

**U.S.NRC**

UNITED STATES NUCLEAR REGULATORY COMMISSION

*Protecting People and the Environment*

# **Temporary Overhead Crane Failure at Arkansas Nuclear One**

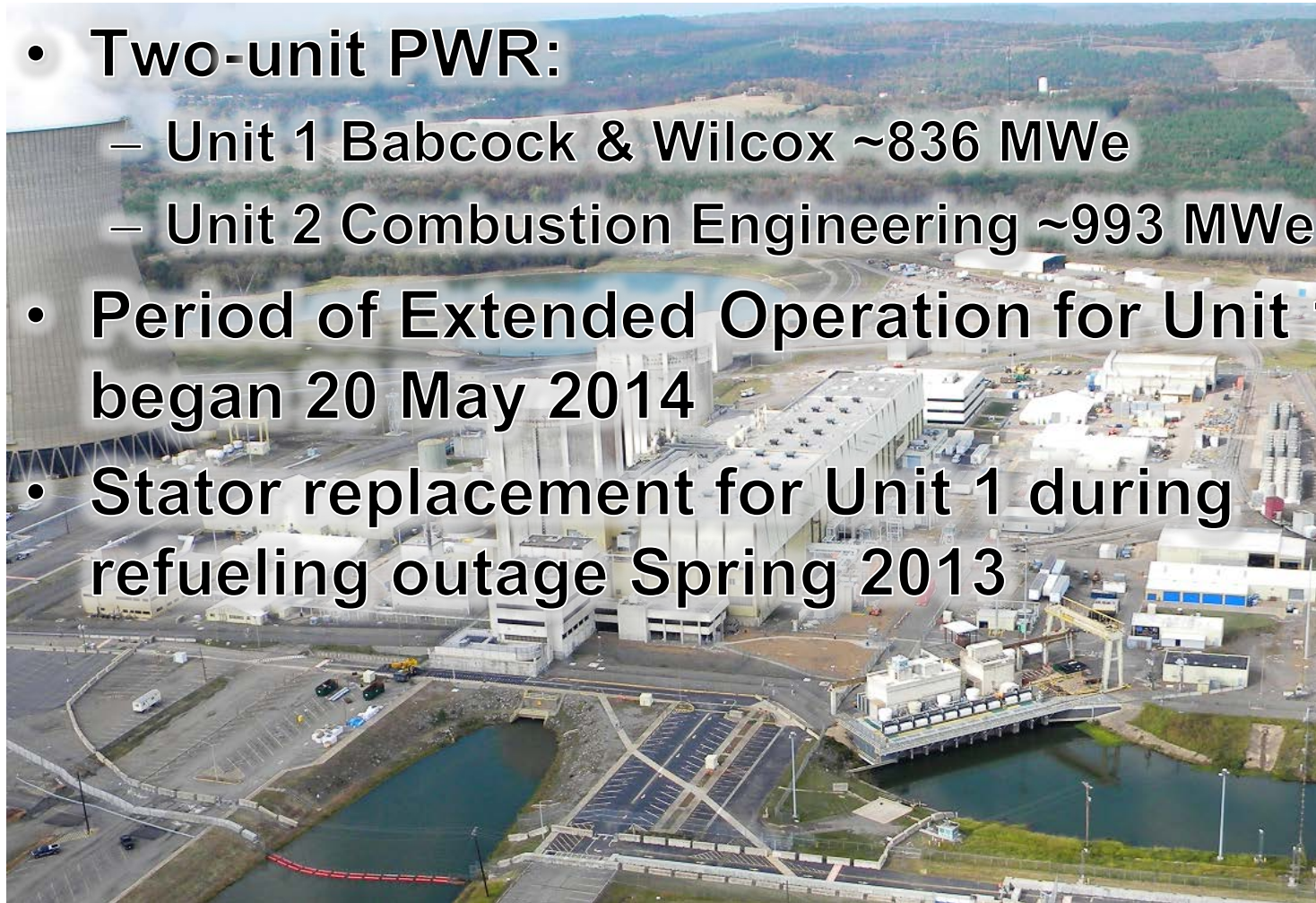
Workshop on Sharing Operating Experience  
from Rigging, Lifting and Load Handling  
Events

IAEA Headquarters  
27-30 November 2017

# Outline

- Overview of site and planned lift
- Discussion of the event
- Response actions
- Lessons learned (some confirmed)
- Recovery
- References

- **Two-unit PWR:**
  - Unit 1 Babcock & Wilcox ~836 MWe
  - Unit 2 Combustion Engineering ~993 MWe
- **Period of Extended Operation for Unit 1 began 20 May 2014**
- **Stator replacement for Unit 1 during refueling outage Spring 2013**

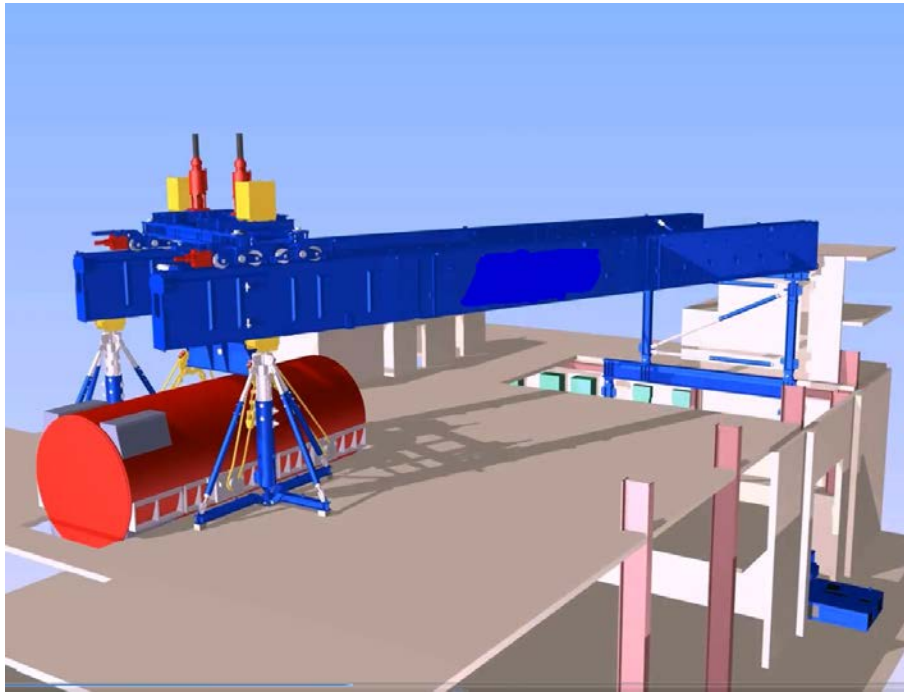


## Arkansas Nuclear One

Russellville, Arkansas

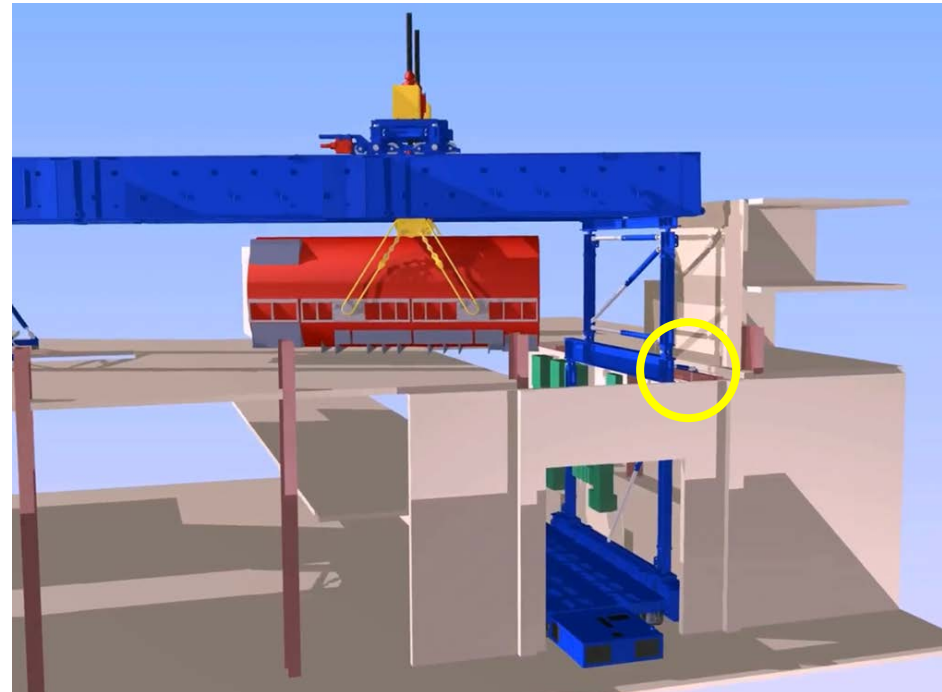
# Unit 1 Stator Replacement

## Computer Modelling



**Lift**

Stator weight ~525 tons  
(~477,000 kg)

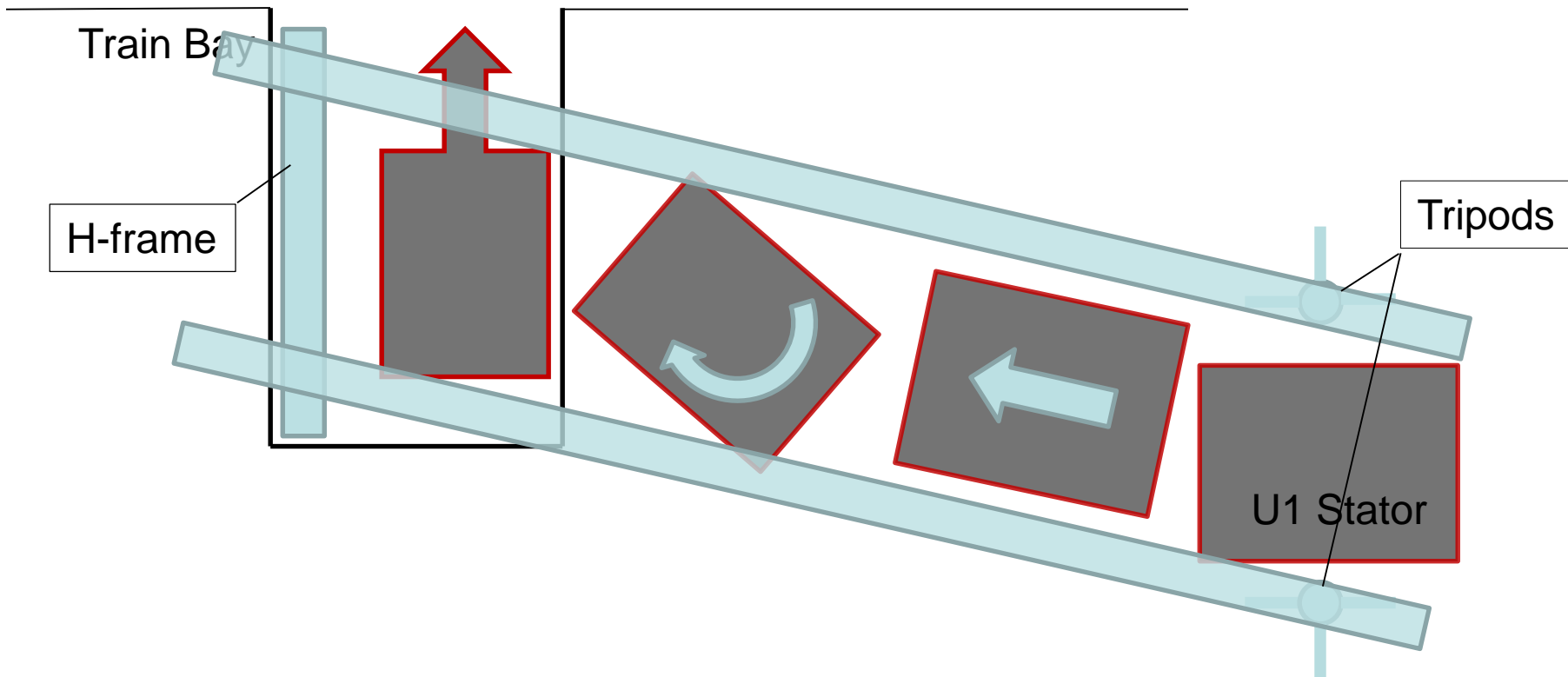


**Move**

Travel path ~90 ft (27 m) horizontal  
~29 ft (9 m) vertical

# Unit 1 Stator Replacement

## Animation of Planned Lift



# Event Summary

## Sunday, March 31

0639: Lift begins

0750: Crane fails, immediate loss of offsite power to Unit 1 (switchgear damaged), Unit 2 reactor coolant pump trip (vibration-induced) and reactor trip, fire piping ruptured

0923: Breaker failure from water leakage causes Unit 2 partial loss of offsite power and loss of instrument air to both units

1033: Notification of Unusual Event Declared

## Saturday, April 6

Offsite power restored to Unit 1 using temporary modifications







# NRC Response

- Senior Resident Inspector immediately responded to control room on site
- Emergency response mode decision
- Coordination with OSHA
- Performed risk evaluation of event to determine inspection response
- Augmented Inspection Team (second-highest reactive inspection) commenced April 8
- Repair/recovery inspections prior to restart



# Cause Evaluation

- From NRC Augmented Inspection Team Follow Up Inspection Report:
  - The overhead temporary hoisting assembly was not properly designed
  - The associated calculation was not reviewed
  - The assembly was not load tested

# Lessons Learned

- **Personnel Safety for Suspended Loads**
  - Be aware the area of impact could be more than beneath the suspended load from falling hoist/crane members or other damaged equipment
  - Installed/available cameras can be used to limit observers in the area



- Collateral Damage Possible from Chain Reaction Events
  - Water from ruptured piping
  - Power failures
- Expect Complications to Response and Recovery
  - Blocked access routes
  - Personnel injuries/fatalities





## Lessons Learned cont'd

- Full Consideration of Plant Risk
    - Watch for complacent attitudes associated with high consequence/low probability events
  - Control of Vendors and Contractors
    - In U.S., the licensee retains ultimate responsibility
    - Additional contractor organizations may be needed for technical review
- \*\*For inspectors: know how the licensee verifies compliance**





# Lessons Learned cont'd

- Inspector Response to Significant Events Involving Fatalities/Injuries
  - Maintain awareness of operator mindset
    - Significant emotional event
    - Licensee management actions to ensure operators remain focused on tasks
  - Be familiar with alternate access routes within the plant
  - Coordination with other government agencies

## Lessons Learned cont'd

- Maintain Open and Frequent Internal and External Communications
  - Coordinate with public affairs representatives and other local/federal government agencies
  - Social media a significant and increasing factor: help public affairs representatives stay in front

# Damaged Stator Removal



# Turbine Deck Repair



# Load Test of Replacement Crane



# References

- NRC Event Number 48869; Notification of Unusual Event Declared Due to a Breaker Explosion in the Protected Area
- Arkansas Nuclear One - NRC Augmented Inspection Team Report 05000313; 05000368/2013011 (ADAMS ML13158A242)
- Arkansas Nuclear One - NRC Augmented Inspection Team Follow Up Report 05000313; 05000368/2013012 (ADAMS ML14083A409)
- Information available on the NRC website [www.nrc.gov](http://www.nrc.gov)
- Investigation of the March 31, 2013 Temporary Overhead Crane Collapse At Arkansas Nuclear One Power Plant In London/Russellville, AR – OSHA ([www.osha.gov/doc/engineering/pdf/2013\\_r\\_04.pdf](http://www.osha.gov/doc/engineering/pdf/2013_r_04.pdf))