

# U.S.NRC

UNITED STATES NUCLEAR REGULATORY COMMISSION

*Protecting People and the Environment*

## 2019 Flood at Cooper Nuclear Station and Fort Calhoun Station

February 21, 2020

Patricia Vossmar – Cooper SRI (Former)

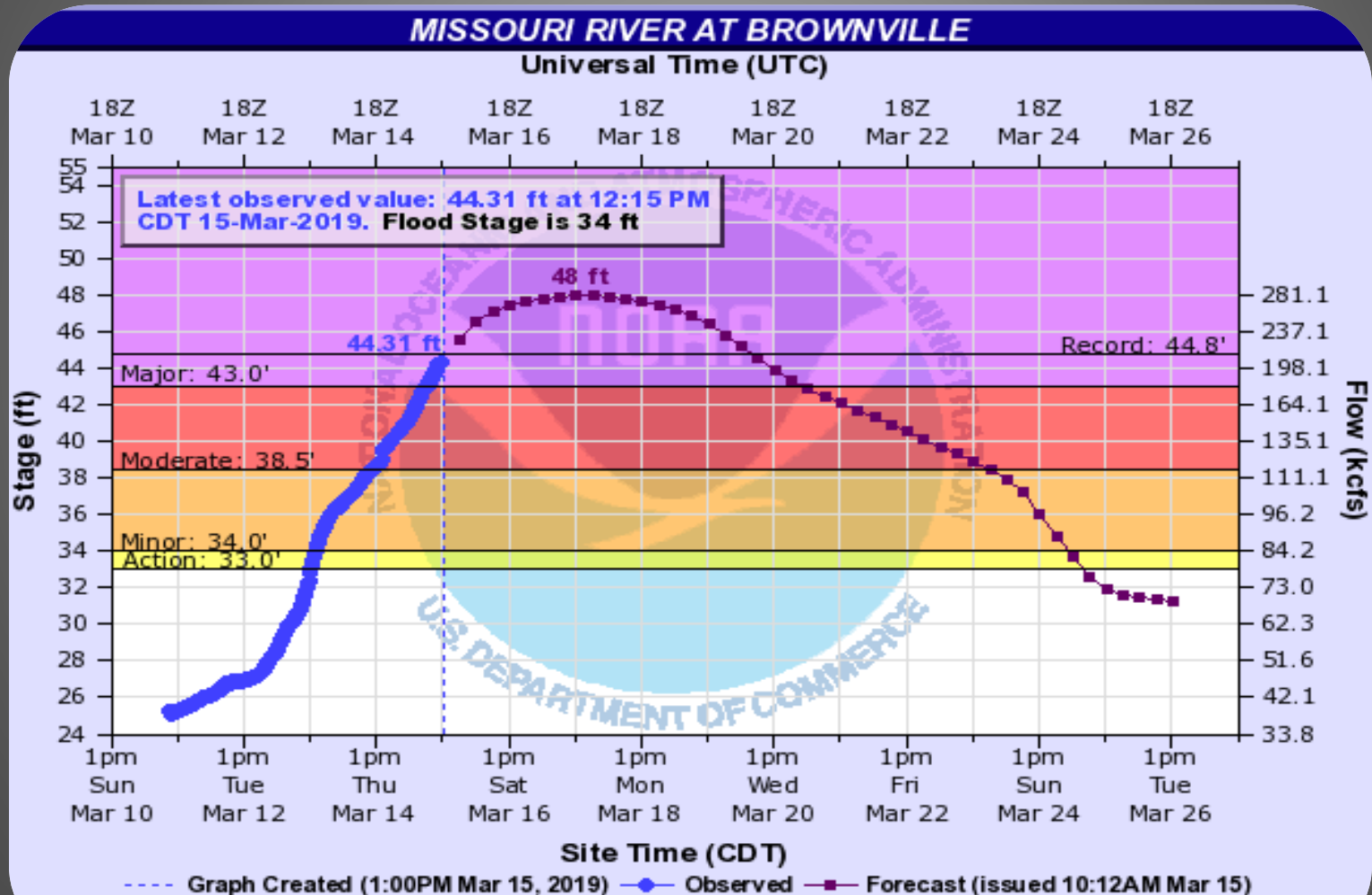
Mike Stafford – Cooper RI

# Agenda

- Cooper (CNS) Flood
- Fort Calhoun (FCS) Flood
- Area Flooding Damage
- Unanticipated Aftereffects
- Key Lessons Learned



# Flood Prediction – CNS





# Licensee Preparation

- Flood Plan
- Schedule Scrub
- Survey Levees
- Sandbagging
- River Monitoring





# Licensee Preparation



- Staged Primary and Secondary Flood Barriers
- Staged FLEX equipment
- Obtained FHRR Crane



## CNS Event

- 3/15 am – CNS staffed OCC.
- 3/15 am – Notification of Unusual Event (NOUE) Declared at 899.1'; NRC stayed in Normal Mode.
- 3/15 pm – river level rose to 901.5' at CNS and remained stable for a few days.





# Early Site Flooding



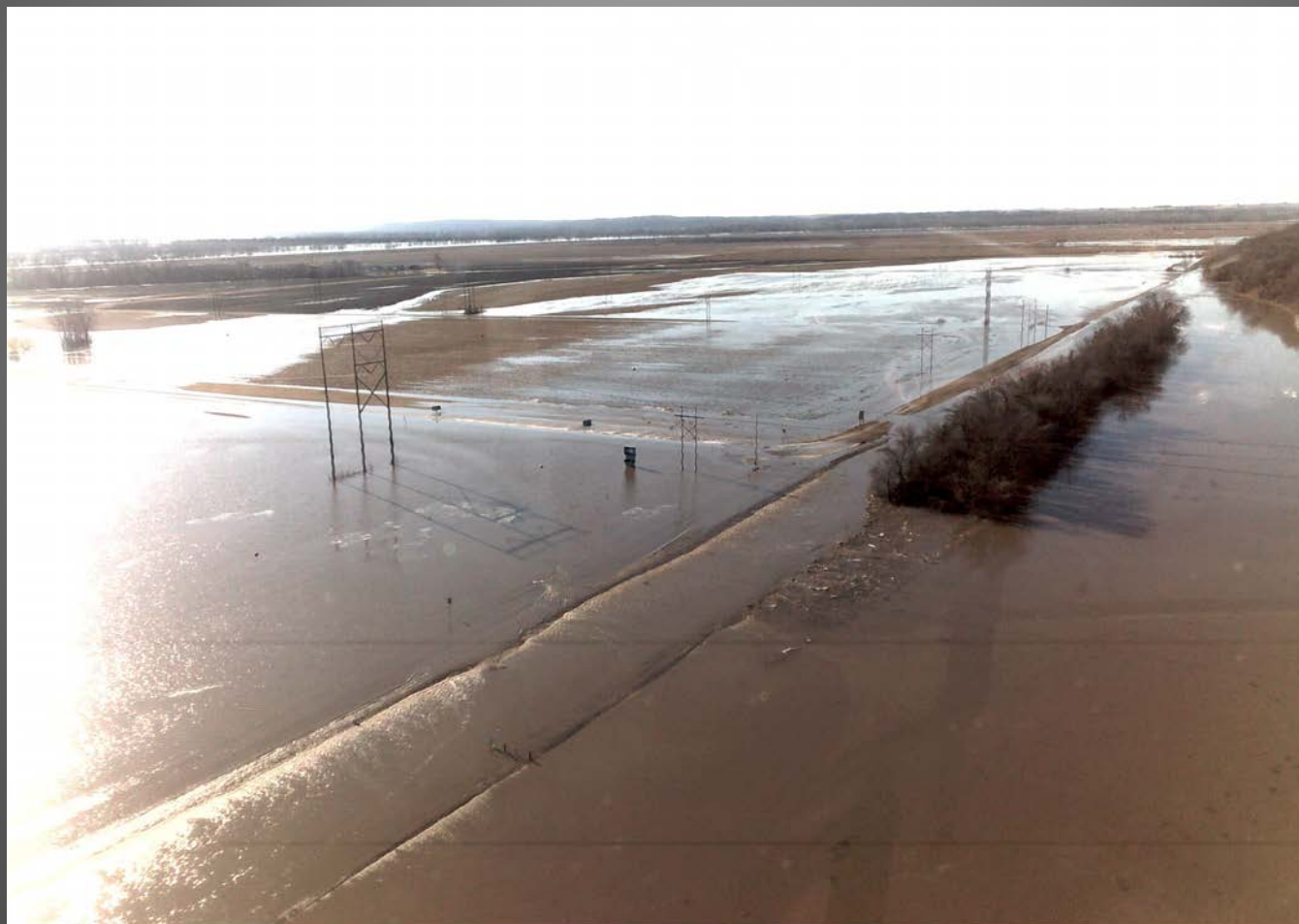
## CNS Event – Plant Access Road

- 3/16 am – Shuttling of employees across access road required due to road flooding caused by overtopping of North plant levee. (901.5')
- 3/16 am – CNS considers shutting down.





# CNS Event - Plant Access Road



**N** 40.361458

**W** 95.655667

GPS status : Active

2019/03/16

14:46:18 (UTC)

## CNS Event

- 3/16 pm – several large levee breaches upstream; river begins to lower ~2in/hr.
- 3/16 pm – With levee relief, CNS decides not to shut down.
- 3/16 – River level hovers at or below 901.5' feet for remainder of event.
- 3/24 1601 – Exited NOUE.





# Before (Looking North)





After (Looking North)





# West









 **U.S.NRC**  
UNITED STATES NUCLEAR REGULATORY COMMISSION  
*Protecting People and the Environment*

# Governor Visit





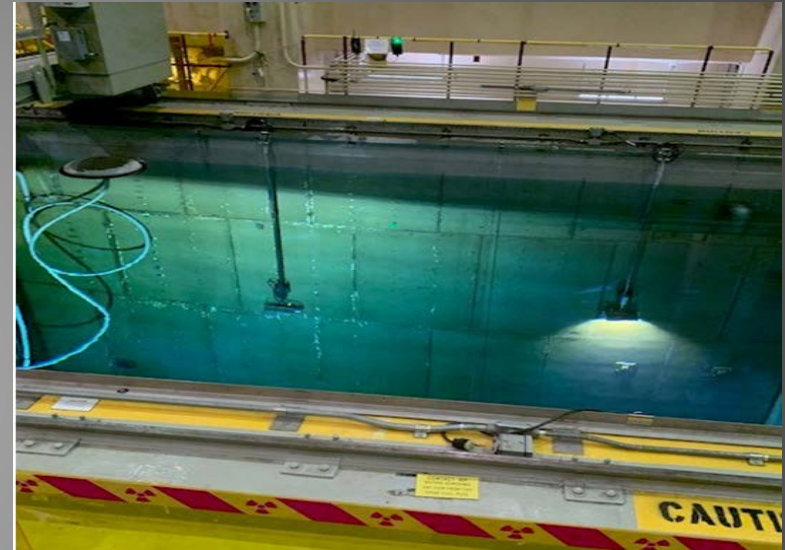
# National Guard





## Fort Calhoun Station 2019 - Event

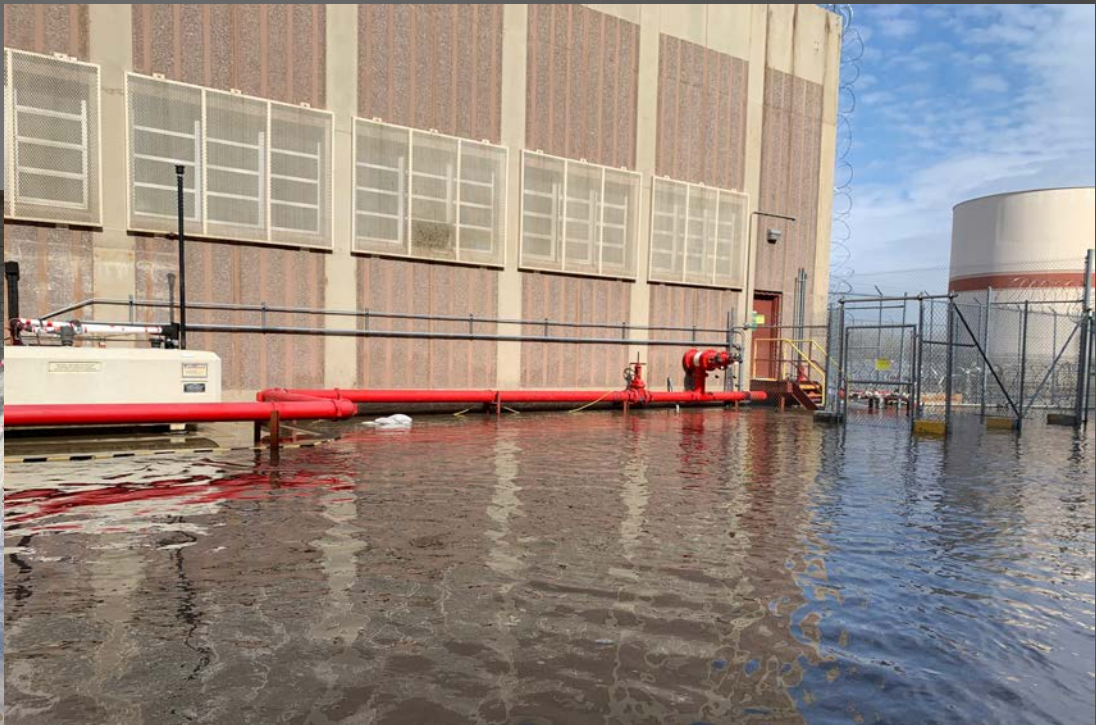
- Unit permanently defueled
- Entered Abnormal Flood Procedure 3/13/19
- Staffed OCC
- Water Above Site Grade 3/15/19
- Transferred SFP loads from 161kV to EDG on 3/15-3/16/19
- Restored offsite power 3/21



# FCS 2019 – Onsite Transit







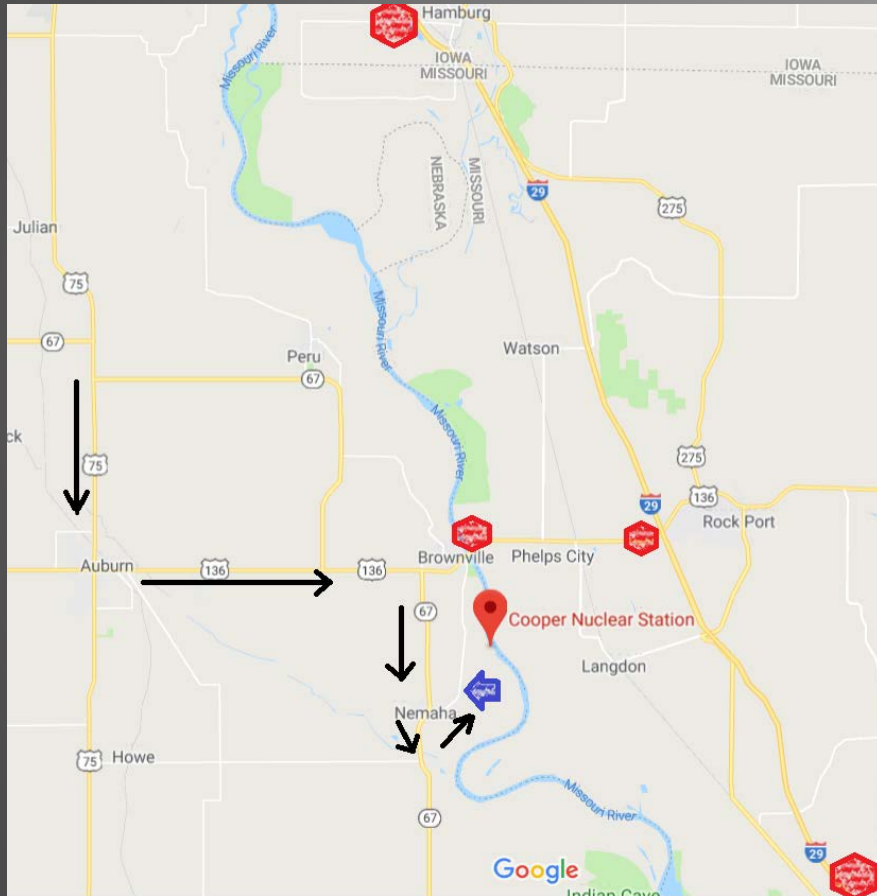


# FCS 2019 -DG Fuel Oil tank Water Intrusion



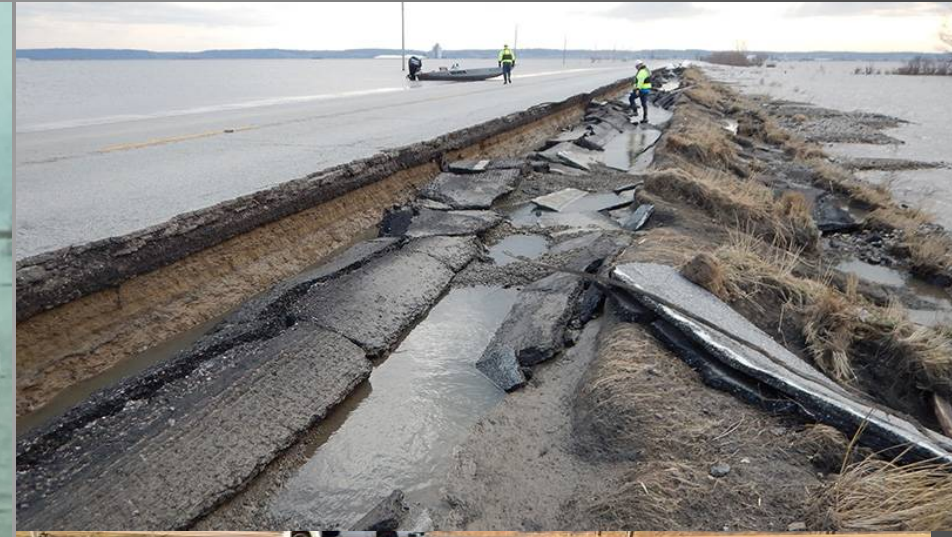


# Post Flooding Damage - Roads



40.404318 | W 95.595232 | GPS status : Active | 2019/03/18 | 15:37:19 (UTC)

# Flooding Damage - Roads





## Semi trucks on levee near CNS

- Road Closures and poor GPS directions led two semi trucks to inadvertently drive and get stuck on the levee near CNS.





## Flood Aftereffects - Groundwater

- 10/2/19 – alarms for ground on Div 1 125V DC bus.
- Groundwater inleakage onto Reactor Core Isolation Cooling.
- Elevated groundwater levels exposed deficient flood penetration seals.





# Flood Aftereffects – Heat Sink

- 12/8/19 – CNS discovers one division of Service Water discharge pipe plugged
- Determines likely cause is silting
- 12/12 – CNS begins dredging discharge
- NRC sends Special Inspection Team





# Spencer Dam – Nebraska (Before)





# Spencer Dam – Nebraska (After)





## Key Lessons Learned

- Flood vulnerabilities difficult to predict
  - Sandbags, sump pumps (defense-in-depth key)
  - DG Fuel Oil flange connection protection
  - Conduit and cable vault in-leakage likely
  - Elevated groundwater in-leakage into plant
  - Levees may overtop or fail
- Must prepare for Latent flood aftereffects
  - Groundwater in-leakage; silting of heat sink
- Highly complex flood strategies introduce additional vulnerability



# Questions?

