SAFETY CULTURE IN THE NUCLEAR SUPPLY CHAIN:

A CASE STUDY

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Workshop on Vendor Oversight

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Protecting People and the Environment

AGENDA

- Objective
- Background
- Timeline of Events
- Detailed Event Discussion

OBJECTIVE

Highlight safety culture challenges at the Chicago Bridge and Iron Lake Charles (CB&I LC) (formerly known as Shaw Modular Solutions) facility impacted the quality of items supplied to AP1000 construction sites.

BACKGROUND

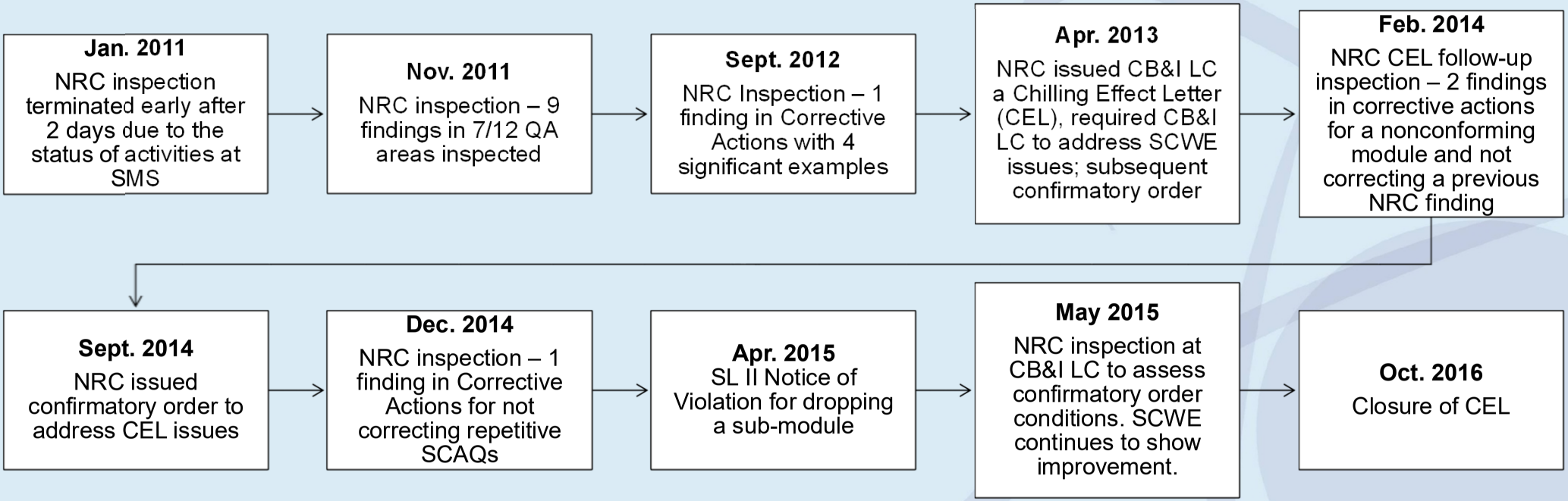
Shaw Modular Solutions (SMS) was contracted to fabricate and assemble structural and mechanical submodules for AP1000

Items included safety significant steel framework modules, valves, and piping on structural steel framework

SMS started delivering modules to Vogtle and Summer in August 2011

SMS became Chicago Bridge and Iron Lake Charles (CB&I LC) in Feb. 2013

TIMELINE OF EVENTS



JANUARY 2011 - NRC INSPECTION

- Routine vendor inspection (ML110190676) was terminated early due to the status of activities at SMS.
- Inspection of the effective implementation of the Appendix B to 10 CFR Part 50 (Appendix B) and 10 CFR Part 21 programs was not feasible.
- NRC inspection team gained valuable insights regarding the technical and programmatic challenges at the SMS facility.

JANUARY 2011 - NRC INSPECTION (CONT.)

- The NRC requested SMS provide the following information:
  - A description of the technical and programmatic challenges that SMS has identified during its self-assessment conducted in December 2010;
  - The proposed corrective actions that SMS plans on implementing to address the technical and programmatic challenges;
  - The date SMS expects to be in full production of structural and mechanical AP1000 submodules and;
  - The expectant date of the first shipment of AP1000 sub-module(s).

FEBRUARY 2011 - SMS RESPONSE

- In SMS' response (ML110550458), SMS identified technical and programmatic challenges since the initiation of fabrication activities in May 2010, in the areas of:
  - **Quality Assurance - Independence**
  - Training
  - **Corrective Action**
  - Management Oversight
  - **Welding Capabilities**
  - Material and Nonconforming Material Control

FEBRUARY 2011 - SMS RESPONSE (CONT.)

- SMS developed an action plan to address the challenges. The actions are related to the following general topics:
  - Nuclear Safety Culture
  - Quality Assurance
  - Nuclear Fundamentals
    - Corrective Action Program
    - Procedure Quality, Use and Adherence
    - Human Performance
    - Training
    - Management Oversight
  - Process Improvement
    - General
    - Welding
    - Work Control
    - Material Control

NOVEMBER 2011 - NRC INSPECTION

- NRC inspection to follow-up on the January 2011 inspection (ML11354A389)
  - Identified 9 findings in 7 of 12 QA areas inspected
    - Included multiple examples against Criterion II (QA Program) of 10 CFR 50, Appendix B
  - the NRC inspection team determined that SMS was not fully implementing its quality assurance program in the areas of:
    - training, **design control (redline drawings without proper approval)**, procurement document control
    - **control of special processes (welder qualifications)**, control of materials and test equipment
    - control of nonconforming items, and corrective actions **(72 of 561 CARs beyond due date; no evidence of corrective action report trend analysis required by customer purchase orders)**

SEPTEMBER 2012 - NRC INSPECTION

- **Unannounced** limited scope NRC Inspection (ML12279A119) to assess

SMS's compliance with the provisions of selected portions of 10 CFR Part 50, Appendix B

- Inspectors identified 1 finding Notice of Nonconformance (NON) in Corrective Actions with four examples for failure to:
  - Promptly implement corrective actions for conditions adverse to quality and SCAQs
  - Effectively implement a corrective action regarding documentation of late entries in the quality records procedure
  - Preclude recurrence of a significant condition adverse to quality (SCAQ) related to identification and control of weld wires used in the fabrication of safety-related modules
  - Perform adequate corrective actions associated with an NON from the Nov. 2011 NRC inspection for not performing trend analysis for CARs

APRIL 2013 - CHILLING EFFECT LETTER

- NRC issued CB&I LC a Chilling Effect Letter (CEL) (ML13092A077) after determining that a chilled work environment for raising and addressing safety concerns exists at SMS (now CB&I LC). Specifically:
  - In February 2012, SMS consultants identified that a chilled work environment exists at SMS.
  - SMS management took minimal actions to remedy the chilled work environment within a year following the survey – no corrective actions or implementation plans
  - The NRC reached the same conclusion as the SMS survey (after 3 inspections and 2 allegation follow-up safety conscious work environment (SCWE) assessments)
    - Portions of the SMS workforce, especially employees with nuclear and quality control backgrounds, have the perception that they are not free to raise safety concerns using all available avenues
    - SMS employees also believe individuals have been retaliated against for raising safety concerns
    - Management has not been effective in assuring employees that they may raise safety issues without fear of retaliation

FEBRUARY 2014 - NRC INSPECTION

- Limited scope NRC Inspection (ML14072A315) to assess CB&I LC's implementation of its QA program and the SCWE and actions taken to address the April 2013 chilled environment letter
- Inspectors identified 2 findings (NON) for failure to:
  - Correctly identify unresolved nonconformances on a safety-related sub-module awaiting shipment.
  - Promptly and effectively correct an NRC finding for red lining safety-related AP1000 sub-module drawings (20 CARs in 2013 for similar issue after closing the CAR for the finding)
- Inspectors found that the SCWE had improved.
- Inspectors concluded that the corrective actions taken, if continued to be implemented, will result in a sustained SCWE.

SEPTEMBER 2014 - CONFIRMATORY ORDER

- NRC issued CB&I LC a Confirmatory Order (ML14248A445) to confirm commitments reached after an alternative dispute resolution (ADR) mediation
- NRC investigation concluded three CB&I LC employees deliberately subverted welder qualification requirements:
  - A welder took qualification tests for another coworker
  - The coworker allowed the welder to take the test on his behalf
  - The weld test administrator certified that the coworker passed the tests
- CB&I LC agreed to correct the underlying causes:
  - Improve quality control and processing for welding products
  - Enhance new employee training to highlight the errors behind the weld testing issues
  - Enhance CB&I LC's nuclear safety culture monitoring program based on lessons learned

DECEMBER 2014 - NRC INSPECTION

- Limited scope NRC inspection (ML14352A127) to assess CB&I LC's implementation of its QA program and Part 21

- Inspectors identified 1 NON for failure to:
  - Take corrective actions to preclude repetition of SCAQs associated with the breakdown of CB&I LC's QA program
    - Licensees reported the QA program breakdown at CB&I based on the quality of the items they received
    - CB&I LC only took corrective actions for SCAQs related to welding, while others were not corrected
    - CB&I LC lacked objective evidence that a comprehensive review of the QA program was performed to verify the effectiveness of the corrective actions taken

APRIL 2015 - NOTICE OF VIOLATION

- Severity Level II Notice of Violation issued to CB&I LC (ML15082A130) for:
  - Deliberate misconduct by CB&I LC officials and employees related to a dropped sub-module that occurred on March 1, 2013
  - Officials and employees attempted to cover up the incident on a sub-module destined for the Virgil C. Summer Nuclear Station
  - Information omitted from the incident investigation statements include:
    - The sub-module dropped approximately 3.5 feet
    - Improper rigging equipment was used, and cables broke during movement
    - The sub-module sustained damage
  - Resulted in a finding against 10 CFR Part 50, Appendix B, Criterion XVI (Corrective Actions) for failing to promptly identify and correct the SCAQ for the issues that led to the damaged module

MAY 2015 - NRC INSPECTION

- NRC inspected CB&I LC (ML15169A231) to assess actions taken regarding the 2014 confirmatory order.
  - specifically, to evaluate communications, training, work processes, nuclear safety culture, and SCWE
- No findings were identified
- Inspection found CB&I LC was meeting the conditions of the confirmatory order
- Inspection identified that SCWE continues to show improvement

OCTOBER 2016 - CEL CLOSURE

- NRC closed the April 2013 chilling effect letter; confirmatory order remained open
  - Results of multiple inspections, interviews and safety culture surveys and assessments, found CB&I LC made reasonable progress in addressing SCWE issues
  - NRC determined that CB&I LC had implemented a range of corrective actions
    - NRC found the implementation of new programs to continue improving the SCWE at CB&I LC to be adequate to address the chilling effect letter
  - NRC determined that the SCWE program was consistent with the NRC's June 2011 Safety Culture Policy Statement