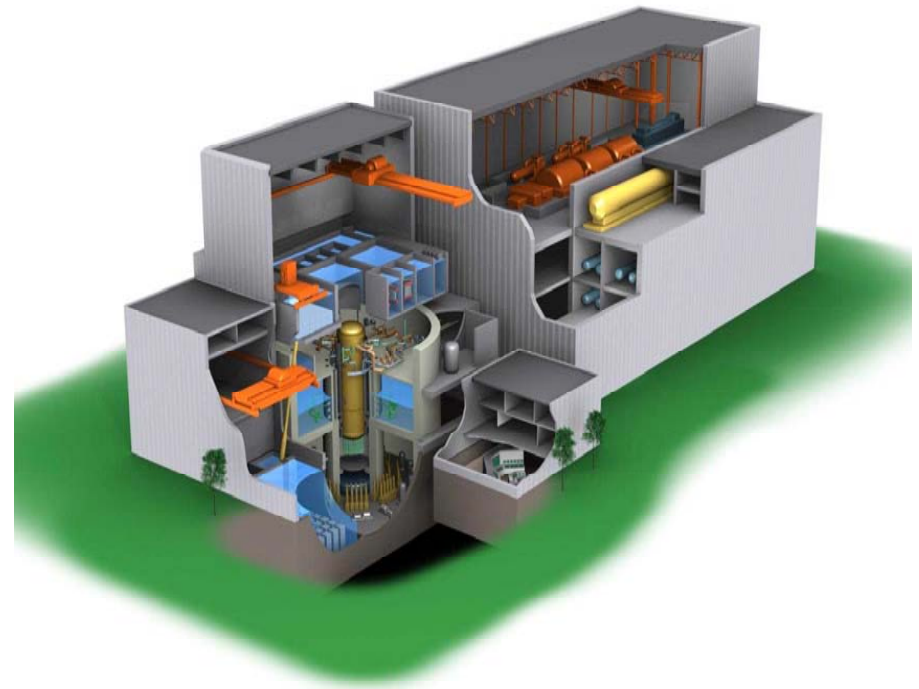


Reactor Building and Control Building Heat Up Calculation

Performed by
Empresarios Agrupados,
Madrid Spain

Presented by
Antonio Barrett
April 10, 2008

GE Hitachi Nuclear Energy



Computer Codes

- Calculations performed with CONTAIN 2.0 for the RB and CB
 - CONTAIN 2.0 was developed by Sandia National Laboratories and sponsored by the NRC
 - Validation found in NUREG/CR-6533, SAND97
- Calculations for the CRHA during winter conditions performed with ECOSIM
 - Validated by comparison to CONTAIN results

Limiting Conditions for Reactor Building and Control Building Heat up

- Reactor Building and Control Building
 - Normal HVAC cooling is lost
 - Safety-related equipment is operating for 72 hours during event
 - After 72 hours no electrical heat load is considered if power is unavailable; Safety-related equipment has performed its safety-related function in order to maintain safe shutdown

Limiting Conditions for Reactor Building and Control Building Heat up Cont.

- Reactor Building
 - LOCA and/or HELB concurrent with SBO
 - Nonsafety-related equipment operating for 2 hours
- Control Building
 - SBO with HVAC isolation
 - Only safety-related heat loads are considered for the Control Room Habitability Area
 - After 72 hours no heat loads other than people, minimal lighting and the EFU are considered in the Control Building

Modeling Assumptions

- The Reactor Building and Control Building are integrated models that consider room to room interactions
- Initial room and concrete temperatures are conservatively assumed relative to normal operating temperatures
- Walls, floors and ceilings modeled as passive heat sinks

Modeling Assumptions

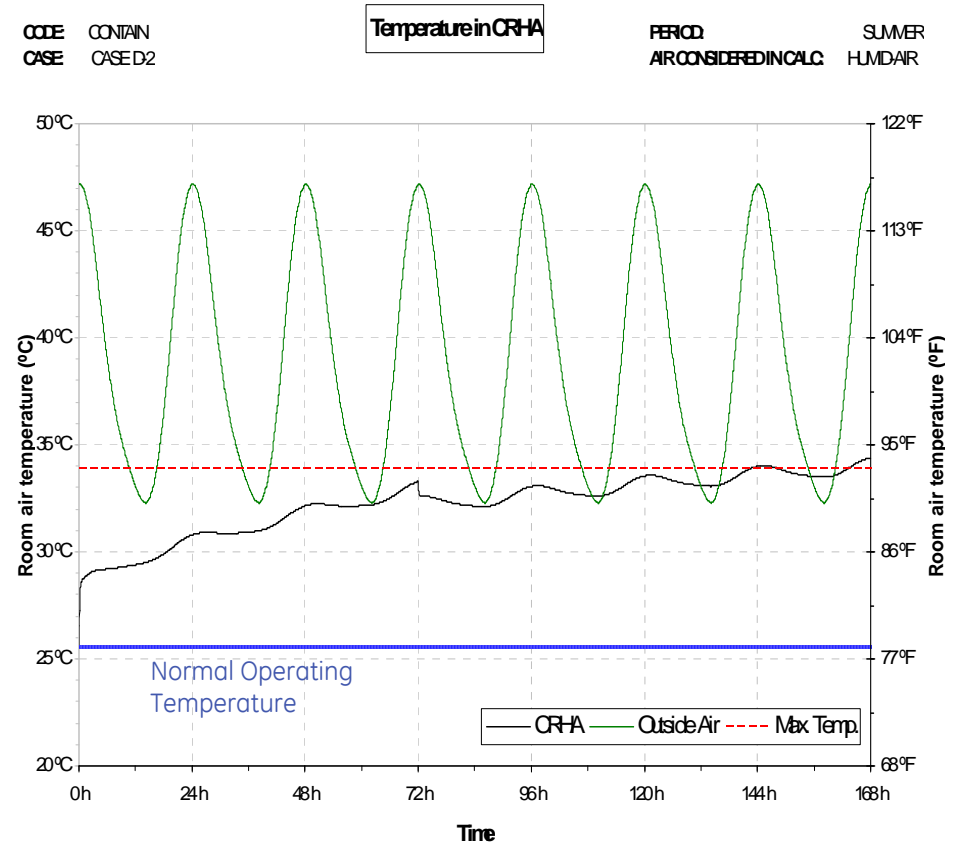
- There are no temperature differences inside the room
 - Stratification is not considered which is conservative
- A 10% margin was applied to all heat loads in the Reactor Building and the Control Building with the exception of the CRHA where a 15% margin was applied to the heat loads
- Conservatively low thermal conductivity assumed for concrete
- 424 cfm (200 l/s) of outside air injected into the CRHA
- Summertime and wintertime conditions considered

Rev 5 Calculations

- Update analysis to reflect latest ESBWR general arrangement
 - Updated CRHA layout per human factors engineering
- Reduced heat loads in 4 rooms
- Account for solar loads
- CRHA heat up/cool down for 72 hours and 7 days
- Reactor Building and Control Building heat up for 72 hours

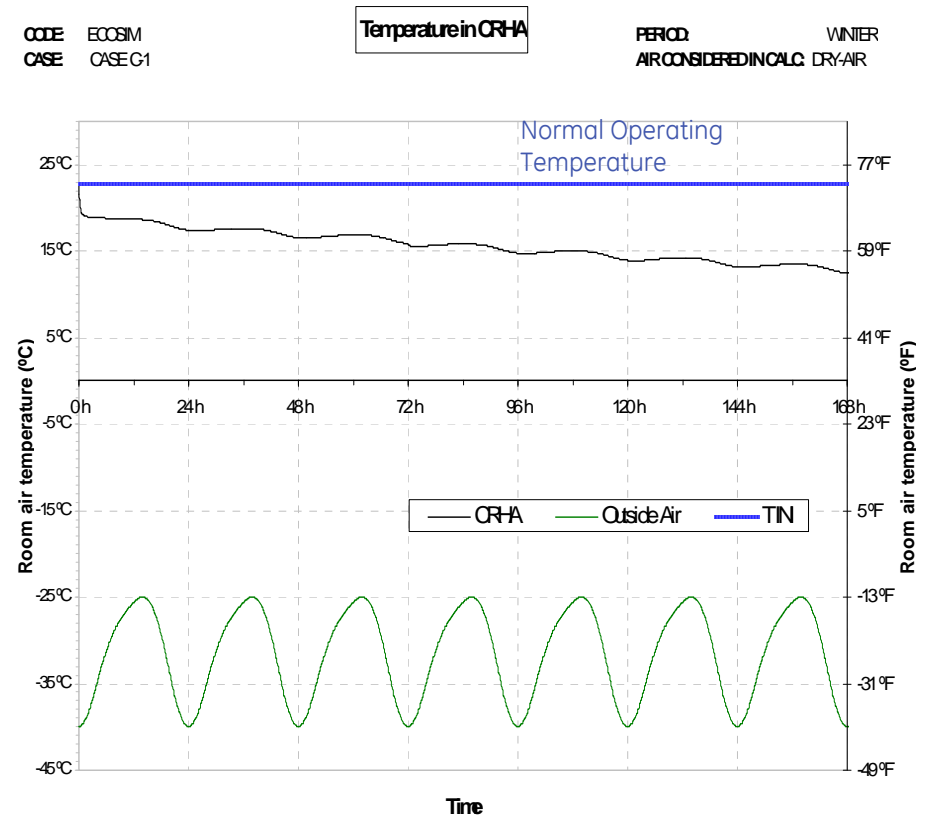
CRHA Heat up Analysis

- Summertime conditions
- Below 93°F for 72 hours



CRHA Cool Down Analysis

- Wintertime conditions
- Minimum of 61°F after 72 hours



Conclusions

- All safety-related equipment will be able to function during extreme accident conditions
 - Safety-related equipment environmental conditions are within qualification temperature limits
- Heat up calculations bound values for the sensitive parameters of outside air temperature, concrete thermal conductivity, and heat loads
- The CRHA remains below 93°F for 72 hours which satisfies the acceptance criteria of the EPRI URD
- The CRHA bulk temperature remains well below 110°F which is the NUMARC conservative limit for habitability during SBO coping times, which can last from 4 to 16 hours
 - NUMARC 87-00 referenced by Reg Guide 1.155
“A dry bulb temperature of 110°F appears to be a conservative limit for control room habitability.”
- The CRHA does not become unreasonably cold during extreme cold conditions