IN VESSEL HYDROGEN PRODUCTION

- A Comparison of NRC Contractor and IDCOR Estimations

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THE PRESENTATION IS BASED ON THE FOLLOWING REFERENCES.

- NRC CONTRACTOR CALCULATIONS USING THE MARCH CODE:

  1. GIESEKE, J. A., ET AL., "RADIONUCLIDE RELEASE UNDER SPECIFIC LWR ACCIDENT CONDITIONS," BMI - 2104, VOLS. I - VI (DRAFT PUBLISHED IN JULY 1984).

  2. HANDOUTS FROM THE FIRST NRC/IDCOR MEETING (IN HARPER'S FERRY, WEST VIRGINIA, NOVEMBER 29 - DECEMBER 1, 1983) AND FROM THE THIRD NRC/IDCOR MEETING (IN ROCKVILLE, MARYLAND, MAY 15 - 17, 1984).

- IDCOR CALCULATIONS USING THE MAAP CODE*:

  1. IDCOR TECHNICAL REPORTS 23.1 FOR ZION, SEQUOYAH, PEACH BOTTOM, AND GRAND GULF (DRAFT PUBLISHED IN JULY 1984).
  2. SAME AS NO. 2 ABOVE.
  3. IDCOR TECHNICAL REPORT 12.1, "HYDROGEN GENERATION DURING SEVERE CORE DAMAGE SEQUENCES," (JULY 1983).
  4. IDCOR TECHNICAL REPORT 15.1A, "IN-VESSEL CORE MELT PROGRESSION PHENOMENA," (JULY 1983).

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* IDCOR TECHNICAL REPORTS 23.1 SUPERSEDE OTHER IDCOR RESULTS SHOULD ANY DIFFERENCES EXIST.

QUANTITATIVE COMPARISON OF IN-VESSEL HYDROGEN PRODUCTIONS
CALCULATED FOR VARIOUS ACCIDENT SEQUENCES

- NUMBERS GIVEN ARE THE IN-VESSEL HYDROGEN PRODUCTIONS EQUIVALENT TO THE FRACTION OF ALL ZIRCALOY IN THE CORE OXIDIZED.

- HYDROGEN PRODUCTION FOR ALL ZIRCALOY IN THE CORE OXIDIZED:
  ZION - 1950 LBs SEQUOYAH - 2230 LBs
  GRAND GULF - 7660 LBs PEACH BOTTOM - 6330 LBs

- PWR - TMLB'

PLANT	ZION	SEQUOYAH
BCL	0.51 (0.28 BEFORE CORE SLUMP)	0.49 (0.25 BEFORE CORE SLUMP)
IDCOR	0.15	0.34
RATIO	3.4	1.4

- PWR , ICE CONDENSER CONTAINMENT - S_2HF

PLANT	SEQUOYAH
BCL	0.66 (0.57 BEFORE CORE SLUMP)
IDCOR	0.39 - 0.40
RATIO	1.7

- PWR - S_2D

Plant	Zion Or Sequoyah
BCL	0.85 (0.73 Before Core Slump) For ZION
IDCOR	0.30 For SEQUOYAH

- BWR/6 , MARK III Containment - TQUV

Plant	Grand Gulf
BCL	0.40 (0.18 Before Core Slump)
IDCOR	0.056 (0.0013 For A Case With Depressurization)
Ratio	7.1

- BWR/4 , MARK I Containment - TW

Plant	Peach Bottom
BCL	0.61 (0.60 Before Core Slump)
IDCOR	0.068
Ratio	9.0

- BWR/4 , MARK I Containment - TC

Plant	Peach Bottom
BCL	0.47 (0.26 Before Core Slump)
IDCOR	0.047
Ratio	10.

- IDCOR RESULTS ARE OBTAINED BY ASSUMING (1) AS A CUT-OFF TEMPERATURE OF 2300 K IS REACHED, BLOCKAGE FORMS IN THE CHANNEL AND SHUTS OFF STEAM SUPPLY AND STOPS HYDROGEN PRODUCTION, (2) AS CORIUM ENTERS THE LOWER PLENUM OF THE VESSEL HYDROGEN PRODUCTION DUE TO CORIUM - WATER INTERACTION IN THE VESSEL LOWER PLENUM IS NEGLIGIBLE, AND (3) STEAM GENERATED BY CORIUM ENTERING THE LOWER PLENUM HAS NO EFFECT ON THE HYDROGEN PRODUCTION IN THE CORE. THEREFORE, LOWER HYDROGEN PRODUCTIONS ARE CALCULATED.

- ON THE CONTRARY, BCL RESULTS ARE OBTAINED BY ASSUMING (1) NO BLOCKAGE FORMS AND MELTING NODES REMAIN IN THE CORE FOR OXIDATION UNTIL CORE SLUMPS, (2) AS CORE SLUMPS, MORE STEAM IS GENERATED TO FURTHER OXIDIZE THE REMAINING FUEL RODS IN THE CORE, AND (3) SOME HYDROGEN CAN BE PRODUCED DUE TO CORIUM - WATER INTERACTION IN THE VESSEL LOWER PLENUM.

- IT SHOULD BE NOTED THAT THE TMI-2 ACCIDENT PRODUCED AN AMOUNT OF HYDROGEN EQUIVALENT TO ABOUT 50% OF ALL ZIRCALOY IN THE CORE OXIDIZED. REPEATED PROCESSES OF CORE UNCOVERY - WATER BOILOFF - CORE REFLOOD ARE BELIEVED TO PLAY AN IMPORTANT ROLE IN HYDROGEN PRODUCTION.