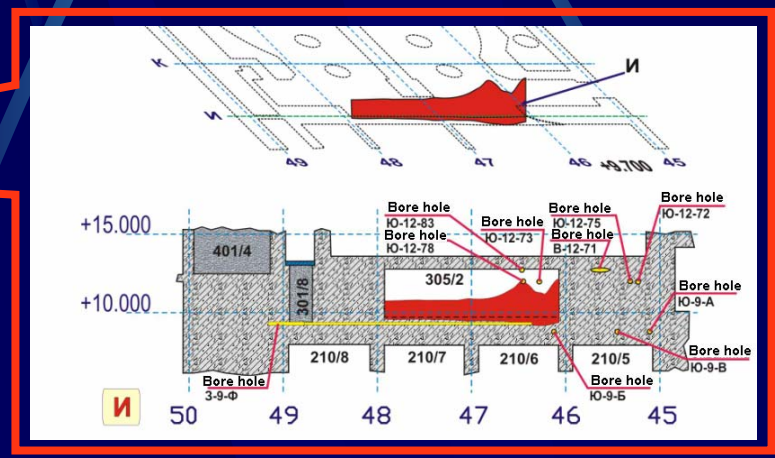






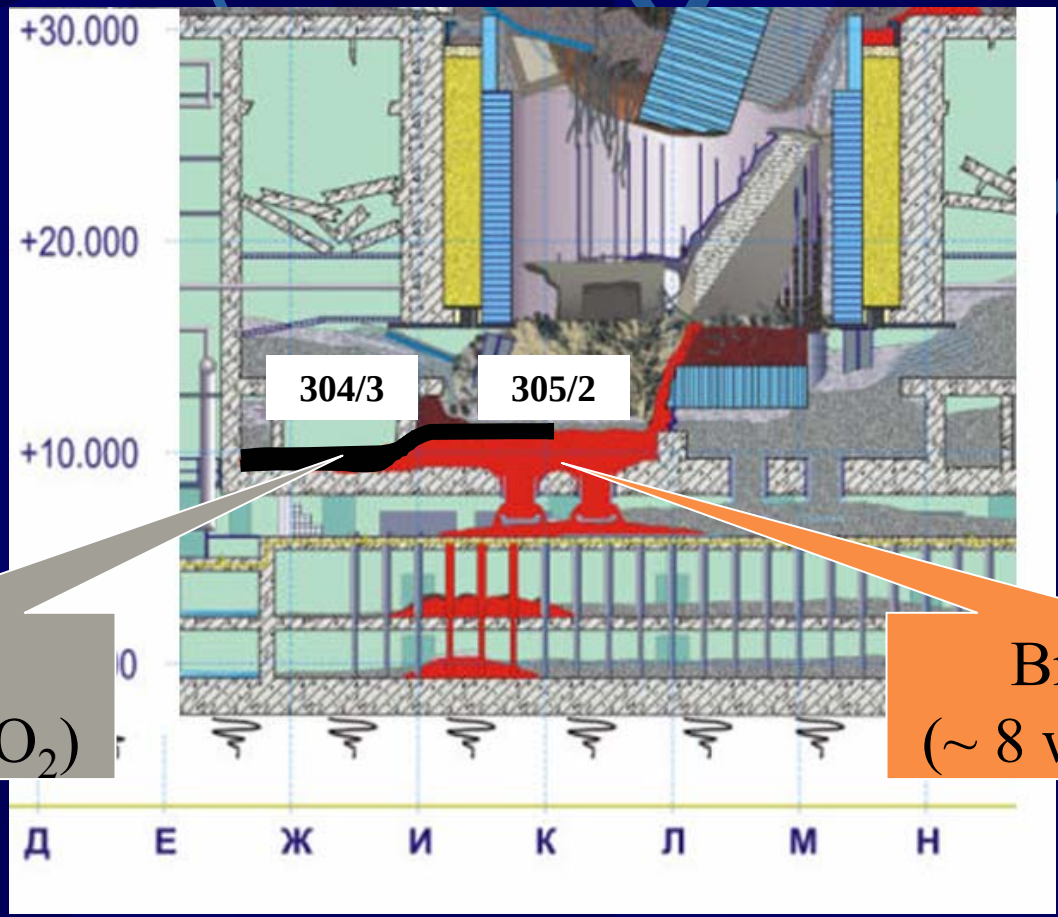
Anticipated location with high Uranium content





1 – Mostly black LFCM
2 – Mostly brown LFCM
3 – FCM areas with high fuel concentration

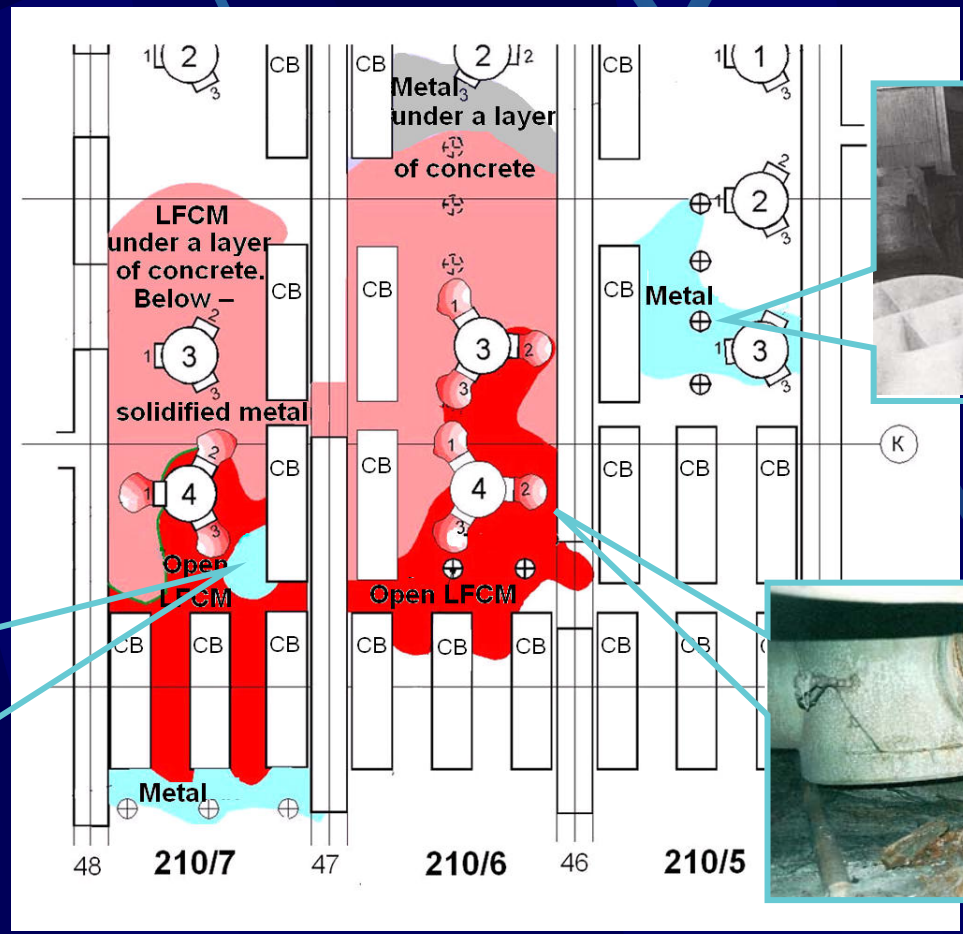
Streams of lava



Black lava
(~ 4 wt.% of UO_2)

Brown lava
(~ 8 wt.% of UO_2)

Molten metal location

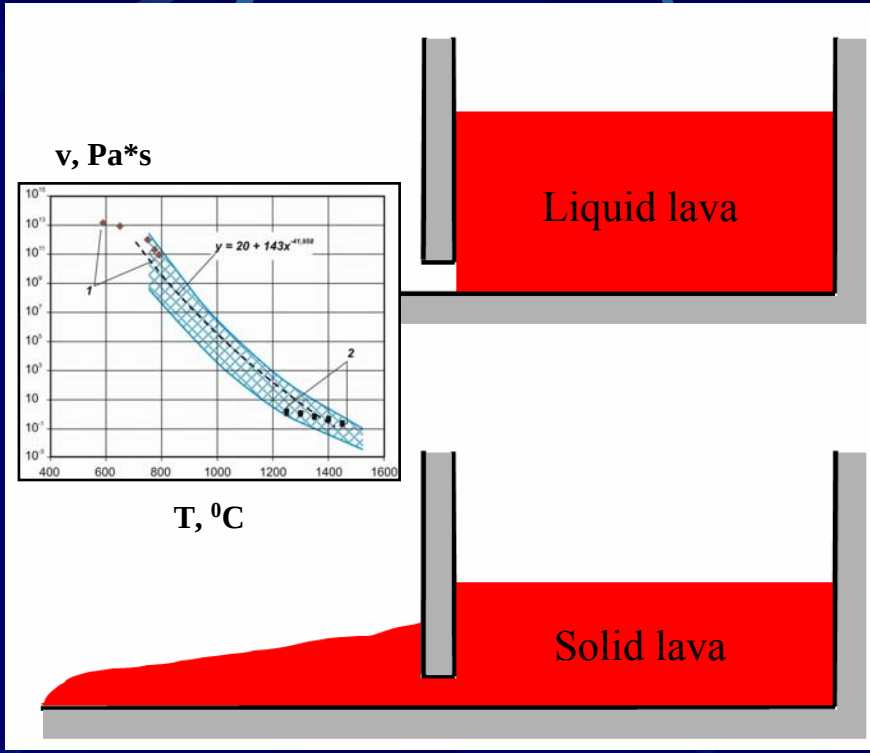


Average radionuclide content in molten metal samples

Sampling area	Bq/g of metal, recalculation as of 26.04.86		
	Co-60/10^6	Sb-125/10^6	Ru-106/10^8
Metal globules from deep-brown ceramics, pile in PSP-1	6,7	7,8	9,4
Metal globules from black ceramics of SDC, "bank"	3,4	8,3	9,8
Metal globules obtained while washing 'chernobylit', Room #304/3	3,2	4,8	8,1
Globules from brown ceramics, PSP, 47-48, И/К, level mark 3.00	3,3	6,3	8,7
Globules from black ceramics, Room #304/3	3,2	5,6	8,3
Spread and solidified metal in SDC	4,0	8,4	8,9

No presence of ^{95}Zr-^{95}Nb as well as Cerium, Europium etc. isotopes

Approaches to modelling ("breach of dam")



Objectives:

1. To compare profile of solidified lava with visible one versus {UO2 content; initial temperature; heat generation; melt viscosity}
2. To take into account lava-concrete interaction (to assess depth of concrete destruction and its involvement in the melt)
3. To assess density separation along height of the melt (?)

Conclusion

- Project #2916 implementation corresponds to schedule.
- Accurate analysis makes us to assume density separation along the corium height.
- Melted metal does not include noticeable amount of fuel.
- Modelling of real lava flows has been started.