LONG-TERM STATION BLACKOUT

Part of the RASCAL Instructor-led Training

LTSBO - Background

In a Long-Term Station Blackout, a facility will lose all offsite and onsite AC power. Cooling is initially maintained using diesel generators and batteries. However, after these are exhausted, water in the core will start to heat and eventually boil. RASCAL models this heatup time as 8 hours in a PWR and 6 hours in a BWR. After the core is fully uncovered, fission products begin to release.

The source term model for LTSBO in RASCAL is based on the State-of-the-Art Reactor Consequence Analysis (SOARCA) reports.

LTSBO - SCENARIO

Arkansas Nuclear One (ANO), Unit 2, was shutdown at 10:00, due to an earthquake.

All offsite and onsite AC power was lost.

LTSBO - SCENARIO

Battery controlled instrumentation and diesels initially provided power and cooling was maintained. However, 11 hours after the original event, further technical complications incapacitated the diesels.

Fission products leak through a slightly damaged containment at 2.0 percent/d with no sprays available.

Finally, power is restored and the core is recovered at 10:00 on the next day. Containment pressure was reduced to atmosphere at noon.

KNOWLEDGE CHECK

Reactor was shutdown at 10:00. Battery controlled instrumentation and diesels initially provided power and cooling was maintained. However, 11 hours after the original event, further technical complications incapacitated the diesels. Finally, power is restored and the core is recovered at 10:00 on the next day. Containment pressure was reduced to atmosphere at noon.

Given the models in RASCAL, at what time does the core heat up to the point of damage/release?

- 1500
- 2100
- 0500 next day
- 1000 next day

YOUR TURN TO USE RASCAL

Given the scenario excerpt below, start building a RASCAL case.

Arkansas Nuclear One (ANO), Unit 2, was shutdown at 10:00, due to an earthquake. 11 hours after the original event, further technical complications incapacitated the diesels. Fission products leak through a slightly damaged containment at 2.0 percent/d with no sprays available. Finally, power is restored and the core is recovered at 10:00 on the next day. Containment pressure was reduced to atmosphere at noon. Use the following weather data for the on-site station.

Type	Date	Time	Wind Dir (deg)	Wind spd (mph)	Stability Class	Precip	Air Temp (Deg F)
Obs	Today	12:00	210	6	B	None	53
Fcst	Today+1	00:00	210	6	B	None	53
Fcst	Today+1	04:00	340	4	D	None	48
Fcst	Today+1	08:00	350	6	C	None	50
Fcst	Today+1	12:00	0	7	B	None	66

KNOWLEDGE CHECK

There is a warning message you received when processing your weather data. What is this from?

- The large wind shift from 350 deg to 0 deg
- The change from observations to forecasts
- The large wind shift from 210 deg to 340 deg
- I did not get a warning message

Your Turn to Use RASCAL

Continue building and run your entire case in RASCAL.

Do an assessment of the Unit 2 LTSBO and record the TEDE and Thyroid CDE at 1 and 5 miles from the release using ICRP 26/30.

Dose	Distance from the Site	
	1.0 mi	5.0 mi
TEDE (rem)		
Adult Thyroid CDE (rem)		

LET'S WALK THROUGH THE PROBLEM TOGETHER

LTSBO - RESULTS

Dose	Distance from the Site	
	1.0 mi	5.0 mi
TEDE (rem)	7.1	.24
Adult Thyroid CDE (rem)	82	2.5

Conclusions?

– Release timing vs LOCA