ADVANCED REACTOR, FUEL CYCLE, AND ENERGY PRODUCTS WORKSHOP FOR UNIVERSITIES

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DOE Nuclear Hydrogen Initiative

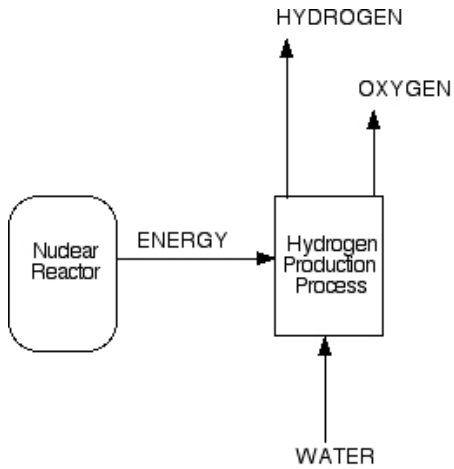
Reactor-Hydrogen Production Process Interface

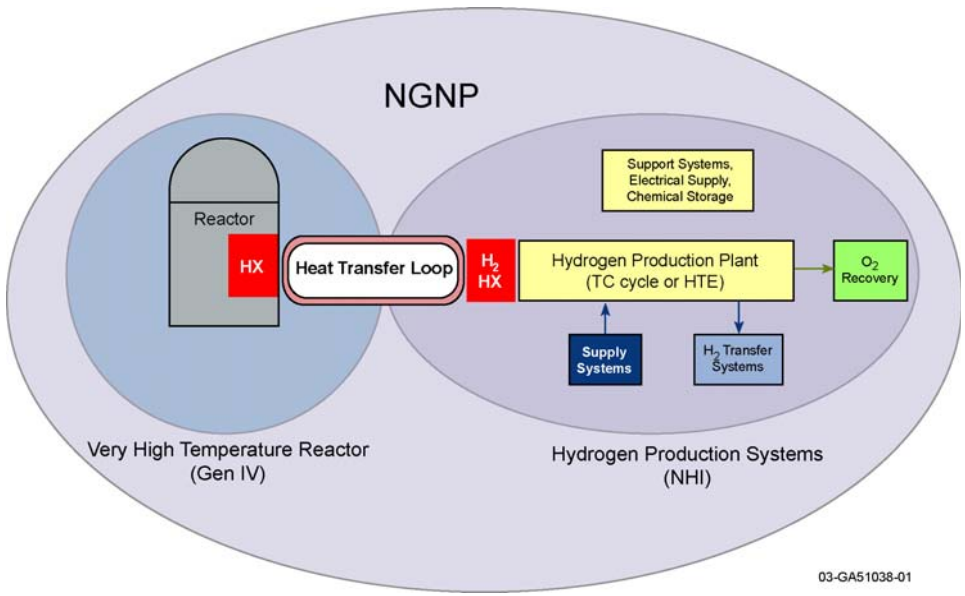
Intermediate Heat Transfer Loop

Workshop for Universities
Hilton Hotel, Gaithersburg, MD
March 20, 2007

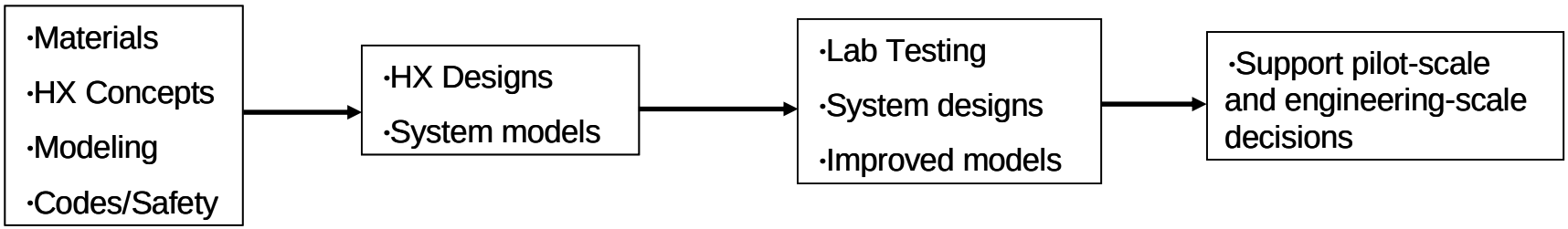
Overall Work Scope

- DOE Nuclear Hydrogen Initiative is concerned with developing the technologies necessary to enable commercial-scale production of H_2 using nuclear power
- Intermediate Heat Transfer Loop
  - High-temperature heat transport loop between the nuclear plant and H_2 plant
- Assumptions
  - Nuclear plant
    - VHTR
  - H_2 Plant
    - S-I process
    - HTE process
    - Other(?)





FY06 Accomplishments (1)



- Work is proceeding along separate but converging lines
  - Materials
  - HX concepts
  - System modeling
  - Safety
- Work is being performed at
  - National laboratories (ANL, INL, ORNL)
  - Universities (UNLV, Univ of Wisconsin, Johns Hopkins, MIT, UC-Berkeley)
  - Companies (Ceramatec, General Atomics)

FY06 Accomplishments (2)

- Materials
  - High-temp tensile testing of metallic alloys
    - Inconel 617, Incoloy 800H, Waspaloy, Hastelloy C-22, C-276
  - Corrosion testing of metals and ceramics
    - H_2SO_4 environments
      - SiC, Si_3N_4, Al_2O_3
    - HI-I_2-H_2O environments
      - Ta-2.5W, Ta-10W alloys work best
    - Surface chemistry measurements
- HX modeling
  - Compact heat exchanger designs analyzed

FY06 Accomplishments (3)

- System modeling
  - Integrated steady-state models of entire plant being developed under an I-NERI agreement between U.S. and Korea
- Codes and Safety
  - Minimum plant separation distance calculated using risk-based tools
    - 60-110 meters
  - Initial assessment of applicable codes and standards performed
- Additional work
  - On-going NERI projects
    - Molten salts at University of Wisconsin
    - C/SiC manufacturing methods at Johns Hopkins
    - Dynamic system modeling at MIT

Work in Progress for FY07

- Continuation of work performed in FY06
  - Materials
  - HX modeling
  - Integrated model development
  - Safety

Plans for FY08-09

- Near term: driving towards pilot-scale H_2 plant decisions in FY09-FY11
  - Choose intermediate loop heat transfer fluid
    - Helium, salt, or other?
  - Lab-scale testing of heat-exchanger and loop components
  - Steady-state and dynamic modeling of combined plant
  - Development of detailed Probabilistic Risk Assessment data to support NGNP licensing application
- Longer term: advanced technology development
  - Extend boundaries of current technologies
    - Higher temperatures
    - More efficient heat transfer methods/equipment
    - Increased reliability and safety
    - Lower costs