



***United States
Nuclear Regulatory Commission***

*New File:
High Temperature
Gas Reactor*

**Briefing for Commissioner Merrifield
on
DOE MHTGR
and
GT-MHR**

**T.L. King
April 19, 2001**

H-3

Background

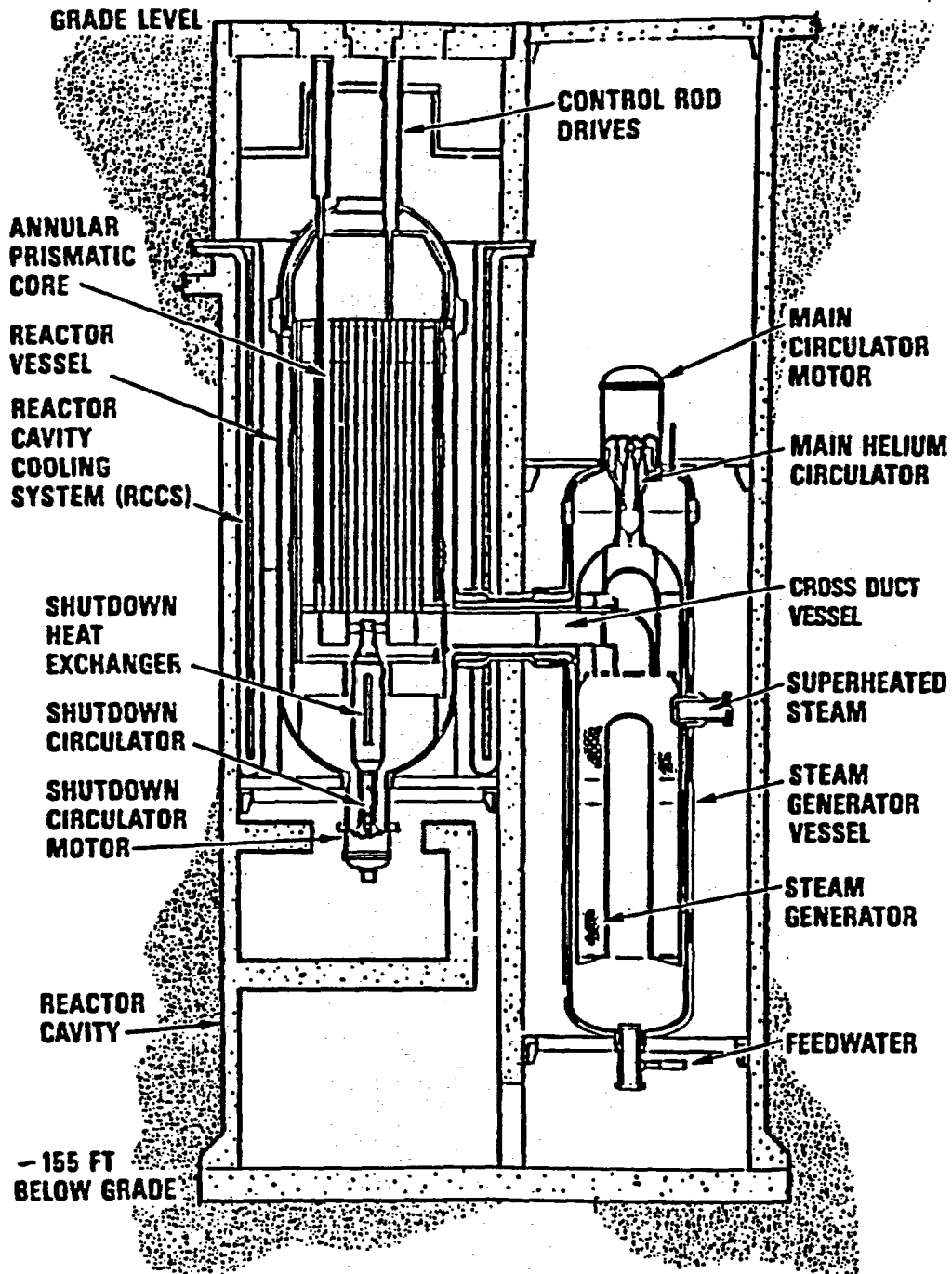
- Beginning in 1986, NRC conducted a preapplication review of a DOE sponsored modular HTGR design (MHTGR)
- The review objectives were to:
 - identify key safety, research and licensing issues
 - provide feedback to DOE on the potential licensability of the design
- Scope of review included:
 - conceptual design and safety analysis
 - preliminary PRA
 - regulations
- Draft preapplication SER (PSER) issued in March 1989 (NUREG-1338)
- DOE canceled the program in 1996. No final NUREG was issued.

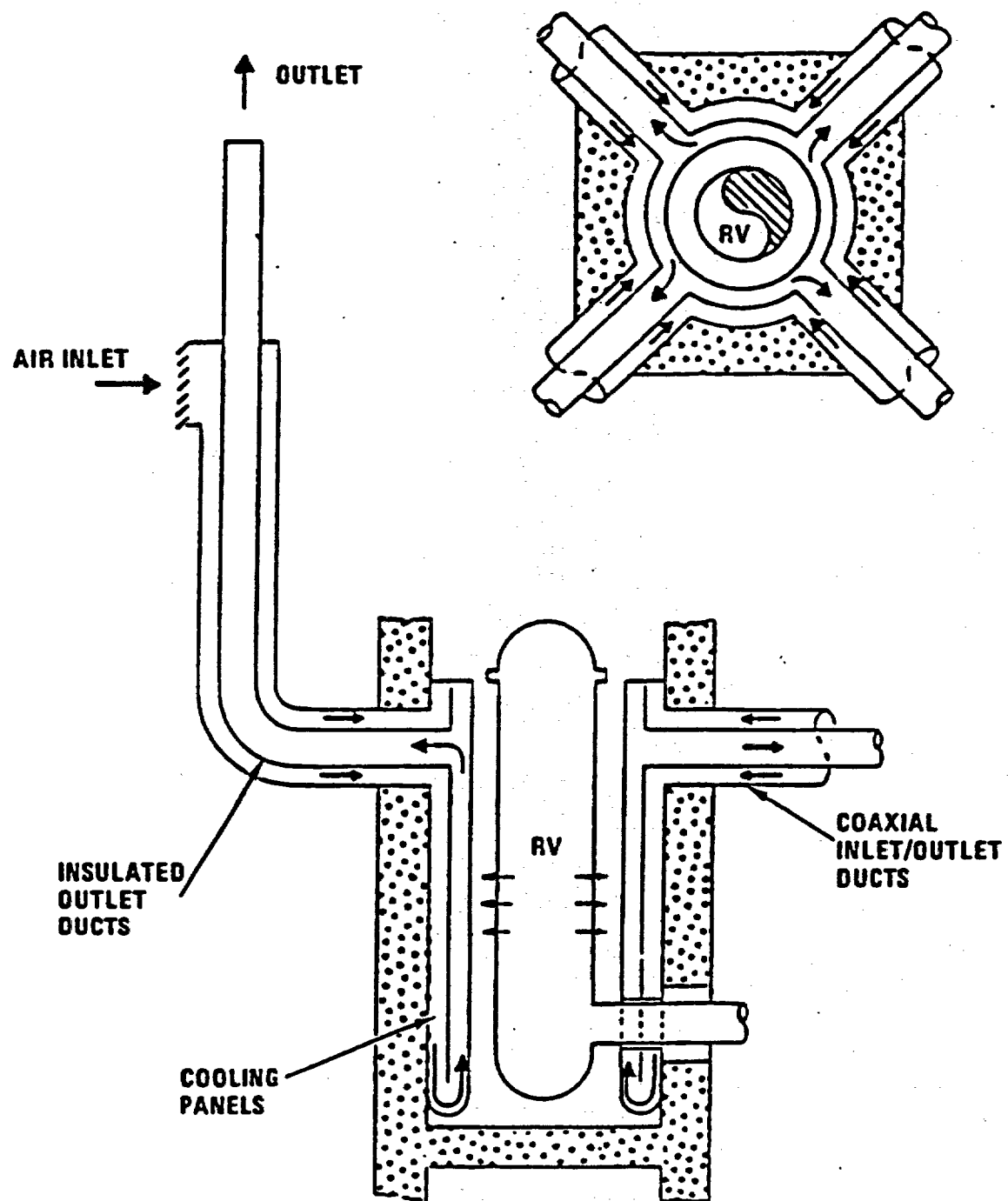
MHTGR CONCEPT

- DESIGNERS - GA TECHNOLOGIES/S&W/BECHTEL/CE/GE.
- 350 MWT (137 MWE), MODULAR DESIGN, WITH REACTOR VESSEL AND STEAM GENERATOR LOCATED BELOW GRADE.
- STEEL REACTOR VESSEL.
- EXTERNAL STEAM GENERATOR.
- TRISO COATED FUEL PARTICLES SIMILAR TO FSV.
- ANNULAR COPE DESIGN WITH PRISMATIC FUEL BLOCKS SIMILAR TO FSV.
- ONE LOOP PER MODULE.
- ONE TURBINE-GENERATOR PER 2 MODULES.
- NO CONTAINMENT OR CONFINEMENT BUILDING.
- PASSIVE DECAY HEAT REMOVAL AND SHUTDOWN SYSTEMS
- NON-SAFETY GRADE BOP.
- 40 YEAR MODULE LIFETIME.

FIGURE 1.1

USA MODULAR HTGR -- 350 MW(t)





Passive air-cooling

MHTGR Key Issues

- Source Term:
 - proposed mechanistic source term for siting and containment evaluation
 - fuel quality was central issue
- Containment:
 - confinement proposed by DOE
- EP:
 - EPZ = site boundary proposed
- Design Basis Accidents
 - frequency criteria proposed
- SECY-93-092 proposed criteria for their resolution
 - SRM of July 30, 1993, provided guidance to the staff

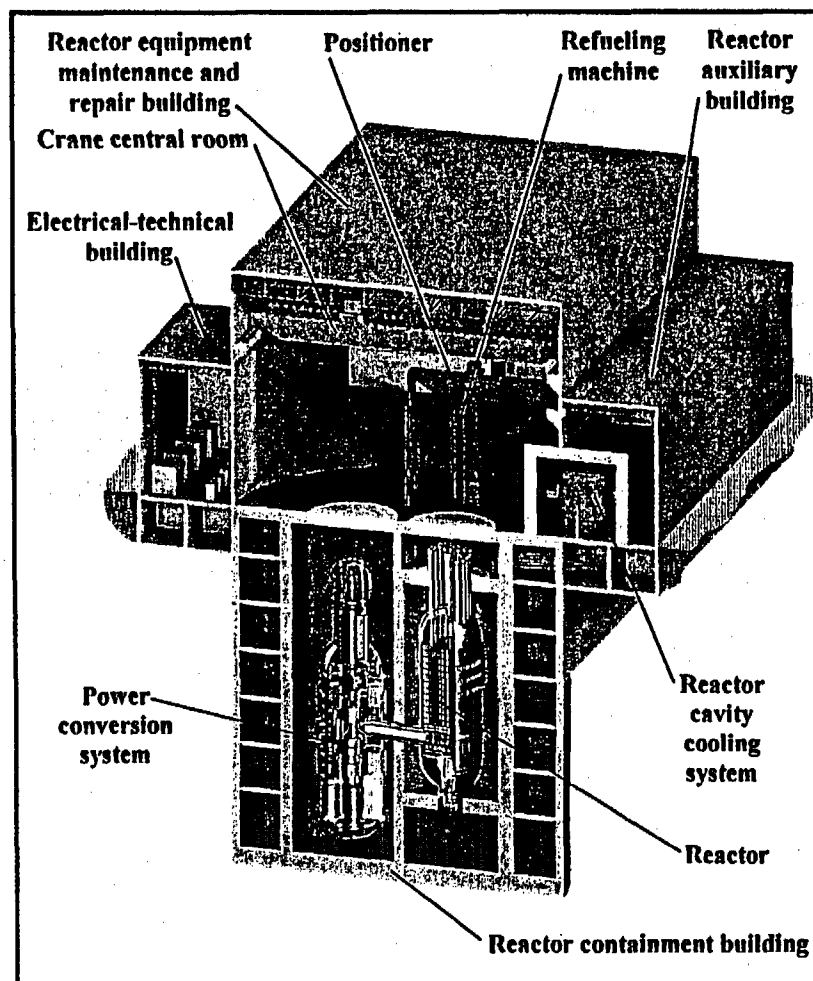
Current GA Design - GT-MHR

- Evolution of the MHTGR design:
 - larger size - 600 Mwt
 - TRISO - UO_2 fuel
 - in-line Helium turbine
 - development funded by DOE for Pu disposition
- GA is pursuing a commercialization program
- Preapplication interactions with NRC requested

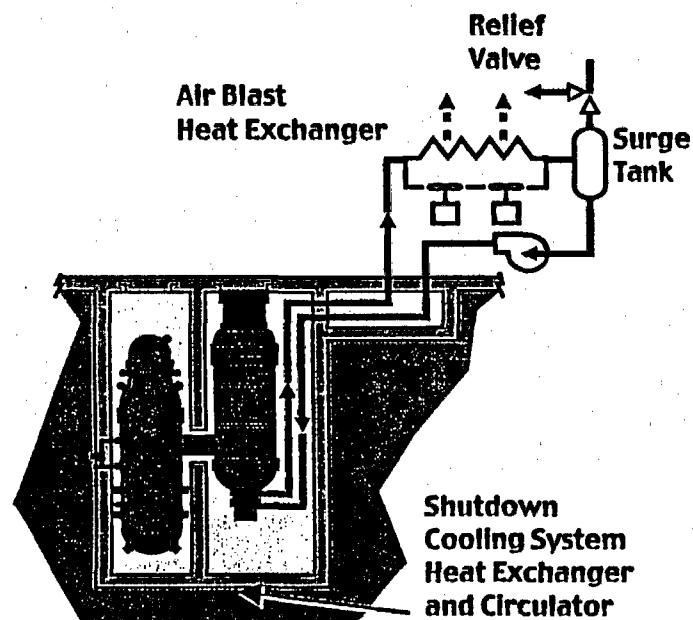
INTERNATIONAL GT-MHR PROGRAM

- Design, construct and operate a prototype GT-MHR module by 2009 at Tomsk, Russia
- Design, construct, and license a GT-MHR Pu fuel fabrication facility in Russia
- Operate first 4-module GT-MHR by 2015 with a 250 kg plutonium/year/module disposition rate

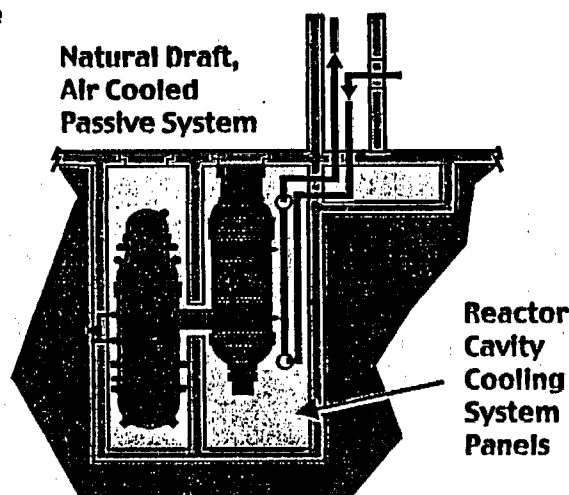
*....Fuel contains Pu only
.....No fertile component*



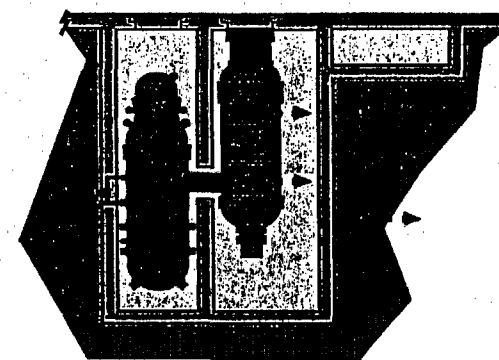
POSSIBLE DECAY HEAT REMOVAL PATHS WHEN NORMAL POWER CONVERSION SYSTEM IS UNAVAILABLE



A) Active Shutdown Cooling System



B) Passive Reactor Cavity Cooling System

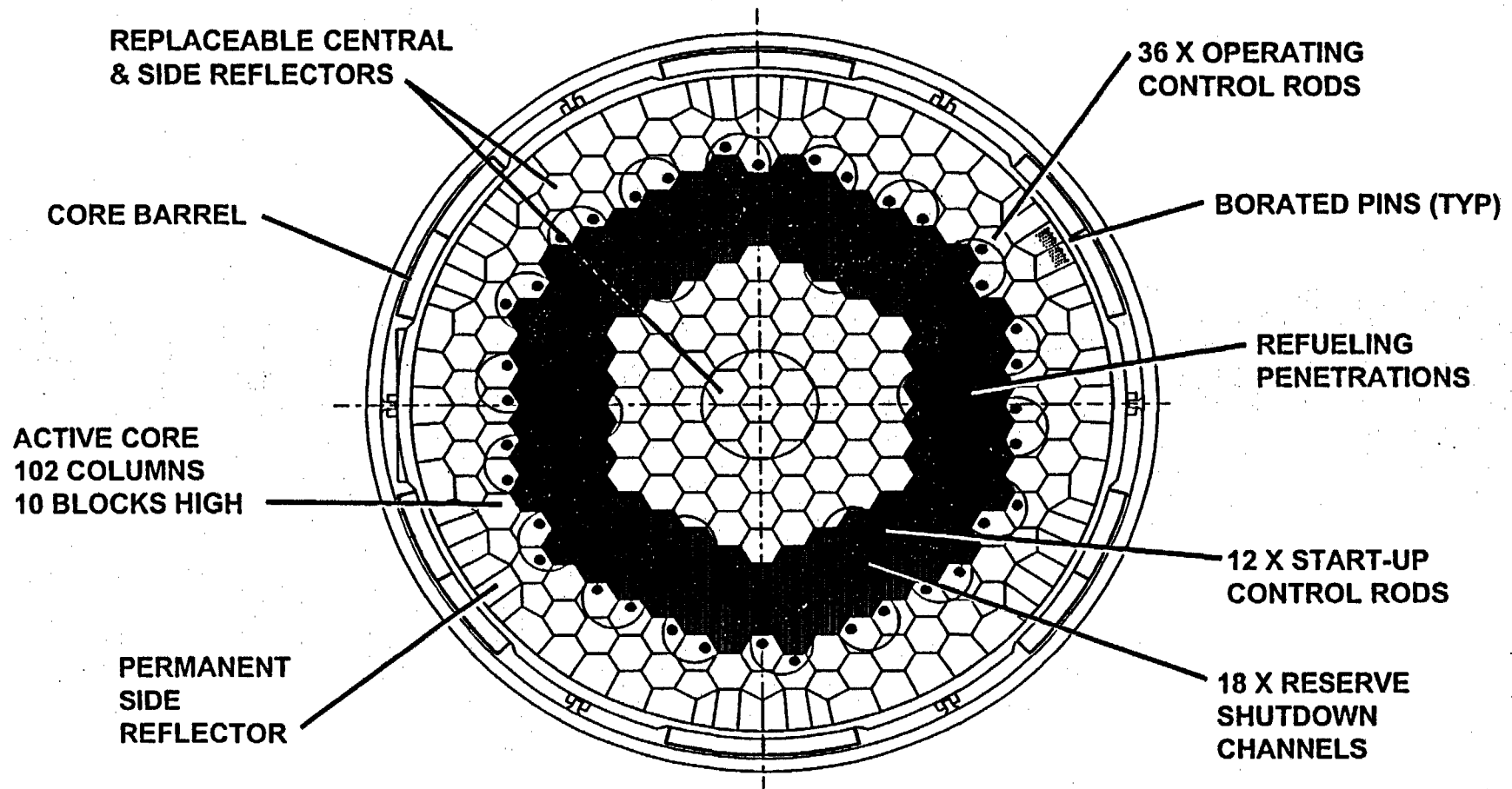


C) Passive Radiation and Conduction of Afterheat to Silo Containment (Beyond Design Basis Event)

**... DEFENSE-IN-DEPTH BUTTRESSED BY
INHERENT CHARACTERISTICS**

 **GENERAL ATOMICS**

ANNULAR REACTOR CORE LIMITS FUEL TEMPERATURE DURING ACCIDENTS



... ANNULAR CORE USES EXISTING TECHNOLOGY



COMMERCIAL PROGRAM FOLLOWS INTERNATIONAL PROGRAM

| | '02 | '03 | '04 | '05 | '06 | '07 | '08 | '09 | '10 | '11 | '12 | '13 | '14 | '15 |
|---------------------------|-----|-----|-----|-----------------------------------|-------------------------------|---|----------------------------|-----|-----------------------|---------------------|----------------------|-------|-------|-------|
| INTERNATIONAL PROGRAM | | | | | | | | | | | | | | |
| Design and Devel | | | | ▼ | Complete Design & Development | | | | | | | | | |
| Prototype Licensing | | | | ▼ | Construction License | | | | | | | | | |
| Prototype constr | | | | | | | | ▼ | Complete Proto Constr | | | | | |
| Prototype Startup | | | | | | | | | ▼ | Complete Proto Demo | | | | |
| Full Power Operation | | | | | | | | | | ▼ | Start Full Power Ops | | | |
| GT-MHR COMMERCIAL PROGRAM | | | | | | | | | | | | | | |
| Prel Design | | | ▼ | Complete Plant Preliminary Design | | | | | | | | | | |
| SAR | | | ▼ | Complete SAR | | | | | | | | | | |
| SER | | | | ▼ | Complete SER | | | | | | | | | |
| Final Design | | | | | ▼ | Complete Final Design | | | | | | | | |
| Fuel | | | | | | | | | | | | | | |
| - Automated FF Plt | | | | | ▼ | Complete Automated Fuel Fab Plant Pilot Plant | | | | | | | | |
| - Qualified Fuel | | | | | | | | | | ▼ | Complete Tests | | | |
| First Comm Plt | | | | | | | | | | | | | | |
| - First Order | | | ▼ | Ltr of Intent | | ▼ | Order for First Comm Plant | | | | | | | |
| - Constr | | | | | | ▼ | Start Plant Construction | | | | | | | |
| - Operation Mod 1 | | | | | | | | | | ▼ | Startup of Module 1 | | | |
| - Operation Mod 2 | | | | | | | | | | | ▼ | Mod 2 | | |
| - Operation Mod 3 | | | | | | | | | | | | ▼ | Mod 3 | |
| - Operation Mod 4 | | | | | | | | | | | | | ▼ | Mod 4 |

