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Light Water Reactor Sustainability Program

Initial Scoping Efforts for a Plantwide Digital Infrastructure Modernization Business Case Study

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Initial Scoping Efforts for a Plantwide Digital Infrastructure Modernization Business Case Study

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ACRONYMS

BCA	Business Case Analysis
BOP	Balance of Plant
DI&C-ISG-06	Digital Instrumentation and Controls Interim Staff Guidance #06
DA&A	Data Architecture and Analytics
DI	Digital Infrastructure
HSI	Human System Interfaces
I&C	Instrumentation and Controls
ION	Integrated Operations for Nuclear
LWRS	Light Water Reactor Sustainability (Program)
NRC	Nuclear Regulatory Commission
POC	Power Optimization Center
SSPS	Solid State Protection System
U.S.	United States

INITIAL SCOPING EFFORTS FOR A PLANTWIDE DIGITAL INFRASTRUCTURE MODERNIZATION BUSINESS CASE STUDY

1. OVERVIEW

The commercial nuclear sector has recently faced unprecedented financial challenges driven by low natural gas prices and subsidized renewables in a marketplace that did not reward carbon-free baseload capacity until the federal government's action to pass the Inflation Reduction Act. These circumstances, along with increasingly antiquated, labor-centric operating models and analog technology, have forced nuclear licensees to evaluate ways to maintain economic, long-term operations.

For nuclear power plants in the United States (U.S.) to continue to earn the Production Tax Credits available under the Inflation Reduction Act and to extend their operational lifetimes, licensees will need to consider the transformation of their power plant operations to a technology-centric operating model that harvests the native efficiencies of advanced technology. This is analogous to transformations in nearly every other industry. Considering previous industry experience in modernizing safety Instrumentation and Controls (I&C) systems, nuclear utilities have been reluctant to pursue these upgrades due to uncertainty in licensing and cost.

Historical licensing barriers have largely precluded the modernization of nuclear plant first-echelon safety I&C systems to support this transformation. These barriers have now been largely addressed through collaboration between industry leaders and the Nuclear Regulatory Commission (NRC). These advances enable the modernization of key safety systems through the streamlined license amendment process reflected in Digital Instrumentation and Controls Interim Staff Guidance #06 (DI&C-ISG-06), Revision 2, "Licensing Process" [1].

While regulatory advances have improved the environment for modernizing safety systems, the industry has remained reluctant to perform such I&C upgrades because of perceived regulatory risks associated with being the first adopter of the DI&C-ISG-06, Revision 2 process for a major critical safety I&C system. Light Water Reactor Sustainability (LWRS) Program research report INL/LTD-20-58490, "Vendor-Independent Design Requirements for a Boiling Water Reactor Safety System Upgrade" [2], was developed in part to help address this concern.

To address cost uncertainty in large-scale digital upgrades, ScottMadden, Inc., in collaboration with LWRS researchers, produced research report INL/EXT-20-59371, "Business Case Analysis for Digital Safety-Related Instrumentation and Control System Modernizations" [3]. Performing the Business Case Analysis (BCA) as described in Reference [3] while using Reference [2] as a technical foundation was an enabler for the decision by Constellation Energy to perform safety-related I&C upgrades on the Limerick Generating Station.

LWRS research described in this document expands the use of the BCA methodology and associated tools developed as described in Reference [3] to a larger scope of digital upgrades to affect a larger digital transformation of a nuclear plant. This larger scope is described in LWRS research report INL/EXT-21-64580, "Digital Infrastructure Migration Framework" [4]. This effort is guided by the Integrated Operations for Nuclear (ION) concept as summarized in Reference [4]. The intent of this effort is to optimize the application of digital technology to lower the total cost of ownership and enable the long-term nuclear plant economic viability of the existing nuclear fleet in the U.S.

This research report describes the preparatory efforts (Phase 1) to perform a BCA on an expanded set of digital upgrades envisioned for implementation at the Luminant's Comanche Peak nuclear plant. It captures efforts to scope the digital upgrade effort for a BCA. The final BCA (Phase 2) will be the subject of a subsequent report. LWRS pilot research in this area is intended to enable this effort and provide a roadmap for others to follow. Idaho National Laboratory (INL) appreciates Luminant's participation in this research. This document makes no commitments for the Luminant.

2. OVERALL APPROACH

The BCA is separated into two phases, as shown in Figure 1. This report focuses on Phase 1 activities, which are the foundation for Phase 2.

Figure 1. Business Case Analysis approach.

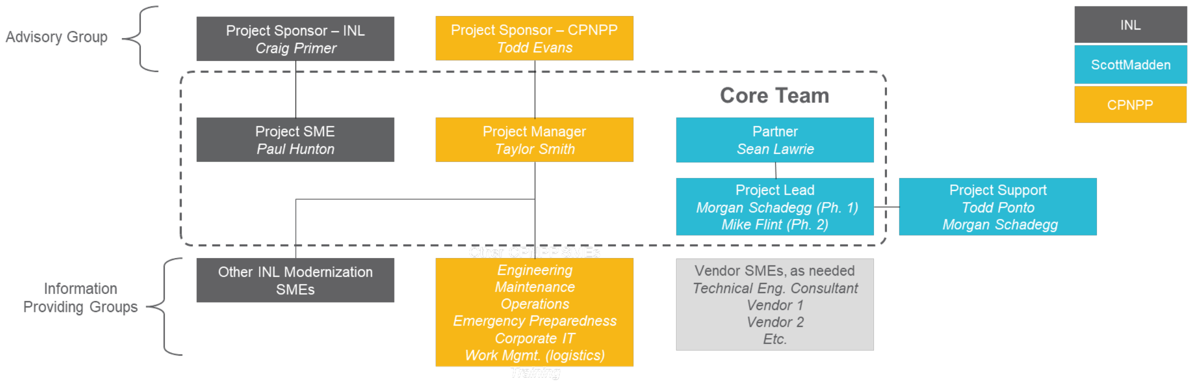
The focus of the Phase 1 of the project, as shown at the top left of Figure 1, was to have all project team members agree on the scope and strategic direction of the digital upgrades planned for the nuclear power plant. In Phase 1, May–September 2022, the project team:

- Performed weekly core team meetings to promote the communication and alignment of Phase 1 efforts (Section 5.1.1)
- Conducted working sessions with nuclear power plant stakeholders to define an advanced concept of operations to support the target facility New State (see Section 5.1.2)
- Conducted a working session with Luminant corporate and Comanche Peak leaders to align the project to a larger utility- and industrywide Power Optimization Center (POC) enabled New State (Section 5.1.3)
- Conducted performance attribute working sessions with separate stakeholder groups to identify current state capabilities of systems in scope for the upgrade and potential advanced capabilities enabled by the application of digital technology within the larger digital infrastructure (DI) shown in Figure 3 (Section 5.1.4)
- Conducted working sessions with potential vendors to establish the viability of their technologies to provide performance attributes, formal lifecycle management) with the nuclear plant leadership (Section 5.1.5).

The result of these activities was to produce a more detailed Project Scope, as captured in Section 5.2, to develop a detailed business case that will be performed during Phase 2 of this effort, as discussed in Section 6.

3. TEAM COMPOSITION

In order to properly execute collaborative research efforts with the industry, a project team was developed. Figure 2 provides the project team structure for this effort.



INL team:	Nuclear plant team:	ScottMadden team:
▪ Provides research input for each stage of the project ▪ Reviews outputs and supporting documentation and provide feedback ▪ Schedules and facilitates validation meetings with the appropriate advisory group, as needed	▪ Provides necessary access to system data and information ▪ Engages and coordinates plant resources, as needed	▪ Collects and analyzes the necessary inputs ▪ Revises the templates for information collection and validation ▪ Develops, inputs data, and revises documentation as needed based on nuclear plan and INL SME feedback

Figure 2. Project team structure.

INL researchers have established the guiding technical basis for this effort through the development of research documents, as described in Section 4.

4. GUIDING TECHNICAL BASIS

4.1 Digital Infrastructure Migration Framework

A wide body of research has been conducted on the DI and systems at a typical nuclear power plant. The Digital Infrastructure Migration Framework [4], part of the LWRS Program at INL, outlines a generic framework for nuclear DI applicable to any facility.

In the DI, there are six network levels that correspond to the Purdue Model for industrial control systems. These Purdue Model levels have been cross referenced to NRC cybersecurity levels from Regulatory Guide 5.71, “Cyber Security Programs for Nuclear Power Reactors.” A simplified diagram showing this is provided in Figure 3. The Purdue Model levels are identified as the corporate network, an intermediate emergency preparedness level, an advanced control and application level, a supervisory level, a control network level, and a field device level. Each Purdue Model level fits within the NRC’s hierarchy of cybersecurity, starting at the NRC’s corporate network level, to the emergency preparedness level, and then to the plant computing level.

Digital components and software described in this report will be installed within multiple levels of the DI. For instance, digital components within the indication and control loops directly interfacing to the nuclear plant that replace existing analog devices will exist in Purdue Network Level 0. Digital I&C systems and their associated software will exist at Purdue Network Levels 1 (Control Network) and 2 (Supervisory Network) and so on. The DI is not constrained to be built from either the bottom up or the top down (see Figure 3). It is imperative that each Purdue Level is treated discreetly to ensure cybersecurity and data fidelity. Data and analysis coming from a non-cyber-secure source (i.e., the corporate network) cannot be used to directly make operational decisions.

The intent of this report is not to explain the DI presented in INL/EXT-21-64580 in detail but to point the reader to this research as a compliment the ION model (described in Section 4.2) and especially the capabilities of digital upgrades to enable work-reduction opportunities.

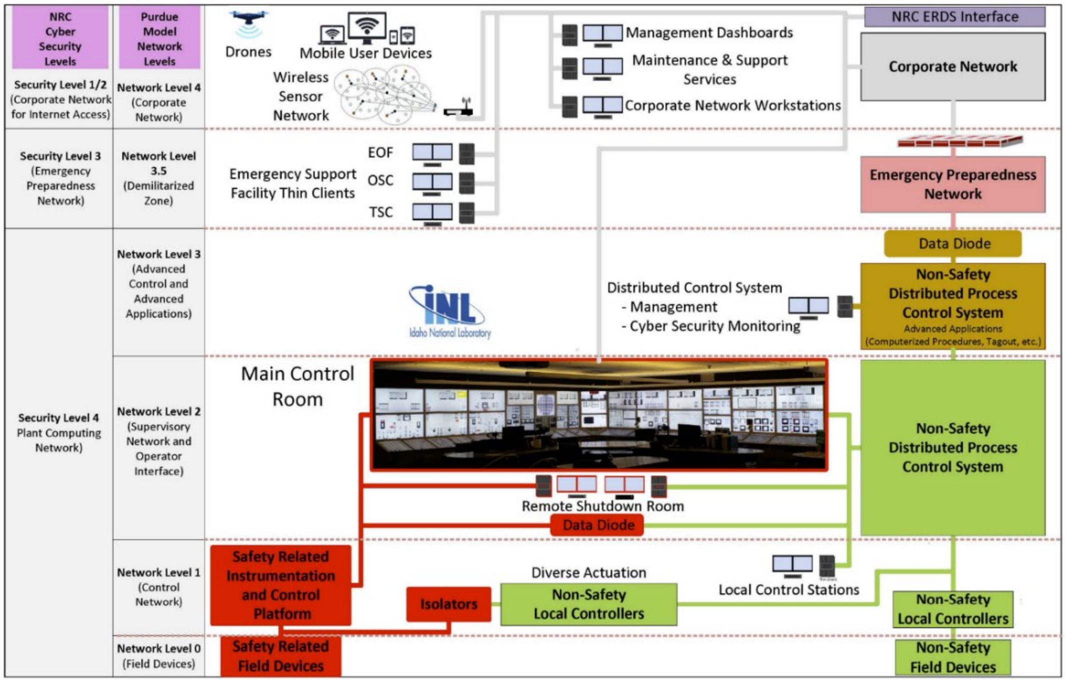


Figure 3. Simplified Digital Infrastructure diagram showing network levels.

4.2 Integrated Operations for Nuclear

Figure 4 provides an overall view of the objectives, research areas, and desired outcomes associated with the LWRS Plant Modernization Research area.

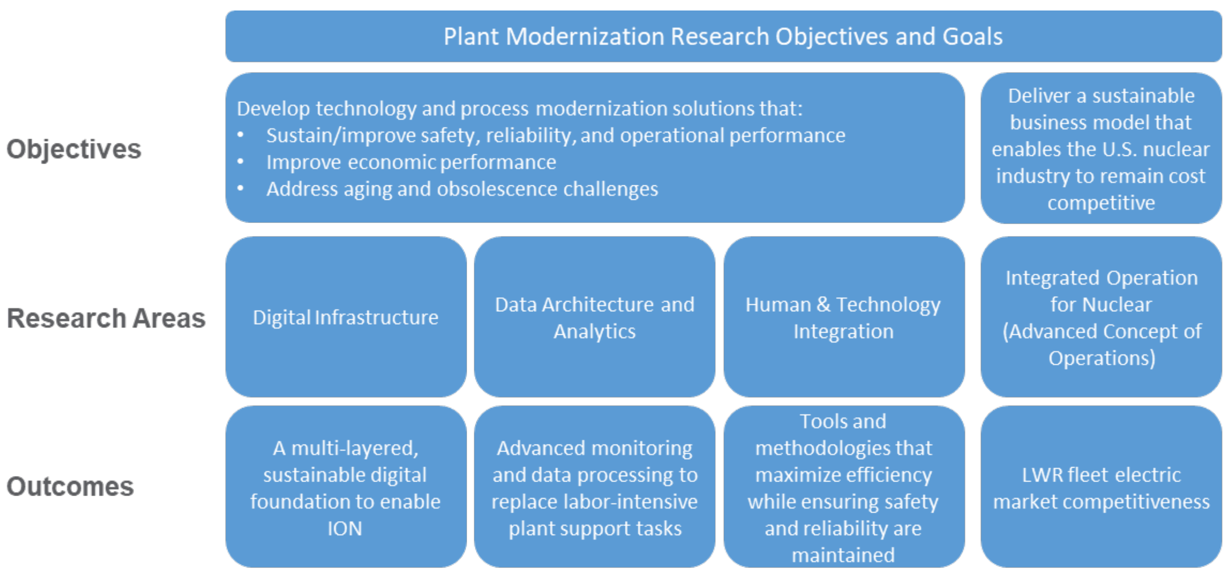


Figure 4. LWRS Plant Modernization Pathway objectives and goals.

The DI, as shown at the bottom left of Figure 4, provides the foundation for overall LWRS Program Plant Modernization Research objectives and goals. Moving from left to right at the bottom of Figure 4, the DI hosts Data Architecture and Analytics (DA&A) software applications developed to enable desired capabilities, such as advanced monitoring and data processing, to replace labor-intensive plant operations and support tasks. Human and Technology Integration activities ensure that the DI Human System

Interface (HSI) hardware, along with the DA&A application functionality accessed through these HSIs, optimizes the use of enabled capabilities by personnel at each Purdue Network level.

ION model research makes up the far-right column of Figure 4. ION provides strategic direction for all LWRS Plant Modernization Pathway efforts performed for utility benefit. Research outcomes in the three left columns of Figure 4 are not performed for their own sake. They are focused to enable operational capability process improvements identified by ION to enhance light-water reactor fleet electric market competitiveness while maintaining and improving safety and reliability.

For this research, INL and ScottMadden have been coordinating with Luminant's Comanche Peak nuclear power plant to understand digital upgrade needs driven from both an obsolescence perspective (bottom up) and from business needs perspective (top down) to best identify the scope of digital upgrades to be performed.

4.3 Business Case Analysis Methodology

The BCA methodology as developed and leveraged as described in Reference [3] is used to synthesize the scope of the digital upgrade effort bounded by the concepts presented in Sections 4.1 and 4.2. The BCA first systematically establishes a forecast of expected lifecycle costs for I&C identified for upgrade by:

- Definitively bounding the scope of current systems envisioned for digital upgrades
- Collecting historical labor and material usage data that bound cost contributors related to the systems to be upgraded
- Synthesizing and analyzing the data to establish lifecycle cost forecasts for the current systems.

In collaboration with engineers familiar with the attributes of the digital equipment to be used in the upgrade and how it is envisioned to be applied, cost savings categories and expected savings in those categories are then identified and applied using the analysis tools developed for this purpose. The result is an estimated Net Present Value of savings enabled by the upgrade. This includes both direct cost savings (e.g., surveillance labor costs) as well as cost avoidance items (e.g., inventory carrying costs). Finally, when utility-provided digital upgrade cost estimates are included, the resultant BCA provides an Net Present Value for the upgrade project.

5. SCOPE DEFINITION FOR THIS RESEARCH

5.1 Working Sessions and Site Meetings

In order to bound the scope of the digital modernization envisioned for implementation at Comanche Peak, as captured in Section 5.2, a series of teleconference working sessions and site meetings occurred. Efforts associated with these activities are summarized in Figure 5 and Section 5.1 subsections.

Meeting	Focus	Attendees	Date and Duration	Key Outcomes
Weekly Core Team	• Review project status, upcoming items, concerns, and key items to be addressed	• Core team members	Once/week 1 hour	• Updated BCA project schedule, addressed issues, and aligned on upcoming items
Advanced Concept of Operations Stakeholder Working Sessions	• Validate identified digital modernization projects • Review target state and identify gaps • Define desired attributes for the New State Vision	• Core team members • Nuclear plant stakeholders	July 21 Full Day; ~2 hours each for 3 stakeholder groups	• Validated and identified necessary digital modernization projects • Defined desired attributes for the New State Vision
Power Optimization Center Alignment	• Educate core team on alignment of new state vision to existing and potential future POC capabilities	• Core team members • Nuclear plant stakeholders	Sept 7 2 hours	• Confirmed POC capabilities can support additional new state vision data monitoring
System Performance Attribute Working Sessions	• Bound in-scope functions / systems: • Define needed capabilities for the New State • Identify target digital platform capabilities	• Core team members • Nuclear plant stakeholders	Sept 7 & 8 Full Day; 1-2 hours per stakeholder group	• Listed necessary application capabilities • Listed platform performance attributes • Preliminarily assessed ability to leverage "existing state" investments
Vendor Attribute Working Sessions	• Educate vendors on the business case approach • Confirm vendor input on the systems in scope	• Core team members • Vendors	Aug 29 & 30 1 hour each	• Confirmed in-scope systems with Vendor 1; waiting on confirmation from Vendor 2

Figure 5. Phase 1 working meetings.

5.1.1 Weekly Core Team Meeting

A series of weekly teleconferences were held to bound and coordinate Phase 1 efforts. This included identifying:

- Dates for the working sessions and meetings described in the remaining Section 5.1 subsections
- Goals and objectives of each
- Detailed content of what was going to be discussed
- Necessary participants for them.

5.1.2 Advanced Concept of Operations Stakeholder Working Sessions

Working sessions were held with four different Comanche Peak stakeholder groups. The objectives of the working sessions were to:

- Conduct a stakeholder-needs assessment to identify the optimal technologies needed to support long-term operations
- Confirm what current systems, components, and parts face obsolescence issues and establish necessary functionality for their replacements
- Define the advanced concept of operations to support the New State
- Agree on the performance attributes for DI systems that support the New State.

The four nuclear Comanche Peak stakeholder groups were:

- Group 1: Operations, Engineering (I&C, Systems), Maintenance (I&C)
- Group 2: Emergency Preparedness
- Group 3: Information Technology Network Subject Matter Experts (SMEs), Logistics Applications SMEs, Cybersecurity SMEs
- Group 4: Training.

The result of this effort contributed to the Project Scope for Phase 2, as captured in Section 5.2.

5.1.3 Power Optimization Center Alignment

An alignment meeting was conducted at the Luminant POC facility in Dallas, Texas (https://www.luminant.com/poc/). POC personnel and core team members met to:

- Understand current system and component monitoring capabilities across all forms of generation (wind, solar, nuclear, gas, biomass, coal)
- Understand the future state vision for the POC and how it can integrate into the New State vision of Comanche Peak
- Understand the capabilities and resource levels if additional monitoring data were to be integrated into the POC
- Validate the current initiatives at Comanche Peak and how critical they are to achieve the POC future operations.

The meeting identified additional opportunities for supporting day-to-day plant monitoring operations without a significant investment in personnel or software licenses. This will be confirmed during Phase 2 of the business case with a deeper financial and workload analysis.

During the meeting, POC stakeholders agreed with the future Concept of Operations and New State vision as enabled by Figure 3 to enhance POC performance, centralize remote monitoring, and reduce total ownership costs of units monitored by the POC.

The result of this effort also contributed to the Project Scope for Phase 2, as captured in Section 5.2.

5.1.4 System Performance Attribute Working Sessions

Working sessions were held with a variety of nuclear Comanche Peak stakeholder groups to:

- Address the following for each Purdue Model level of the DI shown in Figure 3:
    - Bound the in-scope functions and systems of the project
    - Identify the parameter types needed to enable the needed capabilities
    - Define the needed application capabilities for the New State
    - Identify the target digital platform capabilities
- Establish key vendor attributes (e.g., viable technology to provide performance attributes, formal lifecycle management).

The Comanche Peak stakeholder groups included:

- Operations
- Engineering
- Maintenance
- Emergency Preparedness
- Information Technology Network Subject SMEs
- Logistics Applications SMEs

The result of this effort also contributed to the Project Scope for Phase 2, as captured in Section 5.2

5.1.5 Vendor Attribute Working Sessions

A working session was held with each of the two potential I&C vendors. The objectives of the working sessions were to obtain vendor input into the systems in scope for the business case and, for each in-scope system, define the vendor attributes needed to support the desired system performance characteristics. As of the writing of this report, one vendor had provided input into the in-scope systems of the business case. The other potential vendor is still developing its proposed in-scope system list.

The result of this effort also contributed to the result captured in Section 5.2

5.2 Project Scope

As a result of the efforts documented in Section 5.1, the initial Project Scope for digital upgrades was established and captured in Table 1 at the end of this section. The exact systems to be upgraded and proposed order of the upgrades will be established in Phase 2.

The initial scope of the digital I&C replacement business case will focus on the following systems:

- Process Protection System
- Nuclear Instrumentation – Safety and Control
- Solid State Safeguards Sequencer
- Post-Accident Monitoring System Variables
- Hydrogen Monitoring
- Hot Shutdown Panel
- Balance of Plant (BOP) Controls
- Nuclear Safety Shutdown System Process Control
- Anticipated Transient without Scram Mitigation Signal Actuation Circuitry
- Feedwater Heater Drain Controls
- Containment Atmosphere Monitoring
- Rod Position Indication
- Flux Mapping System
- Annunciator System.

Systems or components that will be evaluated for the integration of the existing data into the new digital I&C design:

- Meteorological Monitoring
- Turbine Controls
- Plant Computer
- Leading Edge Flow Meter.

Additional systems and components may be evaluated in Phase 2, depending on an additional evaluation of financial benefits to Comanche Peak and contribution to the New State vision of operations.

In accordance with DI research, the expectation is that:

- Existing safety system functionality impacted by the I&C upgrade effort will be migrated to a single safety-related digital platform to the maximum extent practicable
- Existing non-safety system functionality impacted by the I&C upgrade effort will be migrated to a single non-safety distributed process control system to the maximum extent practicable
- Digital information from the above two platforms (including both plant data and I&C system status) will be made available to higher levels of the DI.

This is intended to enable initial implementation and lifecycle cost reductions by:

- Collapsing the existing physical I&C infrastructure onto the two I&C platforms, which allows for:
    - Standardized implementations that reduce the number of unique parts and total part counts

    - Reduced training requirements to maintain existing disparate and antiquated technology
    - Digital I&C system capabilities, such as:
        - Automated self-diagnostics
        - Elimination of analog calibrations by design to reduce operating and maintenance
    - The automation of previously manual functions to improve plant performance and reduce human error
    - Providing modern HSIs for each of the two I&C platforms that are internally consistent and consistent with each other to improve operator performance and reduce human error
    - Leveraging vendor-developed and tested lifecycle support strategies to protect initial digital I&C upgrade intellectual property investments and minimize costs associated with digital hardware and software obsolescence
- Passing I&C information to higher levels of the DI to:
    - Support the expansion of capabilities as presented by Luminant in their POC, such as:
        - Centralized diagnostic monitoring of the Comanche Peak's systems and equipment to detect off-normal conditions
        - Centralized prognostic monitoring of the Comanche Peak's systems to predict system and equipment performance issues to enable condition-based maintenance
    - Support I&C system remote health monitoring and support
    - Enable higher-level corporate capabilities, such as automated work scheduling, based upon plant system issues or I&C system issues as communicated to or detected by the analysis of I&C systems-provided information.

Development and use of supporting infrastructure at Network Level 3 and above, as shown in Figure 3, will also be evaluated as part of this effort. The use of plant simulators will also be evaluated to support not only ongoing operations but also the optimal implementation of the DI and associated DA&A applications to achieve Comanche Peak's Concept of Operations and New State performance cost goals.

One key issue that will be resolved in Phase 2 is the sequencing of the modernization of I&C systems and components. Vendor 1 suggested starting the implementation of safety systems and transitioning to non-safety systems. The core team plans to evaluate and recommend the implementation of the digital I&C systems and components to be sequenced over multiple outages and start with the non-safety system upgrades then transition to safety system. One initial benefit to this approach is that it would allow for additional time to plan licensing amendment request changes to the plant.

One additional piece of research that will be provided in the Phase 2 business case report is a high-level assessment of the benefits and costs of implementing additional ION technologies to support the plant's long-term operations (INL/RPT-22-68671, "Integrated Operations for Nuclear Business Operation Model Analysis and Industry Validation") [5].

Table 1, below, summarizes the findings from the activities performed in Phase 1. The definitions of each column are:

- **#:** Row number.
- **I&C Subsystem:** Current I&C subsystem evaluated for potential modernization.
- **Safety/Non-Safety:** Whether the I&C subsystem is used for safety purposes, non-safety purposes, or both.
- **Current Platform:** Existing infrastructure of the I&C subsystem.
- **In Scope for Modernization:** Project team's determination as to whether the I&C subsystem should be included as part of the modernization scope in Phase 2.
- **Vendor 1 and 2 Scope:** Whether the I&C subsystem was included in the potential vendors' (e.g., Vendor 1, 2) modernization scope.

- **Reliability:** Project team's evaluation of the I&C subsystem's current performance pertaining to reliability. Reliability refers to the level of corrective actions required to operate and maintain the I&C subsystem. In this case, a favorable reliability rating is characterized by a minimal number of corrective actions, and an unfavorable reliability rating is characterized by a large number of corrective actions.
- **Obsolescence:** Project team's evaluation of the I&C subsystem's current performance pertaining to obsolescence. Obsolescence refers to the level of issues resulting from the obsolescence and lack of availability of parts and components for the I&C subsystem. In this case, a favorable obsolescence rating is characterized by a lack of obsolescence and high availability of subsystems components, and an unfavorable obsolescence rating is characterized by consistent obsolescence and a lack of availability of subsystems components.
- **Workload:** Project team's evaluation of the I&C subsystem's current performance pertaining to workload. Workload refers to the level of workload required to operate and maintain the I&C subsystem. In this case, a favorable workload rating is characterized by a minimal level of workload, and an unfavorable workload rating is characterized by a high level of workload.
- **Other Notes:** Additional notes and context related to the findings and evaluation of the I&C subsystem in Phase 1.

Table 1. I&C system scope list.

Table 1 legend

	Current performance in this area is favorable
	Current performance in this area is mixed
	Current performance in this area is unfavorable
TBD:	To be determined by the project team in Phase 2
Blank cell:	Information not yet received
*	Modernization only includes the system's interface

#	I&C Subsystem	Safety or Non-Safety	Current Platform	In Scope for Modernization?	Vendor 1 Scope?	Vendor 2 Scope?	Reliability	Obsolescence	Workload
1	Process Protection System	Safety	Westinghouse 7300	Yes	Yes				
2	Solid State Protection System (SSPS)	Safety	SSPS	No					
3	Nuclear Instrumentation – Safety/Control	Safety	NIS	Yes	Yes				TBD
4	Nuclear Instrumentation – RG1.97	Safety	ENFMS	TBD					TBD
5	Solid State Safeguards Sequencer	Safety	SSSS	Yes	Yes				

#	I&C Subsystem	Safety or Non-Safety	Current Platform	In Scope for Modernization?	Vendor 1 Scope?	Vendor 2 Scope?	Reliability	Obsolescence	Workload
6	Emergency Diesel Generator Control	Safety	Analog	No			TBD		TBD
7	Safeguards Test Cabinet	Safety	Switches (Part of SSPS)	No					
8	PAMS Variables	Safety	Analog Meters	Yes	Yes				
9	ICCM/RVL (HJTC)	Safety	Vendor Multibus (HJTC)	TBD			TBD	TBD	TBD
10	Hydrogen Monitoring	Safety	Analog Meters	Yes	Yes				
11	Core Exit Thermocouples	Safety	Analog Meters	No			TBD		TBD
12	Auxiliary Relay Racks	Safety	Relays	No					TBD
13	Main Control Board	Both	Analog	No			TBD	TBD	TBD
14	Hot Shutdown Panel	Both	Analog	Yes	Yes		TBD		TBD
15	BOP Controls	Both	Analog Meters	Yes	Yes				TBD
16	Balance of Plant Controls	Both	Westinghouse 7300	Yes	Yes				

#	I&C Subsystem	Safety or Non-Safety	Current Platform	In Scope for Modernization?	Vendor 1 Scope?	Vendor 2 Scope?	Reliability	Obsolescence	Workload
17	NSSS Process Control	Non-Safety	Westinghouse 7300	Yes	Yes				
18	AMSAC	Non-Safety	Vendor Multibus	Yes	Yes				
19	Turbine Controls Interface	Non-Safety	Analog	Yes*	TBD				
20	Plant Computer Interface	Non-Safety	Windows PMS	Yes*	TBD				
21	Safety Parameter Display System	Non-Safety	Windows PMS	No			TBD	TBD	TBD
22	Radiation Monitoring	Non-Safety	Digital	No					
23	Containment Atmospheric Monitoring	Non-Safety	Digital	Yes	Yes				TBD
24	RadWaste Systems	Non-Safety	Analog	No			TBD	TBD	TBD
25	Meteorological Monitoring Interface	Non-Safety	Digital	Yes*	TBD		TBD	TBD	TBD
26	Rod Control Systems	Non-Safety	SSRCS	Yes	Y				TBD
27	Loose Parts Monitoring	Non-Safety	AREVA LPMS (+10yrs)	No					

#	I&C Subsystem	Safety or Non-Safety	Current Platform	In Scope for Modernization?	Vendor 1 Scope?	Vendor 2 Scope?	Reliability	Obsolescence	Workload
28	Seismic Monitoring	Non-Safety	Analog	No			TBD		TBD
29	Rod Position Indication	Non-Safety	Vendor DRPI	Yes	Yes				
30	Flux Mapping System	Non-Safety	Vendor MIDS	Yes	Yes				
31	Annunciator System	Non-Safety	BETA	Yes	Yes				
32	Leading Edge Flow Meter (LEFM) Interface	Non-Safety	Digital	Yes*	TBD				
33	Plant Simulator	Non-Safety	Digital	Yes*	Yes				
34	Feedwater Heater Drain Controls	Non-Safety	Westinghouse 7300	Yes	Yes				

6. PLANNED PHASE 2 ACTIVITIES

The Phase 2 project plan will be executed as a collaborative effort between ScottMadden, INL, Comanche Peak leadership, and vendors, as necessary. The Phase 2 project plan is shown in Figure 6.

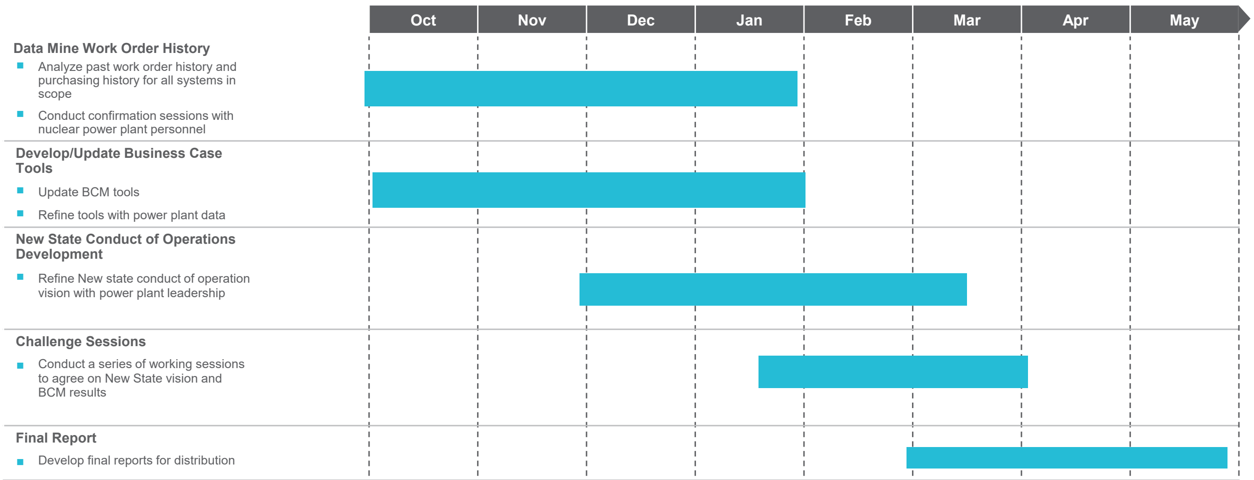


Figure 6. Phase 2 project plan.

The focus of Phase 2 is to conduct the business case for converting the existing infrastructure of the nuclear operator to the New State vision that includes digital equipment. In this phase, the following activities will occur:

- Datamine all sources of cost data and process to identify existing costs and drivers (cost analysis)
- Refine customized business case model using nuclear power plant work order data
- Identify and refine performance attributes to enable optimal Concept of Operations and New State performance and cost goals
- Validate vendor-suggested scope based on walkdowns
- Assess various options from a technical and financial perspective and agree on sequencing of conversion digital parts, components, and systems
- Finalize system assessment matrix
- Provide high-level assessment of additional modernization processes and technology applications to support nuclear power plant operations
- Estimate implementation and ongoing cost data for upgraded and new systems using vendor quotations
- Perform business case benefits analyses for identified in-scope systems and components
- Conduct sensitivity analysis on multiple factors to determine the impact (positive or negative) on the result
- Enter BCA results into the Electric Power Research Institute Business Case Analysis Model tool and share results
- Provide Comanche Peak leadership a brief description and a rough order of magnitude of benefits and costs of advanced technologies that support the New State operating vision of the nuclear power plant
- Develop final reports and deliverables.

Key deliverables are:

- A Comanche Peak-specific presentation and report that will be proprietary as they will contain Luminant and selected vendor proprietary information and will present the methods and techniques used to complete this report, along with:
  - A Business Case Model specific to the scope of this modernization
  - A Completed Electric Power Research Institute BCA Model.
- An industry-facing presentation and report that will present the methods and techniques used to create the utility-specific products directly above. Proprietary information from the Luminant-specific products will be generalized in a manner to communicate process and overall technical direction without containing specific utility or vendor proprietary information.

7. REFERENCES

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