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Xcel Energy		
Docket No.:	EL12-046	
Response To:	South Dakota Public Utilities Commission	Data Request No.
Requestor:		2-8
Date Received:	July 30, 2012	

Question:

Referring to the Prairie Island H Line Protection adjustment:

a) Please provide copies of work order authorizations.
b) Provide a statement of status for the project, i.e., actual expenditures and projected expenditures by month, expected in-service date, etc.
c) Please provide revised PF23 work papers to reflect actual costs incurred.
d) Please identify the date of each unplanned Limiting Conditions for Operations caused by Foxboro H-Line equipment failures over the past 10 years.

Response:

a) The Nuclear Project Authorizations for this project are included as Attachments A and B to this response.
b) Actual costs and projected expenditures are included in the updated work paper PF23-5 included as Attachment C. Expected in-service date is January 1, 2013.
c) Please see Attachment C for updated work papers PF23-1 through PF23-11 which reflect actual project costs through June, 2012.
d) Please see the "Concise Problem Statement" section (page 2) of the project authorization forms provided in Attachments A and B for a discussion of failures leading up to this project.

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Date:	August 16, 2012

NUCLEAR PROJECT AUTHORIZATION (NPA)

The NPA is a request for authorization to implement a specific recommended alternative as determined by the RPA. This authorization is required for all Design and Implementation Phase authorizations, including O&M and Capital, that exceed $100,000. In addition, updated NPAs are required to request additional project authorizations due to project overruns, and/or changes in scope, schedule, and cost. The NPA records the historical project information after initial funding authorization. The NPA is signed by the Project Manager, Project Sponsor and Plant Manager to document their agreement at each project phase and/or changes in scope, schedule, and cost. The Site VP signature is required for O&M and Capital project authorization. The VP Nuclear Projects signature is required for Capital project authorization.

Budget Year(s):	2010	Plant:	Prairie Island	NPA:	
Classification %	Capital:100%	O&M:		Date:	3/31/2010

Project Title:	Foxboro H-Line Replacement (Unit 1 & 2 Reactor Protection System and Steam Exclusion System)

Project Prioritization

(Use LRP Prioritization Guideline)

Urgency:	2	Should be done to ensure equipment reliability during the operating cycle following refueling outages 1R26 September 2009 and 2R26 April 2010, or to support implementation in refueling outage 1R27 April 2011 and 2R27 January 2012.
Risk:	1	Safety – Public and Plant Personnel b. An equipment failure that directly results in a significant reactivity management event

Amount being Requested:	$ 0	
Current Project Authorization:	$ 2,328,000	Includes $700k in hardware costs for long lead time items
YTD Actual:	$ 192,000	
Project to Date:	$ 464,719	
Original Total Project Cost:	$12,652,000	
Revised Total Project Cost:	$ 8,806,000	

- ☐ Project Development (Design Phase)
- ☐ Full Project (Implementation Phase)
- ☐ *Project Overrun
- √ *Scope Change
- √ *Cash Flow Change
- √ *Schedule Change

Provide a clear explanation of why this funding or change is being requested:

This NPA is being revised in March 2010 in the areas of scope, cash flow, and schedule for the following project changes:

1) Cost reduction and schedule extension (and therefore cash flow changes) are being proposed based on a new scope to do only partial implementation at this time. The vendor has provided a quote for the equipment in the previously approved scope (474 modules) that is 60% higher cost (+$3M) and a 1.5 to 2 year delivery schedule (triple the previous delivery time). At the same time, the Advanced Logic System (ALS) equipment that was previously studied in 2007 and was identified as the preferred option for Reactor Protection replacement has become viable and is reported to cost less than full scope replacement with NUS modules. This partial implementation will provide new equipment in one Reactor Protection channel on each unit and one channel of steam exclusion and will provide spares with the modules that are removed. This is a reduction in scope from 474 modules to 123 modules. This is also a reduction in total project probable cost from $12.6 M to $8.8M. This may be the final scope or it may be an interim scope depending on the outcome of our review of the use of the ALS hardware as a permanent long term solution.

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2) Overall delayed schedule for the project start from May 2009 to October 2009.
3) Move spending that was planned for equipment in 2009 into 2010 to allow time for a specification to be developed prior to buying the equipment.
4) Reflect cost and schedule changes based on implementation being performed during outages rather than on-line which was previously thought possible for all modules.
5) Remove language about "no wiring work required" assumptions because some wiring work will be necessary.
6) Remove language about NUS modules being form, fit and function equivalent to Foxboro modules because they are not.
7) Remove language about the work being done on line because much of the work will be required to be done during outages.
8) Reduce the A&G allocation from 5% to 2.5%.
9) Add 19 setpoint uncertainty calculations and 4 setpoint scaling calculations.
10) Add test racks for initial burn in and for long term housing of hot spares removed from the plant.
11) Increase rates for manpower estimates to reflect contract personnel rather than permanent employee rates.

The original NPA was approved to address the continued degradation of the Foxboro H-line reactor protection equipment which poses a significant challenge to plant operation. This has been identified as a Top 10 Equipment Issue for PINGP. Foxboro H-Line protection equipment failures have caused unplanned LCOs and one recent reactor trip. All of the Reactor Protection modules identified in this study cause a Technical Spec Action Statement Entry and/or partial reactor trip upon failure. All of the Steam Exclusion modules in this study cause Technical Requirements Manual (TRM) Action Statement Entry or actuate Steam Exclusion Isolation upon failure. The current maintenance strategy for these modules is to replace modules after they exhibit signs of degradation or failure with a spare module and to repair modules when possible.

Financial Analysis (NPV):

✓ **Projected reactor trip occurring every fourth year:**
- Cost includes, lost of revenue stream, replacement power & cost of resources to restore power

  <u>3 Day Trip(best case)7 Day Trip(worst case)</u>
  $2,250,000 $5,250,000
  Use 5 day average of $3,750,000

✓ **Based on the modules condition, a projected failure rate of 15 per year**
- Average cost of a module failure $28,000
- Average yearly cost is $420,000 (Based on a failure rate of 15 failures per year)

✓ **Regulatory oversight on reactor trip frequency with a <u>do nothing</u> approach**
- Not included in the Net Present Value Calculation

✓ **Following values are over the remaining life of the PI plant (2034)**
- **NPV:** $3.458 Million

Project Manager	Marcia Thompson	**Project Sponsor**	Chris Mundt

Concise Problem Statement: (Provide the problem description or the new requirement or function the project will meet).

The Prairie Island Foxboro modules are over 30 years old and were refurbished once in the late 1980's. A second refurbishment is NOT practical due to obsolescence of some sub-components and the degraded condition of the base circuit card material that occurs as the module ages. Foxboro stopped manufacturing this equipment and stopped providing support in 1989. That left PINGP and other plants on their own to maintain the obsolete equipment for the last 20 years. This has been identified as a Top 10 Equipment Issue for PINGP since 2005.

'wo examples of recent failures due to their degraded condition include:

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- On February 2, 2009, Unit 2 experienced a failure of the Blue Channel OverPower Delta T setpoint at 0608. This required the blue Delta T related instrument channel to be placed in trip, reducing the margin to a reactor trip on Unit Two to a single channel. I&C and Engineering were required to perform troubleshooting to determine the required repair.
- On July 31, 2008, Unit 1 experienced a reactor trip during the Analog Protection Functional Test SP-1003. The yellow RCS average temperature (Tave) channel was in "test" when the red Tave channel Foxboro 62H Fluxtilt Controller failed causing a 2-out-of-4 OTdT reactor trip. The cause of the Fluxtilt Controller failure was determined to be a bad varactor (random failure). [AR01145953]

This trip resulted in development of a plan for improvement of the Reactor Protection system in accordance with 10CFR 50.65 a(1) (Maintenance Rule). Under this rule, NSPM is required to develop a plan to prevent future reactor trips for the same reason. A similar vulnerability exists for all of the existing safety related Foxboro H-line modules which are proposed to be replaced.

There have been multiple other module failures over the past 5 years.

Currently, the Reactor Protection System is in Maintenance Rule a(1) status – with the Foxboro replacement project as the corrective action plan to remove it from a(1) status.

Steam Exclusion System is in Maintenance Rule a(2)* status – Has had a MRFF within 2 years and haven't taken any corrective actions to prevent future failures.

Project Scope: (Provide what the project will and will not deliver, and what functionality is and is not included in the final product. Identify affected equipment, associated equipment, and similar equipment commodities that are included).

For this partial implementation scope, the Design Phase will deliver an approved Engineering Change package to replace one channel (for example all of red channel) of Reactor Protection Foxboro Modules on each unit and one channel of Steam Exclusion with NUS modules. There are 474 modules in the Reactor Protection (RP) System and Steam Exclusion SE System (both units combined). This project will install approximately 123 modules total for this limited scope. There are 14 different module types that will be installed.

This work includes all modules in each loop for the following protection functions (complete loop replacement):

- Pressurizer Level
- Steam Gen Level
- Steam Gen Pressure
- Turb Impluse Pressure
- Containment Pressure
- Steam Flow
- OTΔT / OPΔT
- Tavg / ΔT
- Reactor Coolant Flow
- Pressurizer Pressure

If review of previously recommended ALS equipment status under a separate study determines that ALS is not a viable solution at this time, then the replacement of Foxboro modules with NUS modules under this project may be expanded by further authorization when that data is known. Similarly, if the study determines that ALS technology can be available in a timely manner at a similar or lesser cost, this project could be stopped at some point such as only performing the Unit 2 installation as the interim measure.

This partial implementation scope was chosen (one channel on each unit) because:

- It upgrades one complete channel and retains the removed equipment as a complete set of viable working spares for the remaining modules in the system.
- It is clear from a human factors perspective, where the new equipment is and where the old equipment is, as the project progresses and for the end user after turnover.
- It allows a clean line of designation (one channel) for updating affected documents and for the end user of

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those documents (again a human factors consideration).

- It provides an engineering solution for all of the possible functional applications and so any additional replacement is covered by this engineering and design effort.
- It ensures that no new equipment common failure mode or infant mortality of electronics would affect multiple channels of coincident logic, thereby preventing a common mode failure from causing inadvertent actuation.

Project Description: **(For the recommended alternative** being considered, provide the specific tasks that will be completed in sufficient detail to describe how the project will be implemented. Include any key assumptions use for the project).

For this partial implementation scope, the Design Phase will deliver an approved Engineering Change package to replace one channel (for example all of red channel) of Reactor Protection Foxboro Modules on each unit and one channel of Steam Exclusion with NUS modules. There are 474 modules per unit in the Reactor Protection (RP) System and Steam Exclusion SE System. This project will install approximately 123 modules total to replace one channel in Reactor Protection in each unit and one channel of Steam Exclusion. There are 14 different module types that will be installed.

This work includes all modules in each loop for the following protection functions (complete loop replacement):

- Pressurizer Level
- Steam Gen Level
- Steam Gen Pressure
- Turb Impluse Pressure
- Containment Pressure
- Steam Flow
- OTΔT / OPΔT
- Tavg / ΔT
- Reactor Coolant Flow
- Pressurizer Pressure

The Design Phase will make all applicable changes to plant documents (drawings, procedures, calculations, etc) required to replace one channel of Reactor Protection Foxboro Modules on each unit and one channel of Steam Exclusion with NUS modules.

Modules removed from the existing plant will be maintained in hot racks as spares for the remaining modules in both systems.

All work orders to perform the receipt inspection, bench testing, burn in and final installation and testing will be generated. The work/installation will be done during refueling outages.

The lead unit will be Unit 2 in 2R27 (January 2012), followed by Unit 1 in 1R28 (September 2012).

The current lead time for the equipment is 75 to 106 weeks. We are working with the vendor to improve that lead time to approximately 55 weeks for a small group of modules.

The design phase will include ordering a small group of modules to perform power consumption and EMC testing required to support the design approval as well as the initial Unit 2 order, this is approximately $700,000 in 2010.

There are no simulator modules that will need to be replaced; all protection rack modules are programmably simulated.

If review of ALS equipment status under a separate study determines that ALS is not a viable solution at this time, then the replacement of Foxboro modules with NUS modules under this project may be expanded by further authorization when that data is known. Similarly, if the study determines that ALS technology can be available in a timely manner, this project could be stopped at some point such as only performing the Unit 2 installation as the interim measure.

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Justification / Benefits: (What is the justification for selecting the **recommended alternative** and what are the expected benefits).

The current protection rack maintenance strategy is very inefficient and will result in additional out-of- service time and LCO time. All spares require refurbishment prior to use, creating a burden on plant maintenance personnel. There are currently very limited in-house resources to refurbish existing spare protection rack modules. Expertise and spare parts for refurbishment are also limited, so in-house refurbishments only occur on an emergent basis. To refurbish in-house requires several full time personnel on a permanent basis. True refurbishments are not limited to capacitors, but are far more extensive and include other components and board repairs. Many of the components that require refurbishment are obsolete and alternative components may not be available. Replacement of this equipment with NUS replacement modules will support equipment reliability and operational excellence and reduce maintenance burden.

Replacing all of one channel provides one complete set of new equipment and one complete set of spares for each unit. This scope provides a clear scope for human factors consideration for the engineering work and documentation required to implement the project and to operate and maintain it. This also provides an engineering solution for all of the possible functional applications and so any additional replacement is covered by this engineering and design effort. This has the added risk avoidance benefit of only introducing new equipment in one channel such that common mode failures can not cause coincident actuation logic to be satisfied.

Project Risk Assessment: (Provide the key assumptions and risks which could impact the success of the project).

Potential Risks:

1. No wiring changes were anticipated in the initial authorization, however some will be necessary for resistor replacement/reconfiguration, reconfiguring the PT-485 loops, and removal of the current sources in the OTΔT / OPΔT/Tavg / ΔT loops. This work will be done on the back of the DB boards in the racks. The NUS modules will utilize the same power cords and signal cables as the existing Foxboro modules. There will not be any field wiring changes. Installation is planned during refueling outages, therefore, spurious actuation due to construction activities will not cause a plant trip. In addition, work is planned on only one channel per unit, therefore, coincident actuation logic cannot be satisfied by construction activities or failures in the new equipment.

2. Electronic component infant mortality and current NUS module failure history requires extensive site activities to detect and eliminate failures prior to installation. Therefore, the NUS modules will be bench tested, calibrated and burned-in on a test rack for at least 1000 hours prior to installation.

3. Plant trip or other adverse actuation during installation. Installation is planned during refueling outages, therefore, spurious actuation due to construction activities will not cause a plant trip. In addition, work is planned on only one channel per unit, therefore, coincident actuation logic cannot be satisfied by construction activities or failures in the new equipment.

4. Additional Foxboro modules fail prior to design completion or during installation. The project's design will allow for instillation of NUS modules on an as needed basis to replace failed Foxboro Modules id needed.

Assumptions:

1. No licensing issues.
2. Assumes NUS will remain available to support the equipment.
3. Assumes limited need for re-training of I & C technicians.
4. Assumes that this will not require any changes in plant operations.

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Alternatives: (List and briefly describe other alternatives, including non-authorization, that were considered).

Several options have been considered by PINGP personnel to address the problem of increasing failures of aging, obsolete Foxboro modules including:

1. **Do Nothing:**
The first option assumes continued repair/refurbish on an as-needed basis; however, does not address the long term issue of increasing failure rates and may result in increased regulatory scrutiny. This option would continue to pose a significant challenge to plant operation.
PROS:
   - No modification or ECNs required for equivalent replacements or repairs.
   - No changes in procedures, drawings, procedures
   - No major additional changes in departments or personnel

   CONS:
   - Failure of components will continue and may increase
   - O&M costs for maintenance, engineering, etc will continue to increase as failure rates increase
   - Failed equipment will be replaced with previously repaired spares
   - Failed components will cause unplanned LCOs and reactor trips
   - Will result in increase regulatory scrutiny
   - Assumes continued repair/refurbish on an as-needed basis
   - Does not address the long term issue of increasing failures
   - Poses significant challenges to plant operation
   - PI Foxboro modules are over 30 years old and refurbished in late 1980's.
   - Second refurbishment is NOT practical due to obsolescence of sub-components and degraded condition of the base circuit card material.

2. **Component Refurbishment:**
The second option would require development of a Refurbishment Program by PINGP either on-site or offsite; however, there is no guarantee that refurbished modules will continue to function properly, therefore requiring multiple refurbishments before end of plant life. In addition, the components required to refurbish modules are becoming increasingly difficult to obtain.
PROS:
   - No modifications to the plant or procedures are required
   - Refurbishment hardware less costly than replacement hardware in the short term
   - Most replacements can be removed and re-installed on line

   CONS:
   - An average of $8,000 per module at a total cost of $4.284 Mil would be required for just the refurbishment
   - Requires PI to maintain spare inventory while rack modules are refurbished
   - Few spares exist for some types of modules and others are difficult to obtain
   - Requires multiple refurbishments before end of plant life
   - Attrition of modules due to age and heat related affects on the circuit boards
   - Some circuit boards are already too brittle to refurbish
   - A module repair program will require available spare inventory to install while repairs on rack modules are completed. Few spares exist for some types of modules.
   - An ongoing maintenance program will have to be established to track/document history of repairs for each module.
   - No assurance that all degraded components are identified and replaced.

3. **Replacement with a Digital Reactor Protection System:**
The third option of replacing the existing Foxboro H-Line modules with a Digital Control System (i.e., Westinghouse or some other similar type system) an option for long-term solution for selective plant systems in which digital equipment is beneficial. Implementation of a Digital Reactor System would be an extensive change, requiring removal of the existing system, and would involve digital upgrades, license changes, regulatory reviews, setpoint uncertainty calculation revisions, major procedure changes, and could only be done during a Refueling Outage.
PROS:
   - Improved reliability, diagnostics and control
   - Replaced Foxboro modules can be used as future spares in other systems
   - Reduced calibration requirements and future O&M costs

   CONS:

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- Digital Reactor Protection System has a much higher cost than equivalent module replacements.
- Limited operating history in U.S. for safety-related nuclear protection systems
- New failure modes are introduced and must be analyzed
- Required license changes, Diverse Actuation system, and excessive regulatory reviews and increased NRC scrutiny. NRC is in the process of issuing regulatory guidance to the nuclear industry, including the notion that there is significant regulatory risks associated with the software-based safety system upgrades
- Large modification packages and many procedure, drawing, and vendor changes
- Extensive staff training on new system and components
- Must be installed during refueling outage and will extend refueling outage
- Digital Reactor Protection System will require cyber security reviews and evaluations

4. **Westinghouse 7300 Analog Replacement:**
The fourth option of replacing the Foxboro H-Line protection modules with 7300 series analog modules would require complete modification of the Foxboro Protection Racks. The 7300 modules are not form, fit, function equivalents to the Foxboro modules and complete replacement of the existing rack structure will be required if this option is implemented. This would also require license changes, regulatory reviews, major calculation, procedure and drawing revisions, and could only be done during a Refueling Outage one or two racks at a time. No advantage is obtained from this system, it is simply replacing one analog system for a different analog system that will also require extensive training for I&C and Operations personnel.

PROS:
- None that we could determine for system itself

CONS:
- 7300 analog modules require complete replacement of the Foxboro Protection Racks.
- 7300 modules are not form, fit, function equivalents to the Foxboro modules
- Requires major calculation, procedure & drawing revisions
- Can only be done during a Refueling Outage one or two racks at a time
- No advantage is obtained from this system when replacing one analog system for a different analog system that will also require extensive training for I&C and Operations personnel.

5. **Replacement with ALS (Advance Logic System)**
The fifth option of replacing the existing Foxboro H-Line modules with ALS is a long-term solution for selective plant systems in which logic systems can be replaced with a powerful Field Programmable Gate Array (FPGA) that provides all the benefits of a digital system without the inherent safety and licensing concerns of software failure modes. This was the preferred option in the initial Westinghouse study for Reactor Protection replacement, however, it was recommended that we wait until it has been licensed to reduce licensing risk and possible time delays. The later Protopower study on Reactor Protection did not consider it because it had not been licensed at that time. ALS has since been licensed and installed for safety related Main Steam and Feedwater Isolation System at Wolf Creek and is being licensed generically for Reactor Protection. Installation of ALS can be done in the existing system racks. It involves license approval, setpoint uncertainty calculation revisions, major procedure changes, and could only be done during a Refueling Outage.

PROS:
- Improved reliability, diagnostics, and self detection of changes in system behavior due to failures
- Replaced Foxboro modules can be used as future spares in other systems
- Reduced calibration and surveillance requirements and future O&M costs
- Common platform that can be used in multiple systems reducing overall training burden
- Can expand to include relay logic replacement

CONS:
- Limited operating history in U.S. for safety-related nuclear protection systems
- Extensive staff training on new system and components
- Must be installed during refueling outage

6. **NUS Replacement:**
The currently selected option is the replacement of the aging, obsolete Foxboro Protection Modules with NUS Modules. Installation of modules can be done in the existing system racks. It also involves setpoint uncertainty calculation revisions and most modules can only be done during a Refueling Outage.

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PROS:

- New modules are installed in same location as existing modules with minimal rack work
- No licensing changes
- Minimal changes to existing procedures
- Foxboro modules removed from racks can be used as on-hand spares in other systems

CONS:

- Replacement hardware is somewhat expensive initially compared to refurbishment
- Provides no new major or significant advanced system diagnostics or control features which could reduce maintenance O&M costs due to reduce testing requirements
- Requires evaluation to identify any differences between the Foxboro and NUS designs
- Most modules can only be done during an outage
- NUS modules are not form, fit, function equivalents to the Foxboro modules and require detailed engineering analysis and testing to be used

Material Management (Identify how this project may create obsolete parts, require additional parts, or require the disposition of removed items.)

Are there any spare parts or material (regular inventory or capitalized) that will no longer be usable as a result of implementing this project? Identify and determine the value of each.

No – in the partial implementation scenario being proposed, the parts removed will become spare parts for the remaining systems

Are there any additional spare parts or material (regular inventory or capitalized) that will be needed as a result of implementing this project? Identify and determine the value of each.

Yes - Some additional new modules beyond the exact number being installed (approximately 15) will be ordered as start up spares and can be used in the future as spares for the plant. Average cost per module is $16,000.

Are there any parts or material that will need to be retired or refurbished as a result of implementing this project? Identify and determine the value of each.

No.

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Cash Flow

Year	2009	Year	2010	Year	2011	Year	2012
Jan	$	Jan	$122,980	Jan	$604,750	Jan	$563,750
Feb	$	Feb	$84,000	Feb	$502,250	Feb	$492,000
Mar	$	Mar	$66,000	Mar	$297,250	Mar	$297,250
Apr	$	Apr	$90,000	Apr	$297,250	Apr	$297,250
May	$2,904	May	$297,250	May	$297,250	May	$92,250
Jun	$13,766	Jun	$92,250	Jun	$92,250	Jun	$82,000
Jul	$20,780	Jul	$92,250	Jul	$92,250	Jul	$82,000
Aug	$14,435	Aug	$92,250	Aug	$92,250	Aug	$82,000
Sep	$20,017	Sep	$92,250	Sep	$92,250	Sep	$358,750
Oct	$58,042	Oct	$246,000	Oct	$92,250	Oct	$287,000
Nov	$52,960	Nov	$451,000	Nov	$297,250	Nov	$102,500
Dec	$89,823	Dec	$553,500	Dec	$502,250	Dec	$256,250
TOTAL	**$272,727**	**TOTAL**	**$2,279,730**	**TOTAL**	**$3,259,500**	**TOTAL**	**$2,993,000**

For carryover projects, enter the cash flow in the previous years' months.
Outage Related: √ Yes ☐ No Year:

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Estimate and Project Plan

Support Tasks	Rate:	Hrs	Cost	
Project Scope - sam	$138	80	$11,040	
Stakeholder Input - sam	$138	80	$11,040	
Design Input checklist - sam	$138	40	$5,520	
Bid Specification/Development - sam, bill, doug	$138	1,300	$179,400	
Preliminary Field Walkdown	$120	40	$4,800	
Design Kickoff - sam	$138	40	$5,520	
30% Design Review sam, bill, doug	$138	60	$8,280	
60% Design Review - sam, bill, doug	$138	160	$22,080	
90%/Final Design Review - sam, bill, doug	$138	60	$8,280	
Travel - sam	$138	115	$15,870	
Design Description /Safety Reviews Screening - sam	$138	180	$24,840	
Drawings / Sketches - sam	$138	160	$22,080	
PORC/Review Committees (PlantOperatingReviewCommittee) - sam	$138	40	$5,520	
Design Verification/Technical Review -sam	$138	800	$110,400	
Calculations 50 Uncertainty Calcs 2 Seismic	$120	5,000	$600,000	
Additional setpoint calculations			$50,000	
Work Package/Field Walk down 25 WO at 20 hours each	$95	500	$47,500	
Planning & Scheduling	$95	500	$47,500	
Field Changes / EC	$120	130	$15,600	
Project Management	$136	1,600	$217,600	
Project Cost control	$40	200	$8,000	
Clerical support	$27	200	$5,400	
NOS	$120	200	$24,000	
Project Scheduler	$85	500	$42,500	
Operations Support	$120	100	$12,000	
I&C support doug and dave	$95	1,000	$95,000	
Procurement/Spec Support Jim	$138	600	$82,800	
Supplier Oversight	$95	200	$19,000	
Design Total:				**$1,888,743**
Training	$75	355	$26,625	
Laboratory/Testing	$120	375	$45,000	
Clerical support	$27	550	$14,850	
Project Management	$136	2,700	$367,200	
Project Cost control	$40	600	$24,000	
Project Engineer	$138	1,000	$138,000	
Work Package/Field Walk down 88 WO at 1 week each	$120	3,520	$422,400	
NOS	$120	300	$36,000	
Project Scheduler	$80	1,400	$112,000	
Warehouse Support	$65	300	$19,500	
Operations Support	$120	200	$24,000	
I&C support (2 outages with 2 techs around the clock for two weeks)	$100	1,344	$134,400	
I&C support (receipt inspection,bench test, cal, burn-in) 2 techs 2 outage groups for 6 weeks each	$100	960	$96,000	
I&C support startup testing (2 outages with 2 techs around the clock for two weeks)	$100	1,344	$134,400	
Setpoint Changes 120 * 16 hrs	$82	1,920	$157,440	
Installation/Test Procedures 22 * 60 hrs	$120	1,320	$158,400	
Plant Consultations 8 * 24 hrs	$75	192	$14,400	
Tech manual changes 25 * 30 hrs	$120	750	$90,000	
Field Engineering Support	$120	1000	$120,000	
Oversight	$120	500	$60,000	
Project Closeout - Document/Database Updates	$138	1400	$193,200	

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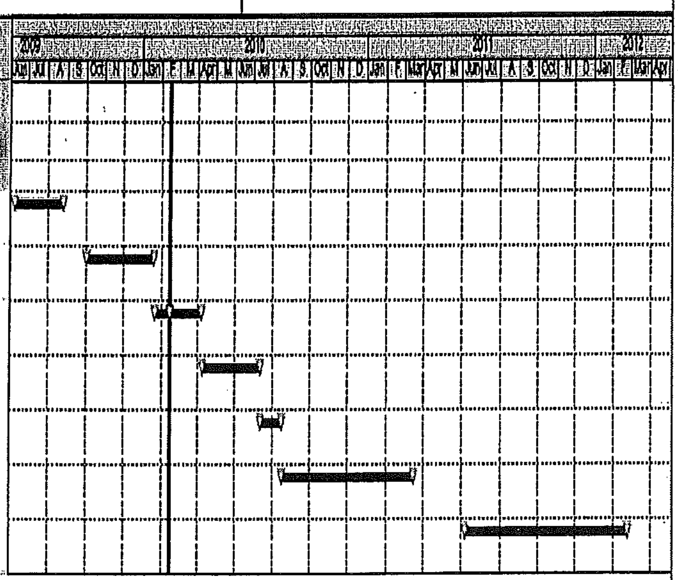
Project Closeout - Work Order Package Technical Review	$138	230	$31,740	
Project Closeout - Final EC work	$138	40	$5,520	
Implementation Total:				**$2,425,075**
Design and Implementation Support Totals:				**$4,313,818**
Materials	**Unit cost**	**Quantity**	**Cost**	
140 Modules, supporting documentation and EMC testing			**$ 2,589,200**	
Test Racks	$50,000	6	$300,000	
Miscellaneous rework, shack, test equipment, furniture			$454,048	
Material Totals:				**$3,343,248**
A&G:	**2.5%**			**$382,853**
Contingency for Design & Implementation:	**10%**			**$765,707**
[illegible]				[illegible]

Schedule

09RP01 - FOXBORO H- LINE PROTECTION REPLACEMENT		TBM - PRINT 09RP01 FOXBORO - LEVEL 1		15-Mar-10 10:53
Activity ID	Activity Name	RD	Start	Finish
09RP01 - FOXBORO H- LINE PROTECTION REPLACEMENT				
Milestones / General				
LEVEL 1 SCHEDULE				
09RP01SUM001	STUDY COMPLETE - FOXBORO H-LINE PROTECTION REPLACEMENT	0h	09-Jun-09 09:00 A	26-Aug-09 09:00 A
09RP01SUM002	DESIGN 33% COMPLETE - FOXBORO H-LINE PROTECTION REPLACEMENT	0h	01-Oct-09 09:00 A	19-Jan-10 07:00 A
09RP01SUM003	DESIGN 60% COMPLETE - FOXBORO H-LINE PROTECTION REPLACEMENT	304h	21-Jan-10 07:00 A	07-Apr-10 17:00
09RP01SUM004	DESIGN 90% COMPLETE - FOXBORO H-LINE PROTECTION REPLACEMENT	525h	08-Apr-10 08:00	12-Jul-10 14:00
09RP01SUM005	DESIGN 100% COMPLETE - FOXBORO H-LINE PROTECTION REPLACEMENT	208h	12-Jul-10 14:00	17-Aug-10 14:00
09RP01SUM006	WORK PLANNING COMPLETE - FOXBORO H-LINE PROTECTION REPLACEMENT	176h	17-Aug-10 14:00	16-Mar-11 14:00
09RP01SUM008	PREP & IMPLEMENTATION 2R27 - FOXBORO H-LINE PROTECTION REPLACEMENT	460h	05-Jun-11 08:00	24-Feb-12 17:00



NUCLEAR PROJECT AUTHORIZATION (NPA)

Project Agreement

Project Manager: Marcia Thompson mathompson presented at 4/20/10 PRG	Date: 5-13-10
Project Sponsor: Chris Mundt	Date: 5-13-10
Plant Manager: Kevin Ryan	Date: 5.14.10

Project Authorization

O&M and CAPITAL	CAPITAL
Site Vice President: M. Schimmel Date: 5/15/10	**VP Nuclear Projects:** Date: 5/19/10

MOP
5/17/10

NUCLEAR PROJECT AUTHORIZATION (NPA)

The NPA is a request for authorization to implement a specific recommended alternative as determined by the RPA. This authorization is required for all Design and Implementation Phase authorizations, including O&M and Capital, that exceed $100,000. In addition, updated NPAs are required to request additional project authorizations due to project overruns, and/or changes in scope, schedule, and cost. The NPA records the historical project information after initial funding authorization. The NPA is signed by the Project Manager, Project Sponsor and Plant Manager to document their agreement at each project phase and/or changes in scope, schedule, and cost. The Site VP signature is required for O&M and Capital project authorization. The VP Nuclear Projects signature is required for Capital project authorization.

Budget Year(s):	2009	Plant:	Prairie Island	NPA:	
Classification %:	Capital:100%	O&M:		Date:	4/10/2009

Project Title:	**Foxboro H-Line Replacement (Unit 1 & 2 Reactor Protection System and Steam Exclusion System)**

Project Prioritization

(Use LRP Prioritization Guideline)

Urgency:	1	• **Must be done** to ensure equipment reliability **during the current operating** • Results in a unit shutdown or significant **reduction in capacity**. • **Delays** start-up or return to service. • **Perform** feasibility studies towards gaining megawatts, maintaining or increasing margins or addressing equipment obsolescence.
Risk:	1	Safety – Public and Plant Personnel **Fails to correct or prevent a radiological, environmental, or industrial safety incident. Includes the Top Ten Safety Issues.**

Design Amount being Requested:	**$2,328,000**
Design Amount Requested 2009:	**$1,420,000**
Design Amount Requested 2010:	**$908,000**
Implementation Requested 2010:	**$4,427,000**
Current Project Authorization:	**0**
YTD Actual:	**0**
Total Project Cost:	**$12,652,000**

√ **Project Development (Design Phase)**

☐ *Full Project (Implementation Phase)

☐ *Project Overrun

☐ *Scope Change

☐ *Schedule Change

Provide a clear explanation of why this funding or change is being requested:
Continued degradation of the Foxboro H-line reactor protection equipment poses a significant challenge to plant operation. This has been identified as a Top 10 Equipment Issue for PINGP. Foxboro H-Line protection equipment failures have caused unplanned LCOs and one reactor trip. All of the Reactor Protection modules identified in this study cause a Technical Spec Action Statement Entry and/or partial reactor trip upon failure. All of the Steam Exclusion modules in this study cause Technical Requirements Manual (TRM) Action Statement Entry or actuate Steam Exclusion Isolation upon failure.

NUCLEAR PROJECT AUTHORIZATION (NPA)

Financial Analysis (NPV):

Projected reactor trip occurring every other year (if not sooner):

- Cost includes, lost of revenue stream, replacement power & cost of resources to restore power

3 Day Trip	**7 Day Trip**
$2,250,000	**$5,250,000**

✓ **Based on the modules condition, a projected failure rate of 15 per year**

- Average cost of a module failures $28,000

  For explanation of module failure costs (**See Attachment D)**
- Average yearly cost is $420,000 (Based on a failure rate of 15 failures per year)

✓ **Regulatory oversight on reactor trip frequency with a <u>do nothing</u> approach**

- Not included in the Net Present Value Calculation

✓ **Following values are over the remaining life of the PI plant (2034)**

- **NPV:** $2.33 Mil
- **IRR:** 9.8%
- **PV RR:** ($2.07 Mil)

Project Manager	Roth Trulson	**Project Sponsor**	Chris Mundt

Concise Problem Statement: (Provide the problem description or the new requirement or function the project will meet).

The Prairie Island Foxboro modules are over 30 years old and were refurbished once in the late 1980's. A second refurbishment is NOT practical due to obsolescence of some sub-components and the degraded condition of the base circuit card material that occurs as the module ages. It is important to note, that Foxboro quit manufacturing this equipment and stopped providing support in 1989. That left PI and other plants on their own to maintain the obsolete equipment for the last 20 years.

Two examples of recent failures include:

- On February 2, 2009, Unit 2 experienced a failure of the Blue Channel OverPower Delta T setpoint at 0608. This required the blue Delta T related instrument channel to be placed in trip, reducing the margin to a reactor trip on Unit Two to a single channel. I&C and Engineering were required to perform troubleshooting to determine the required repair.
- On July 31, 2008, Unit 1 experienced a reactor trip during the Analog Protection Functional Test SP-1003. The yellow RCS average temperature (Tave) channel was in "test" when the red Tave channel Foxboro 62H Fluxtilt Controller failed causing a 2-out-of-4 OTdT reactor trip. The cause of the Fluxtilt Controller failure was determined to be a bad varactor (random failure). [AR01145953] This trip was reported to the Nuclear Regulatory Commission in accordance with 10 CFR 50.72 and 10 CFR 50.73. This event is defined as a significant condition adverse to quality in accordance with 10 CFR 50 Appendix B. From an NRC regulatory standpoint, the licensee (NSPM) is required to take action to prevent reoccurrence of significant conditions adverse to quality in a timely manner. In addition, this trip resulted in development of a plan for improvement of the Reactor Protection system in accordance with 10CFR 50.65 a(1). This regulation is commonly referred to as the Maintenance Rule. Under this rule, NSPM is required to develop a plan to prevent future reactor trips for the same reason. A similar vulnerability exists for all of the existing safety related Foxboro H-line modules which are proposed to be replaced. Under Federal Regulations for nuclear power (10CFR 50 Appendix B) the timing of the corrective actions is up to the licensee (NSPM) but is required to be taken in a timely manner commensurate with safety significance. As a result, replacing the modules over a several year period is acceptable as long as the replacement is timely enough to reasonably minimize the potential for additional reactor trips. Failure to perform the replacement of known aged and/or degraded equipment in a timely manner will very likely result in a finding of violation by the NRC should there be a future plant trip due to a Foxboro H-Line module failure. This determination is somewhat subjective on the part of the NRC and can be influenced by the extent and timeliness of the plan for resolution of the equipment issues.

In 2007, several protection rack bistables experienced recorded events. Bistable modules 2FC-475A/B, Steam Flow Hi-Hi Safeguard Actuation Logic Alarm Unit and 2FC-413, Reactor Coolant Lo Flow Rx Trip Alarm Unit both had an output spiking event documented by AR 1093881 and AR 1094339, respectively. Both modules were replaced with previously repaired spare modules. Bistable module 1PC-430A, Hi Pressure Rx Trip Alarm Unit failed low and had to be replaced with another previously repaired module (AR 1092334). Bistable module 1PC-482A/B, Lo-Lo Safeguard Actuation Logic/Lo Alarm Unit drifted high out-of tolerance and had to be re-calibrated (CAP01074957).

Other RP module failures over the past 3 years also included several AC output failures (CAP1050925, CAP01043735)

NUCLEAR PROJECT AUTHORIZATION (NPA)

resulting in either repair or replacement of the module. Numerous failures have also been documented by AR 1026399, CAP01026277, WO-0505371, WO-0501362, and WO-0408932. Another bistable had to be replaced due to bad calibration history (CAP031390). Steam Exclusion modules have also experienced several drift out-of-tolerance problems over the past few years (CAP01060775, CAP01060775, and WO 0000381) resulting in repairs or replacements.

Currently, the Reactor Protection System is in Maintenance Rule a(1) status - Needs improvement in accordance with the Maintenance Rule and the Steam Exclusion System is in Maintenance Rule a(2)* status - Acceptable but degraded.
Correction action to improve performance regularly per FR 50.65. Failure to improve the system performance is likely to result in NRC findings and/or violations.

Attached to this RPA is an analysis of PINGP Foxboro H-line module failure rate **(Attachment A)**.

Project Description: **(For the recommended alternative** being considered, provide the specific tasks that will be completed in sufficient detail to describe how the project will be implemented. Include any key assumptions use for the project).

Industry trends show that most of the nuclear plants that are approaching their end-of-life dates, are replacing their vintage I&C equipment with NUS instruments to ensure successful operation for an anticipated end of plant life.

Our study shows that the replacement of the Reactor Protection and Steam Exclusion Foxboro modules with form, fit, and function equivalent modernized NUS Instruments (NUS) modules should be conducted. The details relating to the pros and cons are noted in the Alternative Section (option 5).

Attached to this NPA is a list of plants **(Attachment C)** that have been faced with obsolescence issues similar to those experienced by PINGP. This table also shows sites that are changing or have changed Foxboro H-Line or 7100 protection systems to newer equipment, and the progress made to date.

Project Scope: (Provide what the project will and will not deliver, and what functionality is and is not included in the final product. Identify affected equipment, associated equipment, and similar equipment commodities that are included).

The Design Phase will deliver an Engineering Change package and will conduct all applicable changes to plant documents required to replace 474 Foxboro Modules with NUS modules.

There are 207 modules per unit in the Reactor Protection (RP) System. The process loops in the RP System are:

Phases:	Foxboro H-Line Reactor Protection Modules Replacement Schedule
Phase 0	Design
Phase 1	Pressurizer Pressure - High / Low
	Pressurizer Level - High
Phase 2	Over-Temperature Delta Temperature (OTDT)
	Over-Power Delta Temperature (OPDT)
Phase 3	Tavg and dT Temperature Loops
Phase 4	Steam Generator Level - High / Low-Low
	Steam Generator Pressure - Low / Low-Low
Phase 5	Turbine Impulse Pressure
	Containment Pressure - High / Spray
Phase 6	Steam Flow - High / High-High Flow
	Reactor Coolant System Flow - Low
Phase 7	Steam Exclusion (SE) System

A complete list of Foxboro H-Line protection modules in the Reactor Protection System and the Steam Exclusion System is listed in **Attachment B.** There are no simulator modules that will need to be replaced; all protection rack modules are programmably simulated. There are 22 different model types for a total of 474 modules (plus 30 Installation Hot Rack Spares) to be replaced.

NUCLEAR PROJECT AUTHORIZATION (NPA)

.stification / Benefits: (What is the justification for selecting the **recommended alternative** and what are the expected benefits).

The current protection rack maintenance strategy is very inefficient and will result in additional out-of- service time and LCO time. All spares require refurbishment prior to use, creating a burden on plant maintenance personnel. There are currently very limited in-house resources to refurbish existing spare protection rack modules. Expertise and spare parts for refurbishment are also limited, so in-house refurbishments only occur on an emergent basis. To refurbish in-house requires several full time personnel on a permanent basis. True refurbishments are not limited to capacitors, but are far more extensive and include other components and board repairs. Many of the components that require refurbishment are obsolete and alternative components may not be available. Replacement of this equipment with like-for-like replacement modules will support equipment reliability and operational excellence and reduce maintenance burden.

Project Risk Assessment: (Provide the key assumptions and risks which could impact the success of the project).

1. No wiring changes are anticipated. The NUS modules will utilize the same power cords and signal cables as the existing Foxboro modules. If wiring changes are required installation time and budget will be affected. The NUS modules will be bench tested, calibrated and burned-in on a test rack for at least 50 hours prior to installation.

2. Plant trip during installation. The existing Foxboro H-Line modules are functionally checked quarterly by removing one loop at a time from service while the plant is on-line and an annual calibration as required by Tech Specs Section 3.3.1 and 3.3.2.

   - If the replacements are performed during normally scheduled quarterly functional checks, there is no likelihood that the maintenance activity will increase the frequency of a risk initiating event.
   - If the replacements are performed weekly, abiding by the functional test procedures and annual calibration procedures there is no likelihood that the maintenance activity will increase the frequency of a risk-significant initiating event.

Assumptions:

1. Additional Foxboro modules fail prior to design completion or during installation. The project's design will allow for instillation of NUS modules on an as needed basis to replace failed Foxboro Modules.
2. No licensing issue
3. We can install on-line with minimal operational challenges
4. Assumes NUS will remain available to support the equipment
5. Assumes limited need for re-training of I & C technicians
6. Assumes that this will not require any changes in plant operations
7. Based on discussions with other plant personnel who have experience with replacing I&C protection modules with NUS Instruments modules, there have been no negative experiences that compromised plant operability or safety installing replacement modules while the plant is on-line.

NUCLEAR PROJECT AUTHORIZATION (NPA)

Alternatives: (List and briefly describe other alternatives, including non-authorization, that were considered).

Several options have been considered by PINGP personnel to address the problem of increasing failures of aging, obsolete Foxboro modules including:

1. **Do Nothing:**
The first option assumes continued repair/refurbish on an as-needed basis; however, does not address the long term issue of increasing failure rates and may result in increased regulatory scrutiny. This option would continue to pose a significant challenge to plant operation.

PROS:
- No modification or ECNs required for equivalent replacements or repairs.
- No changes in procedures, drawings, procedures
- No major additional changes in departments or personnel

CONS:
- Failure of components will continue and may increase
- O&M costs for maintenance, engineering, etc will continue to increase as failure rates increase
- Failed equipment will be replaced with previously repaired spares
- Failed components will cause unplanned LCOs and reactor trips
- Will result in increase regulatory scrutiny
- Assumes continued repair/refurbish on an as-needed basis
- Does not address the long term issue of increasing failures
- Poses significant challenges to plant operation
- PI Foxboro modules are over 30 years old and refurbished in late 1980's.
- Second refurbishment is NOT practical due to obsolescence of sub-components and degraded condition of the base circuit card material.

2. **Component Refurbishment:**
The second option would require development of a Refurbishment Program by PINGP either on-site or offsite; however, there is no guarantee that refurbished modules will continue to function properly, therefore requiring multiple refurbishments before end of plant life. In addition, the components required to refurbish modules are becoming increasingly difficult to obtain.

PROS:
- No modifications to the plant or procedures are required
- Refurbishment hardware less costly than replacement hardware in the short term
- Most replacements can be removed and re-installed on line

CONS:
- An average of $8,000 per module at a total cost of $4.284 Mil would be required for just the refurbishment
- Requires PI to maintain spare inventory while rack modules are refurbished
- Few spares exist for some types of modules and others are difficult to obtain
- Requires multiple refurbishments before end of plant life
- Attrition of modules due to age and heat related affects on the circuit boards
- Some circuit boards are already too brittle to refurbish
- A module repair program will require available spare inventory to install while repairs on rack modules are completed. Few spares exist for some types of modules.
- An ongoing maintenance program will have to be established to track/document history of repairs for each module.
- No assurance that all degraded components are identified and replaced.

3. **Replacement with a Digital Reactor Protection System:**
The third option of replacing the existing Foxboro H-Line modules with a Digital Control System (i.e., Westinghouse or some other similar type system) an option for long-term solution for selective plant systems in which digital equipment is beneficial. Implementation of a Digital Reactor System would be an extensive change, requiring removal of the existing system, and would involve digital upgrades, license changes, regulatory reviews, setpoint/accuracy calculation major revisions, major procedure changes, and could only be done during a Refueling Outage.

PROS:
- Improved reliability, diagnostics and control
- Replaced Foxboro modules can be used as future spares in other systems
- Reduced calibration requirements and future O&M costs

CONS:

NUCLEAR PROJECT AUTHORIZATION (NPA)

- Digital Reactor Protection System has a much higher cost than equivalent module replacements.
- Limited operating history in U.S. for safety-related nuclear protection systems
- New failure modes are introduced and must be analyzed
- Required license changes, regulatory reviews and increased NRC scrutiny. NRC is in the process of issuing regulatory guidance to the nuclear industry, including the notion that there is significant regulatory risks associated with the software-based safety system upgrades
- Large modification packages and many procedure, drawing, and vendor changes
- Extensive staff training on new system and components
- Must be installed during refueling outage and will extend refueling outage
- Digital Reactor Protection System will require cyber security reviews and evaluations

4. **Westinghouse 7300 Analog Replacement:**
The forth option of replacing the Foxboro H-Line protection modules with 7300 series analog modules would require complete modification of the Foxboro Protection Racks. The 7300 modules are not form, fit, function equivalents to the Foxboro modules and complete replacement of the existing rack structure will be required if this option is implemented. This would also require license changes, regulatory reviews, major calculation, procedure and drawing revisions, and could only be done during a Refueling Outage one or two racks at a time. No advantage is obtained from this system, it is simply replacing one analog system for a different analog system that will also require extensive training for I&C and Operations personnel.

PROS:
- None that we could determine

CONS:
- 7300 analog modules require complete replacement of the Foxboro Protection Racks.
- 7300 modules are not form, fit, function equivalents to the Foxboro modules
- Requires major calculation, procedure & drawing revisions
- Can only be done during a Refueling Outage one or two racks at a time
- No advantage is obtained from this system when replacing one analog system for a different analog system that will also require extensive training for I&C and Operations personnel.

5. **NUS Replacement:**
The preferred option is the replacement of the aging, obsolete 474 Foxboro Protection Modules with form, fit, function equivalent NUS Modules that can be instituted fairly quickly.

PROS:
- Process loops with a history of failures/repairs can be replaced at the beginning of the project
- Does not interfere with quarterly functional test or annual calibration testing nor extend their length of time
- Can maintain a continuous installation process
- A small number of modules can be replaced at one time
- Decreased risk due to possible failures / problems with a module
- Need only one Test Rack to energize one or two loops each week
- Spread installation throughout several years with Site Resources
- Shorter time to complete project (~2 to 3 yrs)
- Equivalent modules are installed in same location as existing modules
- All module replacements can be installed on-line
- Less engineering, licensing, installation, testing and operations impacts compared to the other replacement options (except do-nothing option)
- No licensing changes and minimal changes to existing procedures
- Requires only one modification package and separate ECNs for loop installation
- Foxboro modules removed from racks can be used as on-hand spares in other systems

CONS:
- Replacement hardware is somewhat expensive initially compared to refurbishment
- Provides no new major or significant advanced system diagnostics or control features which could reduce maintenance O&M costs due to reduce testing requirements
- Requires evaluation to identify any differences between the Foxboro and NUS designs
- One loop must be taken out-of-service each week, in addition to quarterly and annual testing

NUCLEAR PROJECT AUTHORIZATION (NPA)

Material Management (Identify how this project may create obsolete parts, require additional parts, or require the disposition of ˙moved items.)

Are there any spare parts or material (regular inventory or capitalized) that will no longer be usable as a result of implementing this project? Identify and determine the value of each. **Yes, 70% of the Foxboro H-Line protection modules will be removed from inventory because they can not be used as Control Foxboro Modules. These modules maybe sold to another station. The remaining 30% of the modules can possibly be used as Control Foxboro Modules, depending on their condition.**

Are there any additional spare parts or material (regular inventory or capitalized) that will be needed as a result of implementing this project? Identify and determine the value of each. **Yes! There will be 30 spare NUS modules in case of failures during the implementation of this project. There are 22 different types of modules and the 30 spares will be a cross section of these various types of modules.**

NUCLEAR PROJECT AUTHORIZATION (NPA)

Budget Distribution

Support Tasks	Rate	Hrs	Cost	
Project Scope	$120	6	$720	
Stakeholder Input	$120	8	$960	
Design Input checklist	$120	16	$1,920	
Bid Specification/Development	$120	45	$5,400	
Preliminary Field Walkdown	$120	24	$2,880	
Design Kickoff	$120	35	$4,200	
20% Design Review	$120	35	$4,200	
80% Design Review	$120	150	$18,000	
Final Design Review	$120	35	$4,200	
Travel	$600	20	$12,000	
Design Description /Safety Reviews Screening	$120	120	$14,400	
Drawings / Sketches	$120	1	$120	
PORC/Review Committees (PlantOperatingReviewCommittee)	$120	40	$4,800	
Design Verification/Technical Review	$120	800	$96,000	
Calculations 50 Uncertainty Calcs 2 Seismic	$120	6,200	$744,000	
Work Package/Field Walk down 88 WO at 1.5 weeks each	$120	2,900	$348,000	
Planning & Scheduling	$75	900	$67,500	
Field Changes / EC & ECN's	$120	120	$14,400	
Project Management	$120	1,300	$156,000	
Project Cost control	$40	200	$8,000	
Clerical support	$27	200	$5,400	
NOS	$120	100	$12,000	
Project Scheduler	$80	200	$16,000	
Operations Support	$120	100	$12,000	
I&C support (3.75yrs/2 techs)	$75	2,500	$187,500	
Materials/Procurement Support 504 modules plus misc	$75	1,500	$112,500	
Supplier Oversight	$95	240	$22,800	
Design Total:				**$2,082,249**
Training	$65	450	$29,250	
Laboratory/Testing	$120	350	$42,000	
Clerical support	$27	600	$16,200	
Project Management	$120	2,700	$324,000	
Project Cost control	$40	600	$24,000	
Work Package/Field Walk down 88 WO at 1.5 weeks each	$120	5,100	$612,000	
NOS	$120	500	$60,000	
Project Scheduler	$80	500	$40,000	
Warehouse Support	$65	300	$19,500	
Operations Support	$120	400	$48,000	
I&C support (3.75yrs/2 techs)	$75	11,300	$847,500	
Setpoint Changes 414 * 20 hrs	$75	8,280	$621,000	
Installation/Test Procedures 22 * 80 hrs	$120	1,760	$211,200	
Plant Consultations 10 * 24 hrs	$75	240	$18,000	
Tec manual changes 20 * 40 hrs	$120	800	$96,000	
Field Engineering Support	$120	2400	$288,000	
Oversight	$120	500	$60,000	
Project Closeout - Document/Database Updates	$120	1300	$156,000	
Project Closeout - Work Order Package Technical Review	$120	225	$27,000	
Project Closeout - Final Walk down	$120	40	$4,800	
Implementation Total:				**$3,544,450**
Design and Implementation Support Totals:				**$5,626,699**
Materials	**Unit cost**	**Quantity**	**Cost**	
Modules	$10,330	474	$4,896,420	
Test Racks	$50,000	2	$100,000	
Miscellaneous	$100	504	$50,400	
Material Totals:				**$5,374,863**
A&G:	**5%**			**$550,078**
Contingency for Design & Implementation:	**10%**			**$1,100,156**
Project Totals with Materials:				**$12,651,797**

Note: The A&G is set to

NUCLEAR PROJECT AUTHORIZATION (NPA)

Cash Flow

Resource Description	Amount Requested	Start Date	2009	2010	2011	2012	Finish Date
Study							
Design	**$2,331,000**	**4/1/2009**	**$1,423,000**	**$908,000**	**----0----**	**----0----**	**6/1/2010**
Implementation	$10,321,000	10/1/2010	----- 0 -----	$4,427,000	$4,685,800	$1,924,000	12/1/2012
Totals	$12,652,000		**$1,423,000**	$5,335,000	$3,970,000	$1,924,000	

For carryover projects, enter the cash flow in the previous Years' months: Outage Related: ☐ **Yes** √ **No** Year: 2009

	2009	2010	2011	2012	Totals
Support Tasks	**$1,423,000**	**$1,990,000**	**$1,940,000**	**$1,924,000**	**$7,277,000**
Implementation Modules		**$3,345,000**	**$2,030,000**		**$5,375,000**
Totals	**$1,423,000**	**$5,335,000**	**$3,970,000**	**$1,924,000**	**$12,652,000**

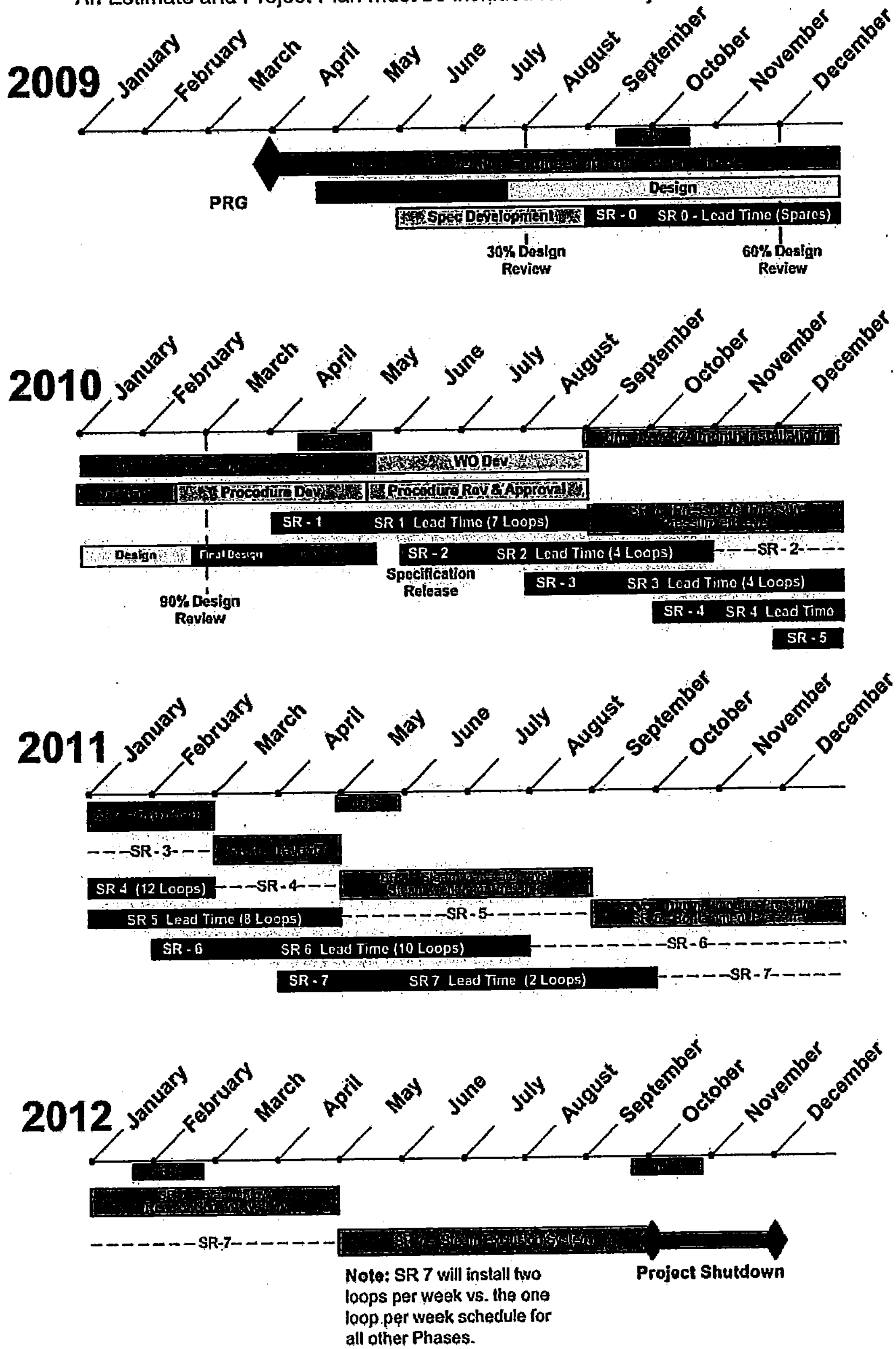
	[illegible]		[illegible]		[illegible]		[illegible]	
	[illegible]	Hardware	Support	Hardware	Support	Hardware	Support	Hardware
[redacted]			$100,000	$200,000	$80,000	$630,000	$100,000	
			$125,000		$100,000		$150,000	$244,000
			$150,000		$120,000	$550,000	$175,000	
			$200,000	$875,000	$120,000		$175,000	
	$50,000		$280,000		$120,000	$540,000	$200,000	
	$75,000		$280,000		$120,000		$175,000	
	$100,000		$350,000	$970,000	$120,000		$175,000	
	$160,000		$380,000		$120,000	$580,000	$150,000	
	$160,000		$220,000		$120,000		$150,000	
	$160,000	$329,000	$126,000	$900,000	$120,000		$100,000	
	$159,000	$150,000	$100,000		$100,000	$350,000	$80,000	
	$80,000		$80,000		$80,000		$50,000	
	$944,000	$479,000	$2,390,000	$2,945,000	$1,320,000	$2,650,000	$1,680,000	$244,000
	$1,423,000		$5,335,000		$3,970,000		$1,924,000	[illegible]

Design Forecast	**Implementation Forecast**
Design Actuals	**Implementation Actuals**

NUCLEAR PROJECT AUTHORIZATION (NPA)

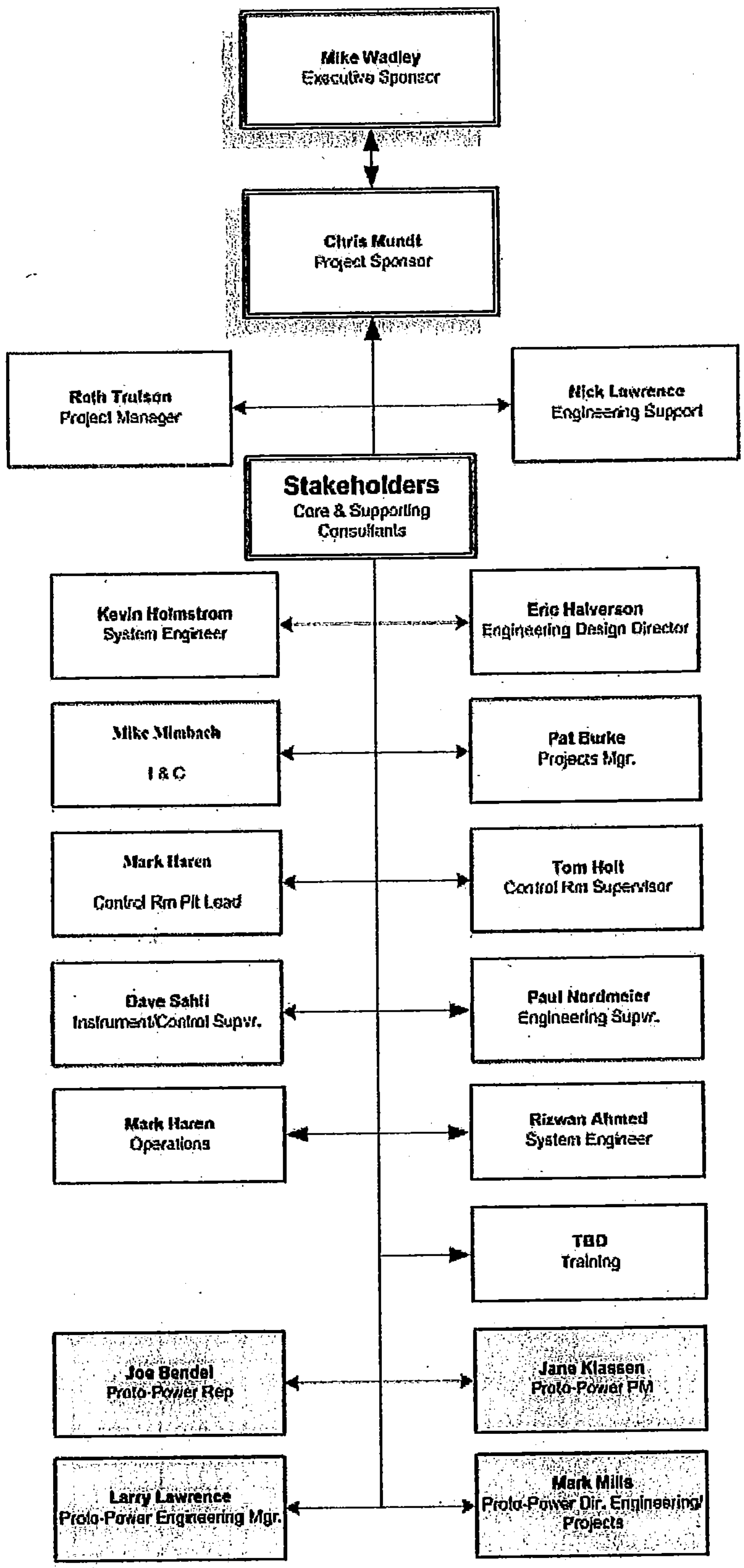
Projected Schedule

An Estimate and Project Plan must be included for Full Project Authorization.



NUCLEAR PROJECT AUTHORIZATION (NPA)

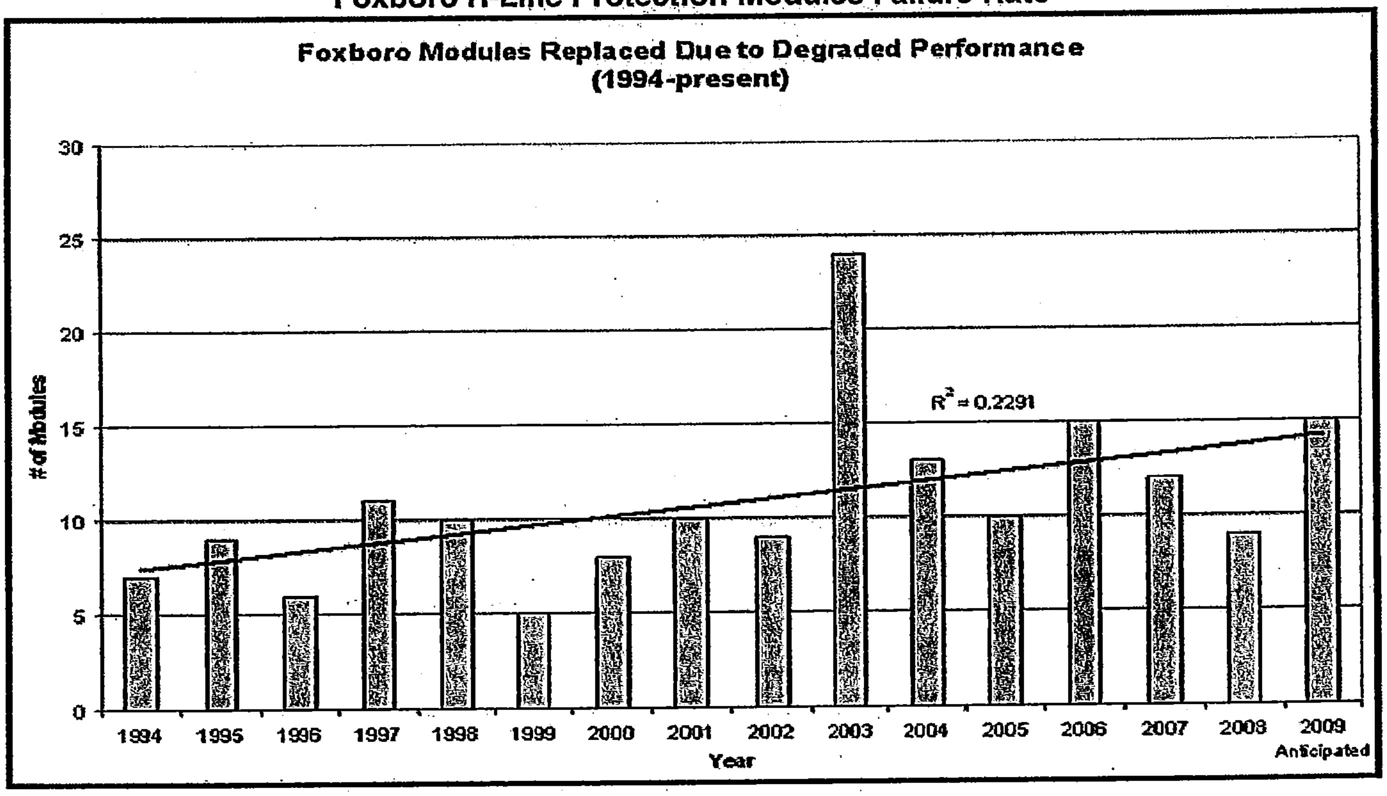
Foxboro H-Line Replacement Project Stakeholders



NUCLEAR PROJECT AUTHORIZATION (NPA)

Attachment A

Foxboro H-Line Protection Modules Failure Rate



Attachment B

Foxboro H-Line Protection Modules

Foxboro Module Name	Foxboro Model No.	Foxboro IDS No.	U1	U2	U0	Spares
Current Repeater (I/I)	66BC-O	A-003	49	49		4
Current Source	66EC-O	A-008	4	4		1
Voltage-to-Current Converter (E/I)	66GC-OW	A-009	8	8		1
Loop Power Supply	610AC-O	B-001	37	37		4
Resistance-to-Voltage Converter (R/I)	66 Special (Y3000AA)	C-011	8	8		1
Special Summing Amplifier	66RC-OL	D-001	4	4		1
Special Lead/Lag Unit	66RC-OL	D-002	4	4		1
Special Lead/Lag Unit	66RC-OL	D-003	10	10		1
Special Voltage-to-Current Converter (E/I)	66RC-OL	D-009	4	4		1
Special Lag Unit	66 Special (Y3000BM)	D-016	4	4		1
Special Impulse/Lag Unit	66RC-OMA	D-020	4	4		1
Special Hi Current Signal Selector	66 Special (A0118EW)	E-001	4	4		1
Single Hi Alarm Bistable	63U-AC-OHAA-F	F-001	14	14		
Single Lo Alarm Bistable	63U-AC-OHBA-F	F-002	3	3		2
Duplex Hi Hi Alarm Bistable	63U-BC-OHCA-F	F-003	8	8		
Duplex Lo Lo Alarm Bistable	63U-BC-OHDA-F	F-004	4	4		
Duplex Hi Lo Alarm Bistable	63U-BC-OHEA-F	F-005	22	22		4
Special Dual Alarm Bistable	63U-Special (custom)	F-026	8	8		1
Proportional Controller	62H-2E (modified)	G-007	8	8		1
Current Repeater (I/I)	66BC-OH	A-016			24	3
Resistance-to-Current Converter (R/I)	694AC-OAW	C-006			24	1
Dual Lo Lo Alarm Bistable	63U-CC-OHDR-F	F-057			12	1
		Totals	207	207	60	30
= 474 total modules and 30 spares						

NUCLEAR PROJECT AUTHORIZATION (NPA)

Attachment C
Foxboro H-Line Protection Modules

Plants of Similar Vintage to Prairie Island		
Plant	**Upgrade Strategy**	**Upgraded From**
Beaver Valley 1	NUS module-for-module replacements for protection and control.	7100
Diablo Canyon 1 & 2	Eagle-21 planned for protection (1991). Triconix performed upgrade for feedwater control (FWC). Planning a complete Triconix control upgrade for the long-term.	7100
Ginna	NUS module-for-module replacements for protection and control.	Foxboro H-Line
Indian Point 2 & 3	NUS module-for-module replacements for protection and control.	Foxboro H-Line
Point Beach 1 & 2	NUS module-for-module replacements for protection and control.	Foxboro H-Line
Robinson 2	NUS module-for-module replacements for protection and control.	7100
Salem 1 & 2	NUS module-for-module replacements for protection and control.	7100
Sequoyah 1 & 2	Eagle-21 for protection (1990) – Planning Foxboro intelligent automation (I/A) upgrade for control.	Foxboro H-Line

NUCLEAR PROJECT AUTHORIZATION (NPA)

Attachment C (Continues)

Foxboro H-Line Protection Modules

Plants of Similar Vintage to Prairie Island (Cont'd)		
Plant	**Upgrade Strategy**	**Upgraded From**
Surry 1 & 2	NUS module-for-module replacements for protection and control.	7100
Turkey Point 3 & 4	Have performed partial Eagle-21 protection upgrades – Planning for Foxboro I/A upgrade for control.	7100
Watts Bar 1 & 2	Eagle-21 for protection – Planning Foxboro I/A upgrade for control.	Units 1 and 2: Foxboro H-Line Unit 2:
Kewaunee 1	NUS module-for-module replacements for protection and control.	Foxboro H-Line

NUCLEAR PROJECT AUTHORIZATION (NPA)

Attachment D

Explanation of module failure costs

Average cost of a module refurbishment is: $12,000

- **Refurbishment Specification**
- **Safety Related Contract Preparation**
- **Equipment Receipt and Inspection**
- **Testing at Vendor (Trip to witness test)**
- **Fee for expedited work**

Average cost to install the module: $6,000

- **Module Testing**
- **Module Calibration**
- **Module Instillation**
- **Work Order Preparation for Instillation**

Average Engineering cost for the root cause analysis: $10,000

- **2 to 4 Engineers for Root Cause Analysis, 1 to 3 Weeks**
- **Equipment Testing by Vendor to determine failure cause**
- **Cost for implementing corrective actions**
- **Verification that cause of failure is not common for all modules**

NOTE: The yearly cost is based on a failure rate of 15 failures per year.

Project Agreement

Project Manager: [signature]	Date: 4/21/09
Project Sponsor: [signature]	Date: 5/4/09
Plant Manager: [signature]	Date: 5.4.09

Project Authorization

O&M and CAPITAL	CAPITAL
Site Vice President: Michael D Wadley. Date: 5/8/09	**VP Nuclear Projects:** Date: [signature] 5/21/09

NUCLEAR PROJECT AUTHORIZATION (NPA)

Preparation of the Nuclear Project Authorization (NPA)

Projects must adhere to the requirements of the Nuclear Project Authorization Guideline for projects exceeding $100,000. This guideline identifies the financial expectations required for securing initial project authorization as well as the continued maintenance of the Capital Budget. The NPA is a document to record the concurrence and acceptance of the project scope, cash flow, and implementation schedule. This document is signed by the Project Manager, Project Sponsor and the Site VP and VP Nuclear Projects. The NPA is prepared by the project manager.

The NPA form requests the following project information:

Budget Year - Identify the year for which funded authorization is requested.

Plant – Prairie Island.

NPA – This is the same number that has tracked the project from its origin as an issue, i.e., the EIR # and the RPA#.

Project Title - The title should be a clear and concise noun name identification of the project proposed ˊɿr implementation.

Urgency and Risk – These attributes are assigned from the LRP Prioritization Guideline.

Costs – These are the amounts being requested for authorization, the current authorization, and the estimated total project cost.

Project Development, Full Project, Project Overrun, Scope Change, Cash Flow Change, and Schedule Change – There are three funding levels available for Capital authorization. Project Development (Design Phase) is the initial funding level and is requested to enable the project scope and estimate to be determined to within +/- 10%. Full Project (Implementation Phase) authorization will secure the total project funding. Project Overrun authorization is required if project management anticipates that the total project cost will exceed 110% of the Full Project funding. Scope, Cash Flow, and Schedule Changes must be identified.

Provide an explanation of why the funding is being requested – It should be clearly described what the funds will be used for especially when the request may be for preliminary, long lead time materials, additional dollars, or other unique situations. The deliverables need to be concisely stated. Include the amount spent to date on analysis, engineering and materials. Explain the Scope, Cash Flow, and Schedule Changes.

Financial Analysis - This is the net present value, NPV.

roject Engineer – This is the project engineer for the project.

Project Sponsor - This is the management sponsor of the project.

☐ **Non Public Document – Contains Trade Secret Data**
☐ **Public Document – Trade Secret Data Excised**
☒ **Public Document**

Xcel Energy
Docket No.: EL12-046
Response To: SDPUC — Data Request No. 6-5
Requestor: South Dakota Public Utilities Commission
Date Received: August 24, 2012

Question:

Please refer to the Company's response to DR 2-8 regarding the Prairie Island H Line adjustment. Please provide revised PF23 work papers to reflect actual costs incurred, removing all projected expenditures, after the project has been placed in service. Please also provide the actual date that the plant addition was placed in-service.

Response:

The project is expected to be placed in service in January 2013; therefore the Company cannot provide final actual costs at this time. Included in the Company's response to SDPUC Data Request No. 2-8 were updated actual costs through June 2012 and the projected expenditures for the project.

Response By: Thomas E. Kramer
Title: Principal Rate Analyst
Department: Revenue Requirements – North
Telephone: 612-330-5866
Date: September 13, 2012