PRISM Heat Removal Safety Systems

5th IAEA/GIF SFR Safety Workshop

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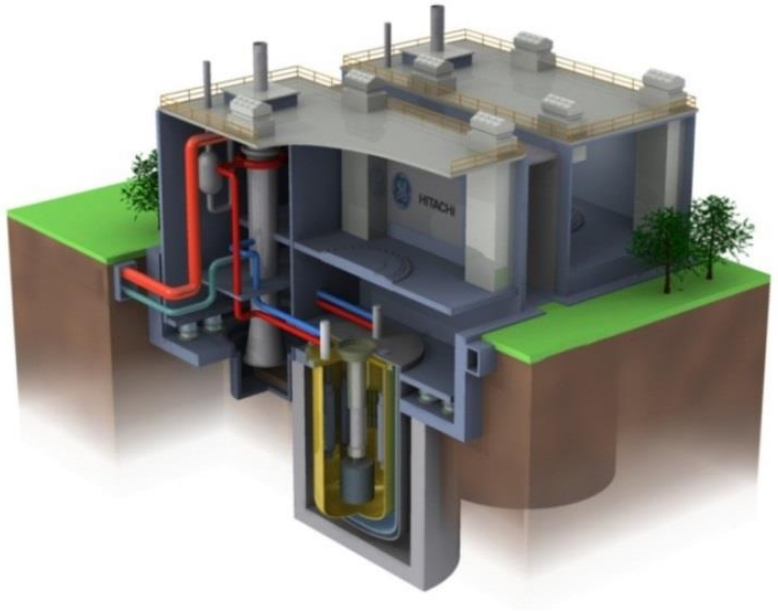

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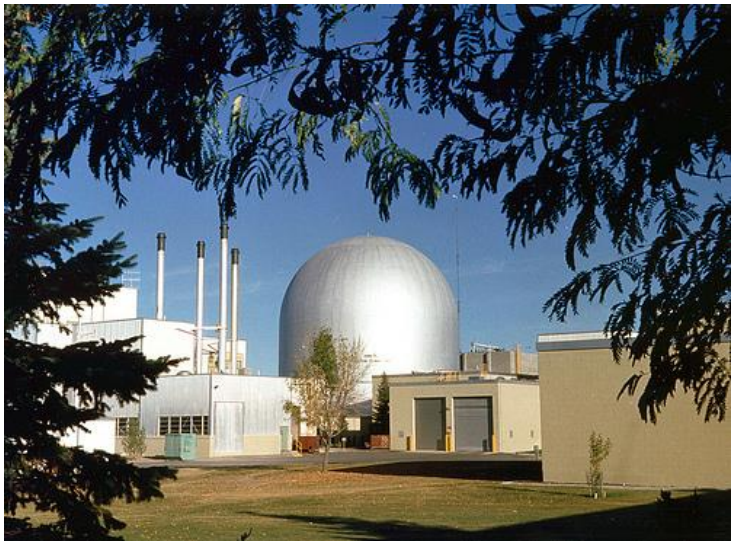
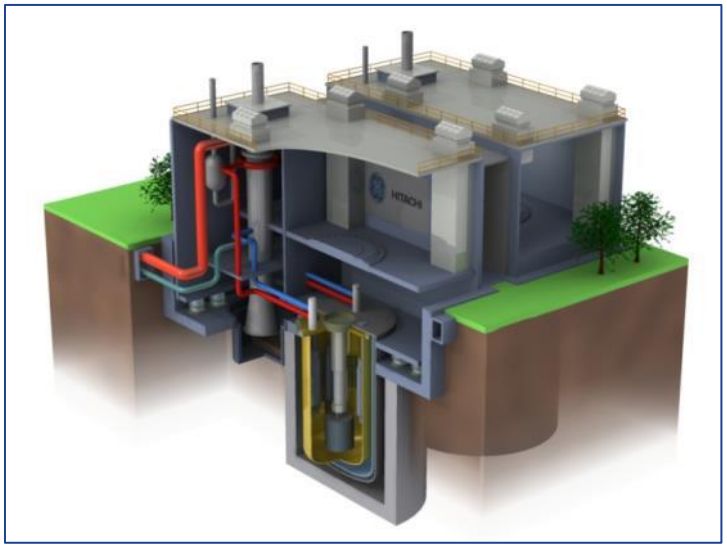
PRISM: The Commercialization of EBR-II



USA's EBR II

- Small
- Pool
- Metal fuel
- Passive safety

EBR-II proved the technology



GEH's PRISM

- Small
- Pool
- Metal fuel
- Passive safety

PRISM commercializes the technology

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Decades of technology development

PRISM related technology programs

1981-1984 GE Program

GE funded
- Innovative design approaches

1985-1987 PRISM

DOE funded $30M
- Competitive LMR concepts

1988 PRDA

DOE funded $5M
- Continuing trade studies

1989-1995 ALMR

DOE funded $42M
- Preliminary design
- Regulatory review
- Economics
- Commercialization
- Tech development ($107M additional)

1995-2002 S-PRISM

GE Funded
- Improved economics
- Actinide burning scenarios

2007-2014 GNEP

- Demo reactor
- Actinide burning
- Commercial
- Best practices
- Advanced power conversion cycle

✓ **Advanced Conceptual Design**

- Development sponsored by US Government
- Various US development programs since 1985

✓ **Nuclear Regulatory Commission: "no obvious impediments to licensing"**

PRISM Conceptual Design Document

- PRDA - Program Research & Development Announcement
- ALMR – Advanced Liquid Metal Reactor program
- GNEP – Global Nuclear Energy Partnership

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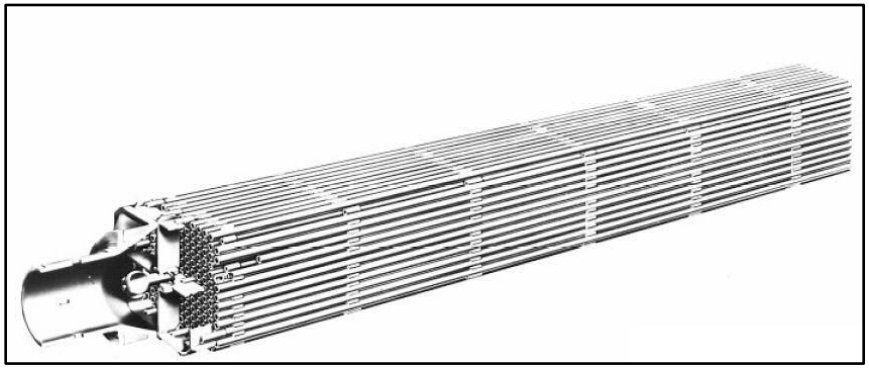
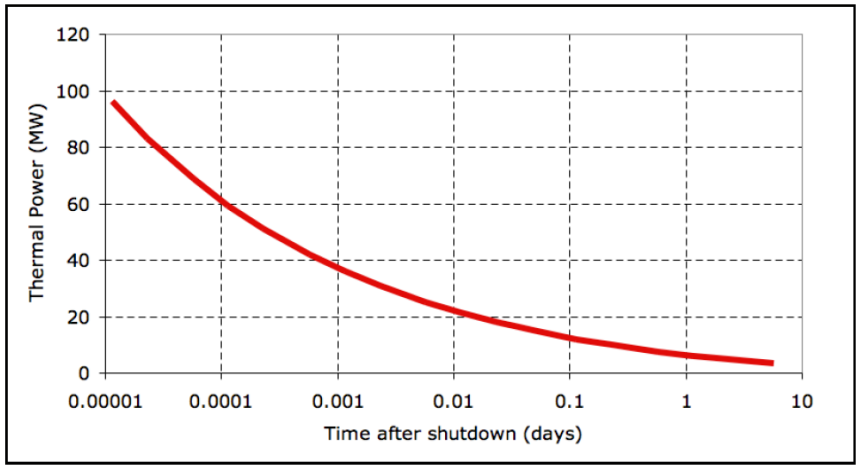
Fundamentals of reactor safety

- **Controlling Reactivity**



- **Decay Heat Removal**



This presentation focuses on Decay Heat Removal

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PRISM decay heat removal

Full power block consists of 2 reactors (840 MWt each) that power 1 turbine-generator (622 MWe)

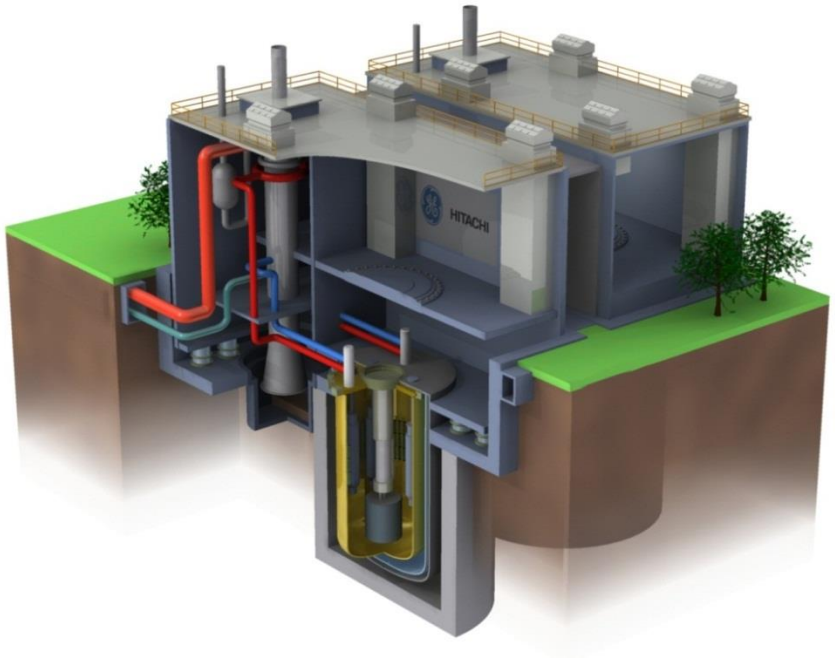
Liquid sodium is the reactor coolant , superheated steam drives turbine

Each reactor module:

- 4 primary electromagnetic pumps
- 2 intermediate heat exchangers
- 2 secondary electromagnetic pumps
- 1 steam generator

Reactor core inlet/outlet temperatures:

360°C/500°C



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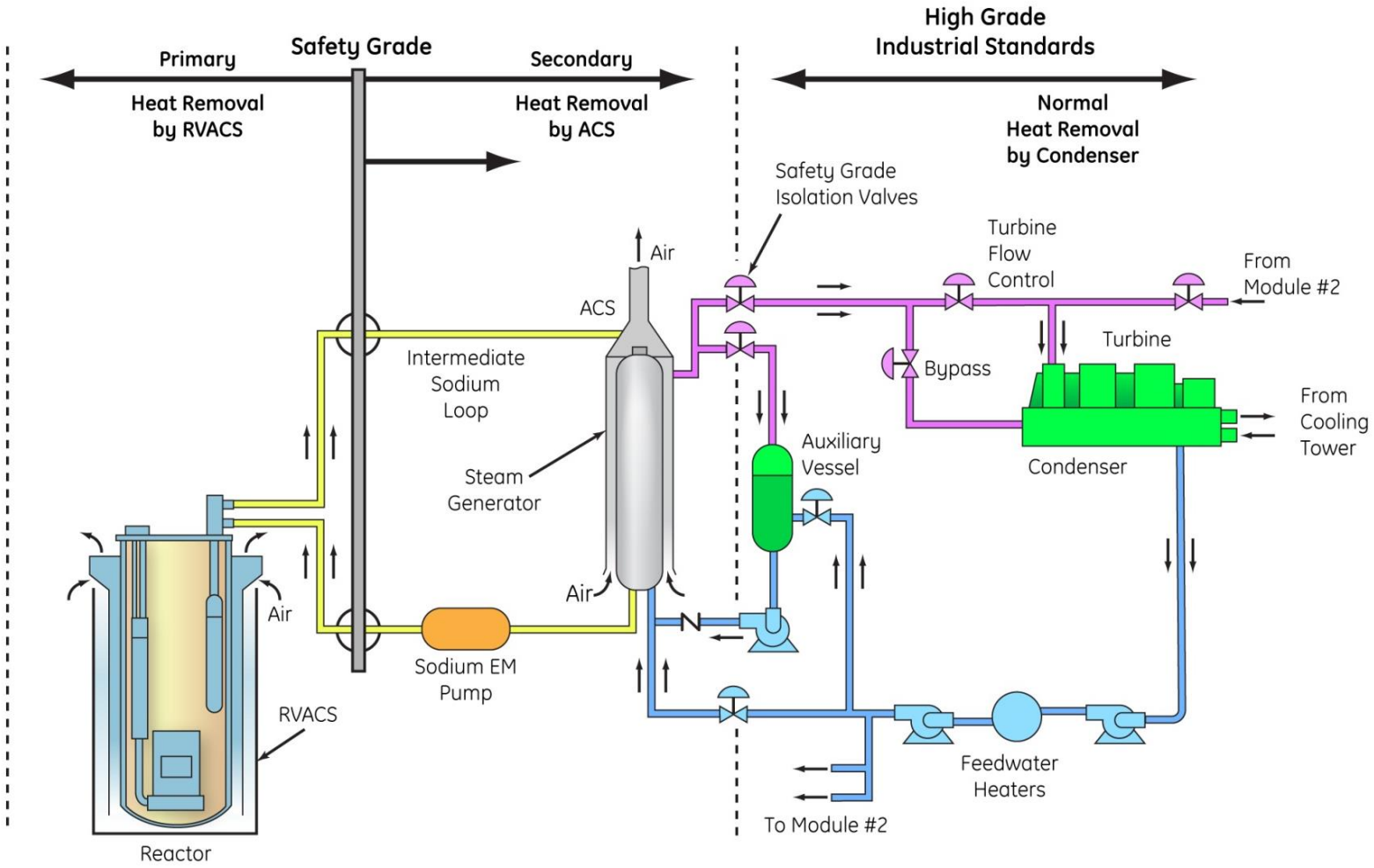
PRISM safety grade systems



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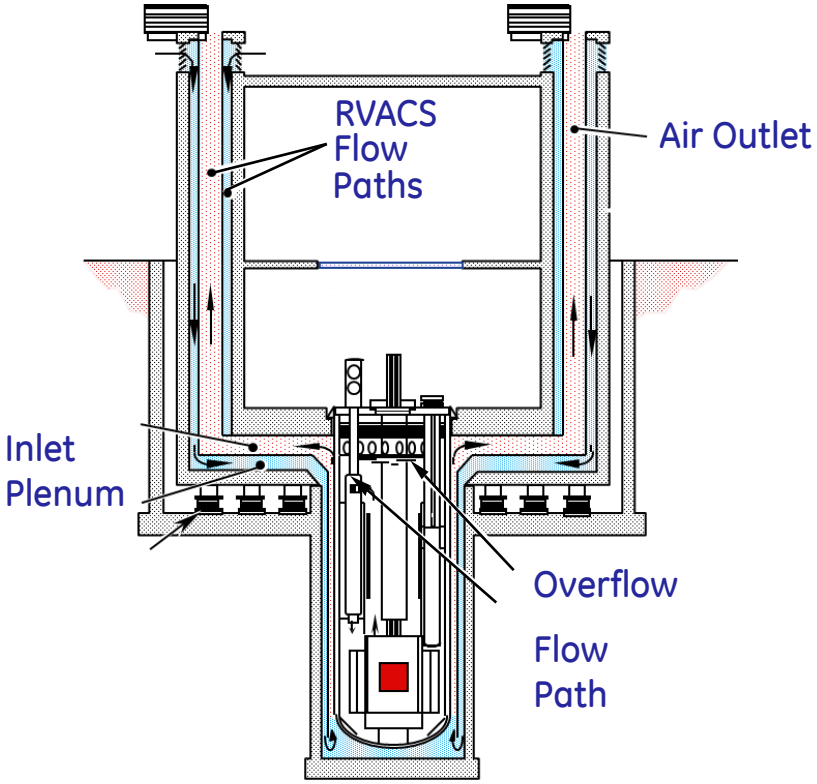
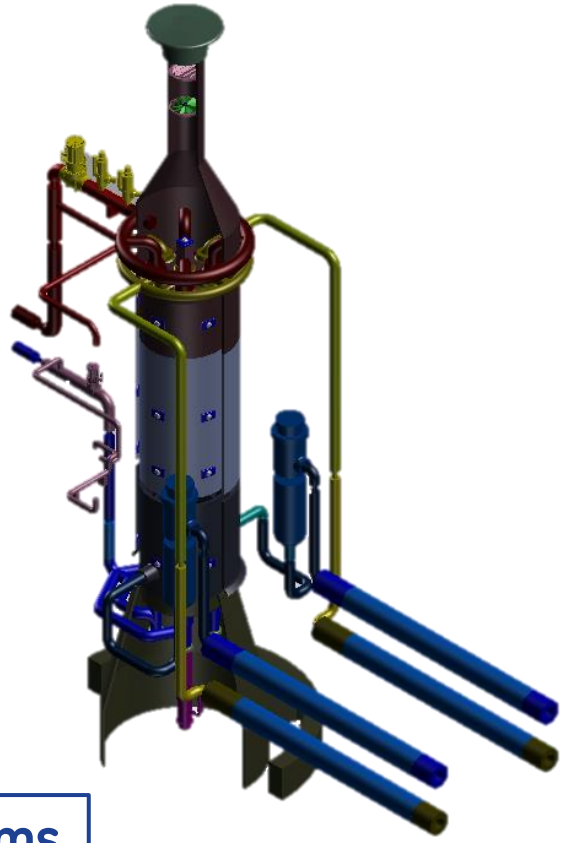
Two methods of heat removal

Reactor Vessel Auxiliary Cooling System (RVACS)



Auxiliary Cooling System (ACS)



Both Safety Systems

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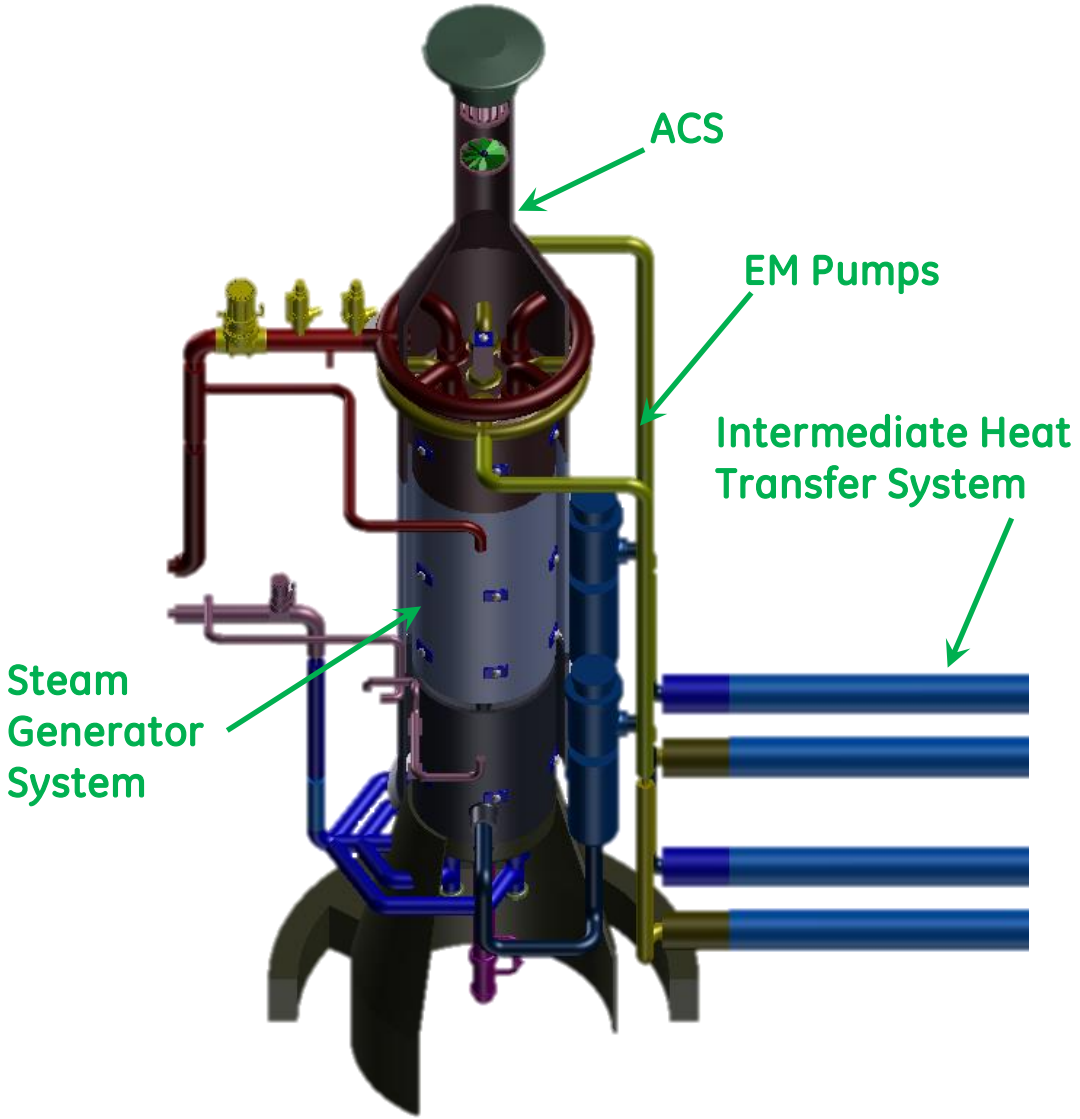
Auxiliary Cooling System (ACS)

- Removes decay heat from Steam Generator shell via natural circulation
- Reduce the primary system temperature following a loss of heat sink (Turbine Condenser)
- Increase plant availability by reducing the reactor cool down time when heat cannot be rejected to the condenser
- Cooling can be augmented and increased with safety power



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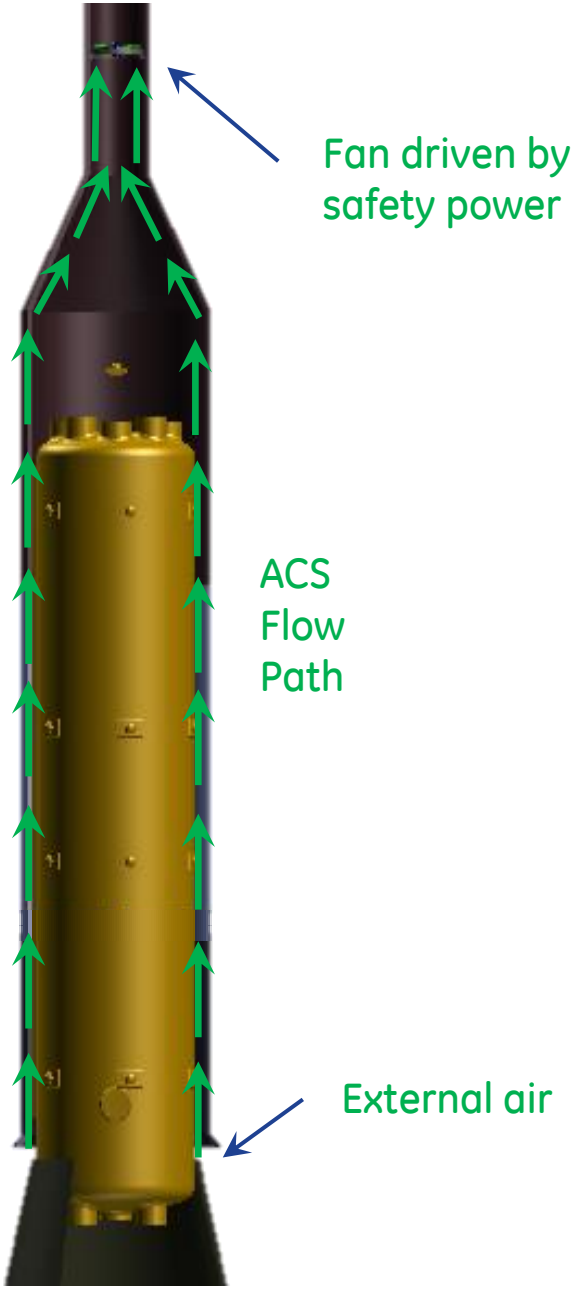
ACS flow path

- Air flows into the annulus between the bottom of the shroud and Steam Generator shell
- Natural circulation is initiated by opening the exhaust damper so that air receives heat by thermal radiation from the steam generator shell
- The intermediate sodium loop, like the primary loop, operates under natural circulation conditions and thus requires no power for core decay heat removal



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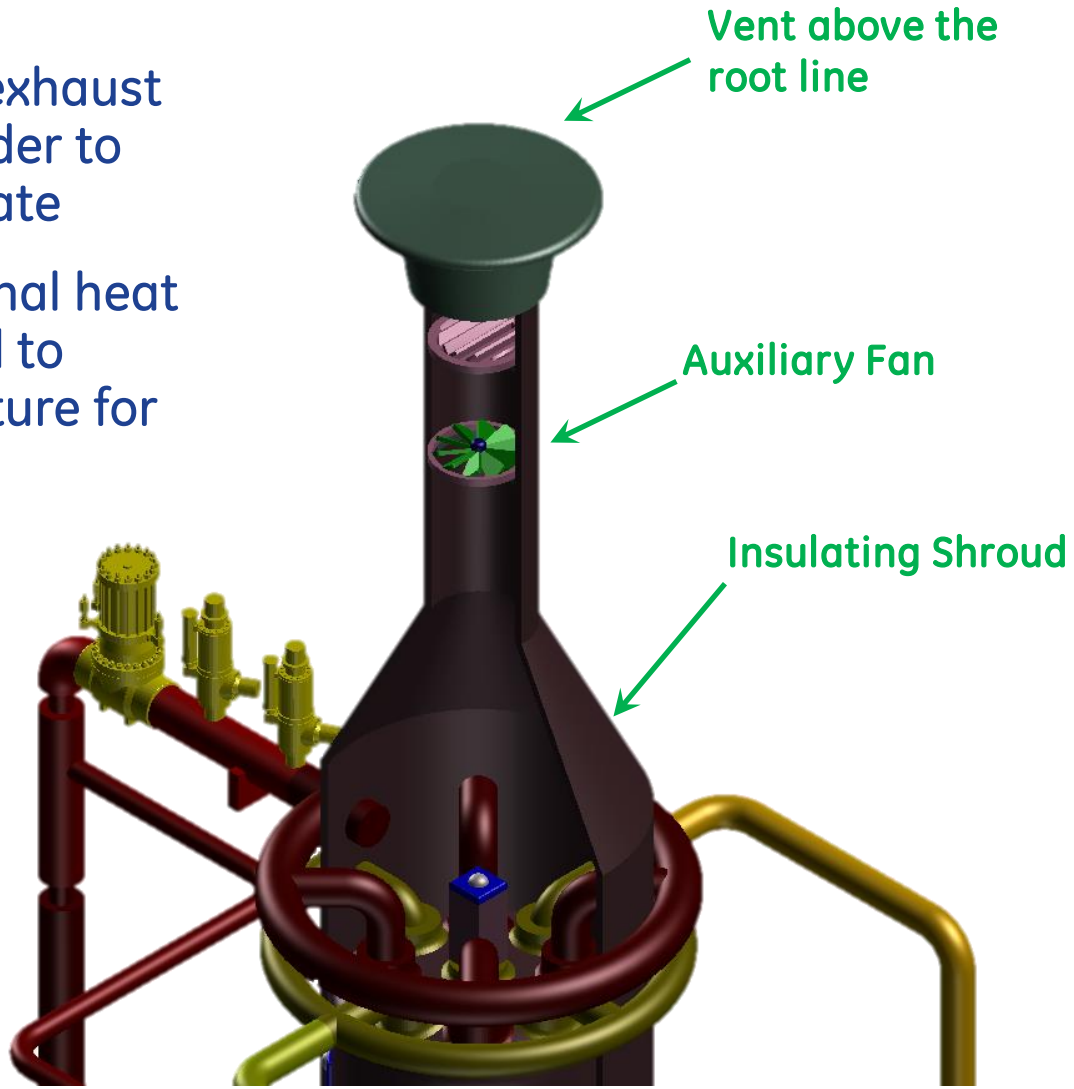
ACS Auxiliary Fan

- Auxiliary fan located in the exhaust stack can be activated in order to increase the heat removal rate
- Fan is only started if additional heat removal capacity is required to reduce the system temperature for maintenance
- Fan is powered by two sources of power: power generation bus and safety batteries



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PRISM safety heat removal

Combination of the ACS and the RVACS system has the capability to maintain the reactor temperatures well below design limits (1250F Upset Conditions).

ACS and RVACS provide two safety grade heat removal systems

PRISM decay heat removal architecture is robust for global enveloping of SFR standards

NUREG 1368 – "The three systems that can provide RHR are quite reliable and appears difficult to disable all three systems"

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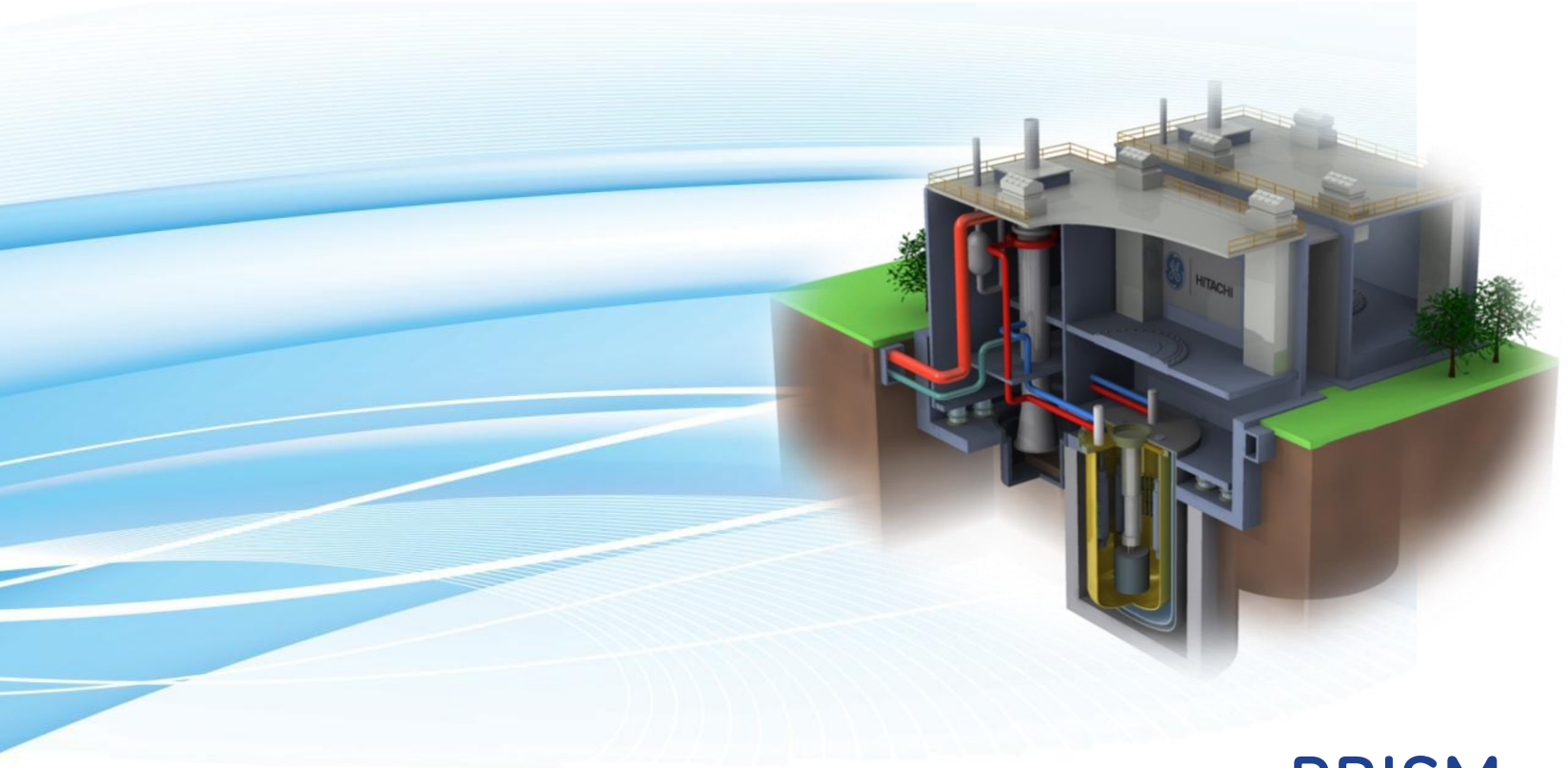
Thank You



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