2019 CMBG – CM Cost Saving Case Study
Wednesday July 31, 2019

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- Twenty-six years in the nuclear industry, including Oak Ridge National Laboratories
- Decommissioning of WWII era Uranium Enrichment Facilities
- Engineering support for the NRC in reviewing COLAs for the AP1000
- Engineering design, licensing and operation of commercial nuclear power plants

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Facilitator: Louis Lollar, Responsible Design Engineer (I&C Site Design), Southern Nuclear Company:

- Eight years at Farley Nuclear Plant near Dothan, AL
- Thirty five years at NASA's Marshall Space Flight Center, AL (Retired) – Project Manager and Design Engineer of advanced spacecraft power systems

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Farley saves $4.5M with one word

- 2-week Design-License Basis study by Carmen DeLong showed that 11 monitors were in excess, could be abandoned in place or removed without prior NRC Approval (NO LAR).
- Large EOC fought against removal stating LAR would be required.
- DeLong performed10 CFR 50.59 analysis: No LAR required.
- DeLong Design-License Basis study saved utility >$4.5M (+ O&M Burdens).

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Do you see the $4.5M word in the FSAR?

FNP-FSAR-12

12.2.3.4 Waste Gas Processing System Leakage

The gaseous waste processing system is designed to contain the gaseous waste for the lifetime of the plant. However, although all precautions are taken to avoid any leakage from the system, an estimated leakage of 100 sf^3/year is assumed.

12.2.4 AIRBORNE RADIOACTIVITY MONITORING

An analysis of the auxiliary building was conducted in order to identify the potential points of releases of airborne radioactive material in the form of contaminated steam or liquid discharges from valves, pumps, tanks, sumps, and other release mechanisms. For plant design, an NRC acceptance criterion, discussed in subsection 12.1.2 of the FNP FSAR Safety Evaluation Report, required concentrations of airborne radioactive material to be controlled such that limits stated in 10 CFR 20 would not be exceeded. In-plant airborne radioactive materials concentration limits that were in effect at the time of plant design are specifically stated in 10 CFR 20.103, which references column 1, Table I of Appendix B to 10 CFR 20.1 - 20.601. The evaluations in this section show that this criterion was addressed in plant design.

During plant operations, access to the rooms, enclosures, or operating areas containing release points, and having the potential of causing operating personnel to be exposed to airborne radioactive material to an average concentration in excess of the limits specified in Appendix B, Table 1, of 10 CFR 20.1001 - 20.2401, will be controlled by a program of:

A. Surveys or continuous online type of sampling.

B. Clear identification of spaces with appropriate caution signs.

C. Locked doors with alarms, as appropriate.

D. Administrative controls through the use of radiation work permits and procedures.

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Observe the Isolation Time Design Inputs

Plant:	Farley 1&2	Calculation Number:	SM-1080538201-001	Sheet:	57

16. Off-Site Atmospheric Dilution Factors (X/Qs)

Receptor	Distance	0-2 Hour X/Q	2-8 Hour X/Q
EAB	1262 m	7.6E-04 sec/m^3	N/A
LPZ	3219 m	2.8E-04 sec/m^3	1.1E-04 sec/m^3

Reference: FNP FSAR Table 15B-2

17. Nominal ventilation isolation times

Ventilation System	Radiation Monitor	Nominal Isolation Time	References	
			BM-99-2040-001	FSD A181015
Containment Purge	QD11RE0024A/B	11 seconds	Sheet 10	3.3.7.2.2
SFP	QD11RE0025A/B	3.6 seconds	Sheet 8	3.3.8.2.2
Control Room	QD11RE0035A/B	7.4 seconds	Sheet 12	3.3.16.2.2

NOTE: Per sheet 8 of BM-99-2040-001, the SFP Ventilation System will be isolated before the radionuclides reach the damper (5.7 seconds). The release from the FHA in the SFP will pass through the PRF System (FSD A181016 section 2.1).

Where did the Design Inputs come from?

Time for RE-35A,B to Process Radiation Concentration, Generate Alarm, and for Dampers to Receive Closure Signal

From Attachment 2, <u>the total signal response time is 0.225 seconds</u>.

Time for Dampers to Close

On a high radiation signal from RE-35A,B isolation of the control room is initiated by closing dampers HV 3622/3623, 3624/3625, 3626/3627, and 3628/3629. (Reference 4.47) **The maximum time allowed for these dampers to close is <u>6 seconds</u>**. (References 4.42, 4.43, 4.44, 4.45, 4.46)

The total control room isolation time is 7.4 seconds. Therefore, the design basis of the containment purge noble gas monitoring system (RE-35A,B) supports the fuel handling accident analysis (Reference 4.19) assumption that the control room will be isolated within 60 seconds following the FHA.

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What does Attachment 2 show?

Attachment 2
Sheet 1 of 2

BECHTEL

Interoffice Memorandum

To	George Gaydos	*File No.*	Farley REA 99-2040
Subject	REA 99-2040 Item 3 RE-24A(B), RE-25A(B), RE-35A(B) Response Times	*Date*	October 04, 2001
		From	Dinesh Taneja
		Of	NOPS Control Systems
Copies to	R. H. Browning	*At*	F1-1C5 *Ext.* 6162

The following response times are based on FHA initiated Hi-Hi radiation isolation signals by RE-24A(B), RE-25A(B), and RE-35A(B):

Damper/Valve	Rad Monitor (Response Time)	Interposing Relay(s) (Response Time)	Total Hi-Hi Rad. Signal Response Time	References
FP Isolation Dampers 01V48SV3990A-A 01V48SV3990B-B 01V48SV3991A-A	RE-25A(B) (0.2 Sec)*	MR-2, ITE Rowan 2190-E44AA (0.012 Sec)	0.212 Sec	D-177394 SH 1, Rev. 19 D-177394 SH 2, Rev. 14 D-177589 SH 2, Rev. 3 Victoreen Form 3201C-10-72 Telemecanique (ITE)/Rowan

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What does Victoreen Form 3201C-10-72 show?

MODEL 842-10 LOG RATEMETER

Ranges: 10 to 10^6 cpm.
H. V. 500 to 2500V d.c. adjustable.

Meter Size: 4½ in. (11.4 cm).

Meter Accuracy: ±2% fullscale.

Scales:
Black: 10 to 10^6 Log.
Red: H.V. 0 to 2500V d.c.
Calibrate Check Point.

Dimensions: 5¼ in. high, 8½ in. wide, 13 in. deep (13.3 cm, 21.6 cm, 33.0 cm). Two mounted side by side in 19 in. rack chassis (48.3 cm).

Weight: Approximately 7½ pounds (3.4 Kg).

Front Panel Controls:
Function Switch: Off, Cal., H.V., Oper. Check Source Button (Spring Loaded).
Alert Alarm Light/Pushbutton.
High Radiation Alarm Light/Pushbutton.
Fail/Reset Alarm Light/Pushbutton.

Alarm Logic:

Alert: Amber light illuminates when radiation level exceeds preset limit. Set point is adjustable over entire scale. Depressing the button allows meter to indicate alarm set point. Normal logic requires manually resetting the alarm by depressing the green reset pushbutton light. A jumper is removed to convert to automatic reset, if desired. Alarm set point is adjusted by a 15-turn potentiometer located behind the front panel to discourage accidental changing of the trip point.

High: A red light illuminates when radiation level exceeds a preset limit, which is adjustable over the entire scale. Depressing the button allows the meter to indicate alarm set point. Normal logic requires manually resetting the alarm by depressing the green reset pushbutton light. A jumper is removed to convert to automatic reset, if desired. Alarm set point is adjusted by a 15-turn potentiometer located behind the front panel, again to prevent accidental changing of the trip point.

Fail/Reset: A green pushbutton light that goes "OFF" when either the power or signal fails. The alarm is automatically reset. Depressing this button resets the Alert and High alarms when they are operating in the manual reset mode.

Alarm Outputs:* One SPDT relay each for Fail, Alert and High alarms. Dust cover type relays with 5 amperes, 115 volts contacts.

Alarm Circuit: Plug-in printed circuit board. Bi-stable trips.

Alarm Accuracy: ±5%.

Recorder Output:* 0 to 10 mV.

Computer Output:* 0 to 50 mV.

*Optional outputs available on request.

Time Constants: 1 minute at 10 cpm; 0.2 seconds at 10^6 cpm.

Sensitivity: 200 mV.

Polarity (Pulse): Negative (—).

Input Impedance: 120 ohms (at SIG. IN terminal).

Discriminator Level: 0.2 — 5.5 volts.

Calibration Check:
Repetition Rate: 60K — 70K cpm.
Amplitude: 6 volts.
Pulse Polarity: Negative (—).

Power Requirements: 100 to 130/200 to 230V a.c., 50 to 60 Hz, 10 watts.

Operating Temperature: 0°C to 55°C (32°F to 130°F).

Power Supplies:
High Voltage: Electronically regulated, adjustable 500 — 2500V d.c. capabilities.
Low Voltage: —6.2 volts regulated, +16.0 volts regulated, +25.0 volts unregulated.

MODEL 842-30 LOG RATEMETER/ANALYZER

Same as Model 842-10 except that a plug-in analyzer board has been added to permit spectrum discrimination.

Analyzer Board: Solid state, printed circuit board.

Gain: Adjustable, 1 — 6.

Pulse Polarity: Negative (—).

Resolution: 10 μsec.

Window Width: 50 millivolts to integral.

Base Line Range: 0 — 5.5 volts.

Adjustments:
Gain Control: 15-turn potentiometer.
Differential (Window Width) Discriminator: 15-turn potentiometer.
Integral (Clip Level) Discriminator: 15-turn potentiometer.

MODEL 842-20 LINEAR RATEMETER

Ranges: 0 to 10^6 cpm in five linear ranges with first range of 0-100 cpm fullscale.
H.V. 500 to 2500V d.c. adjustable.

Meter Size: 4½ inches.

Meter Accuracy: ±2% fullscale.

Scales:
Black: 0 to 1 linear fullscale.
Red: H.V. 0 to 2500V d.c.
Calibrate Check Point.

Dimensions: 5¼ in. high, 8½ in. wide, 13 in. deep (13.3 cm, 21.6 cm, 33.0 cm). Two mounted side by side in 19 in. rack chassis (48.3 cm).

Weight: Approximately 7½ pounds (3.4 Kg).

Front Panel Controls:
Function Switch: Off, Cal., H.V., 10^6, 10^5, 10^4, 10^3, 10^2 cpm.
Check Source Button (Spring Loaded).
Alert Alarm Light/Pushbutton.
High Radiation Alarm Light/Pushbutton.
Fail/Reset Alarm Light/Pushbutton.

Alarm Logic:

Alert: Amber light illuminates when radiation level exceeds a preset limit. The set point is adjustable ... button allows meter to indicate alarm set point. Normal logic requires manually resetting the alarm by depressing the green reset pushbutton light. A jumper is removed to convert to automatic reset, if desired. Alarm set point is adjusted by a 15-turn potentiometer located behind the front panel to discourage accidental changing of the trip point.

High: A red light illuminates when radiation level exceeds a preset limit, which is adjustable over the entire scale. Depressing the button allows the meter to indicate alarm set point. Normal logic requires manually resetting the alarm by depressing the green reset pushbutton light. A jumper is removed to convert to automatic reset, if desired. Alarm point is adjusted by a 15-turn potentiometer located behind the front panel to prevent accidental changing of the trip point.

Fail/Reset: A green pushbutton light that goes "OFF" when either the power or signal fails. The alarm is automatically reset. Depressing this button resets the Alert and High alarms when they are operating in the manual reset mode.

Alarm Outputs:* One SPDT relay each for Fail, Alert and High alarms. Dust cover type relays with 5 amperes, 115 volts contacts.

Alarm Circuit: Plug-in printed circuit board. Bi-stable trips.

Alarm Accuracy: ±5%.

Recorder Output:* 0 to 10 mV.

Computer Output:* 0 to 50 mV.

Time Constants: Automatically changes when range is selected to give optimum response time, from 1 second to 21 seconds.

Sensitivity: 100 mV.

Polarity (Pulse): Negative (—).

Input Impedance: 120 ohms (at SIG. IN terminal).

Discriminator Level: 0.2 — 5.5 volts.

Calibration Check:
Repetition Rate: 60K — 70K cpm.
Amplitude: 6 volts.
Pulse Polarity: Negative (—).

Power Requirements: 100 to 130/200 to 230V a.c., 50 to 60 Hz, 10 watts.

Operating Temperature: 0°C to 55°C (32°F to 130°F).

Power Supplies:
High Volage: Electronically regulated, adjustable 500 — 2500V d.c. capabilities.
Low Voltage: —6.2 volts regulated, +16.0 volts regulated, +25.0 volts unregulated

MODEL 842-40 LINEAR RATEMETER/ANALYZER

Same as Model 842-20 except that a plug-in analyzer board has been added to permit spectrum discrimination.
Analyzer Board: Solid state, printed circuit board. Same as used with the Model 842-30 Log Ratemeter/Analyzer.

... on request.

VICTOREEN

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WHEN THE FOO-FOO HITS THE FAN!

WHAT'S WRONG WITH THIS PICTURE?

FHA Plume – Release of FOO-FOO!!

FOO-FOO!!

MCR Air Intake

MAIN CONTROL ROOM

EOC proposes to move new R35 location from next to MCR Air Intake to farther inside the MCR.

R35 → R35

MAIN CONTROL ROOM

NOTE: When R35 smells the FOO-FOO, it closes the MCR dampers and switches to CREVS to keep dose to MCR personnel below RG 1.183 limits

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Tech Spec Burden Reduction via CM: Turkey Point LAR Example

November 2018 Turkey Point LAR ML18255A360 (p. 55 of pdf):
NRC SER: "....This decay time (72hrs) is consistent with the assumptions used in the safety analyses, and ensures that the release of fission product radioactivity, subsequent to a fuel handling accident, results in doses that are well within the values specified in 10 CFR 50.67 and RG 1.183."

This CM change results in significant cost savings in Plant Operations & Modifications:

- Allows for Removal of SR SSCs from Tech Specs, thereby removing PM & Surveillance burdens.
- Reduces Calc requirement burdens:
  Lengthy expensive accident calcs no longer needed each time rad monitors need to be replaced, or in the event of activities like Power Uprates or Steam Generator upgrades/replacements (activities that increase the source term). A bounding fuel decay calc done by the Plant is sufficient basis for showing requirements are met – no EOC needed.
- Reduces 50.59 Effort when needing to modify/upgrade associated SSCs – the "minimal increase" questions in 50.59 are much easier to answer.

NOTE: 72+ weeks of FHA dose calc revisions at FNP (costing >$M) was avoidable by simply revising FSAR to state that the fuel is allowed to sufficiently decay prior to fuel movement.

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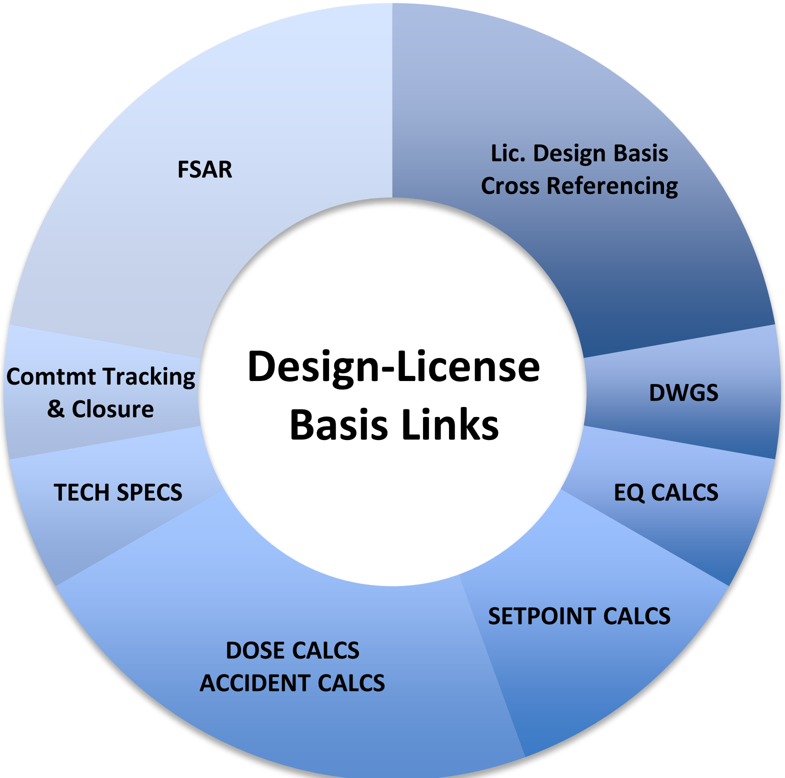
Start 50.59 prior to Conceptual Design…BEFORE ISSUING POs to EOCs!!!!



KNOW WHAT YOU'RE ASKING YOUR EOC TO DO BEFOREHAND…SET EXPECTATIONS ACCORDINGLY. KNOW YOUR PLANT. KNOW YOUR CALCS. KNOW YOUR LICENSE. RISK CAN'T BE DEFERRED TO THE EOC…NRC HOLDS THE LICENSEE ACCOUNTABLE, NOT THE EOC!!!

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Move 50.59 UP in the Plant Modification Process and use it as a Forcing Function to stay on schedule and avoid LARs.

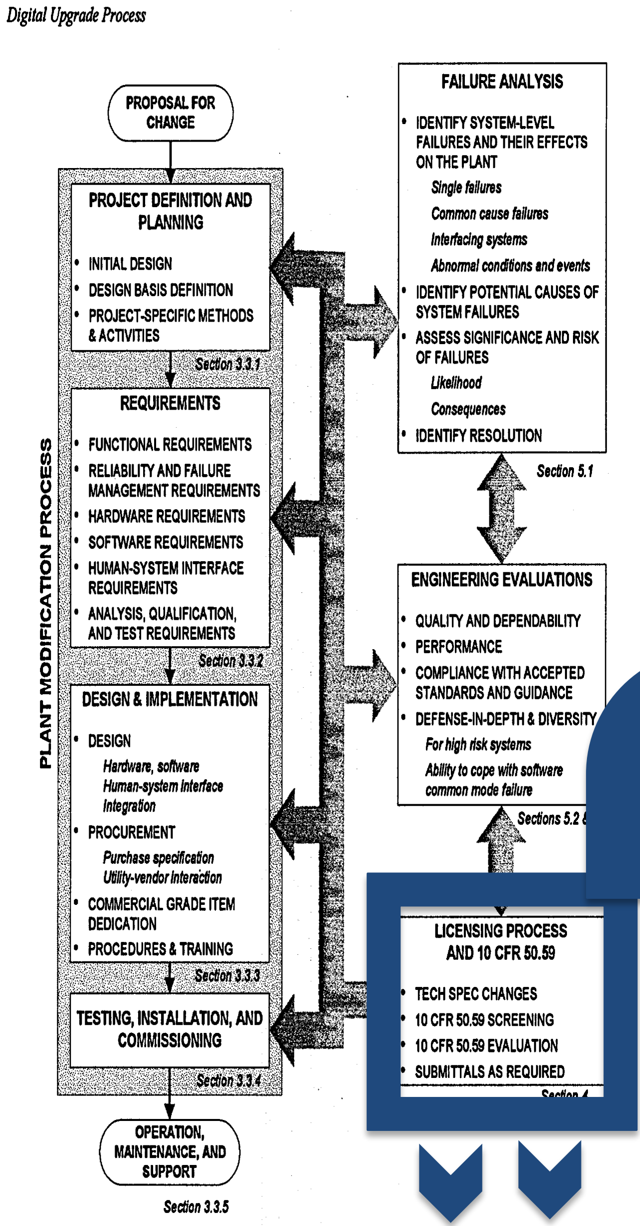
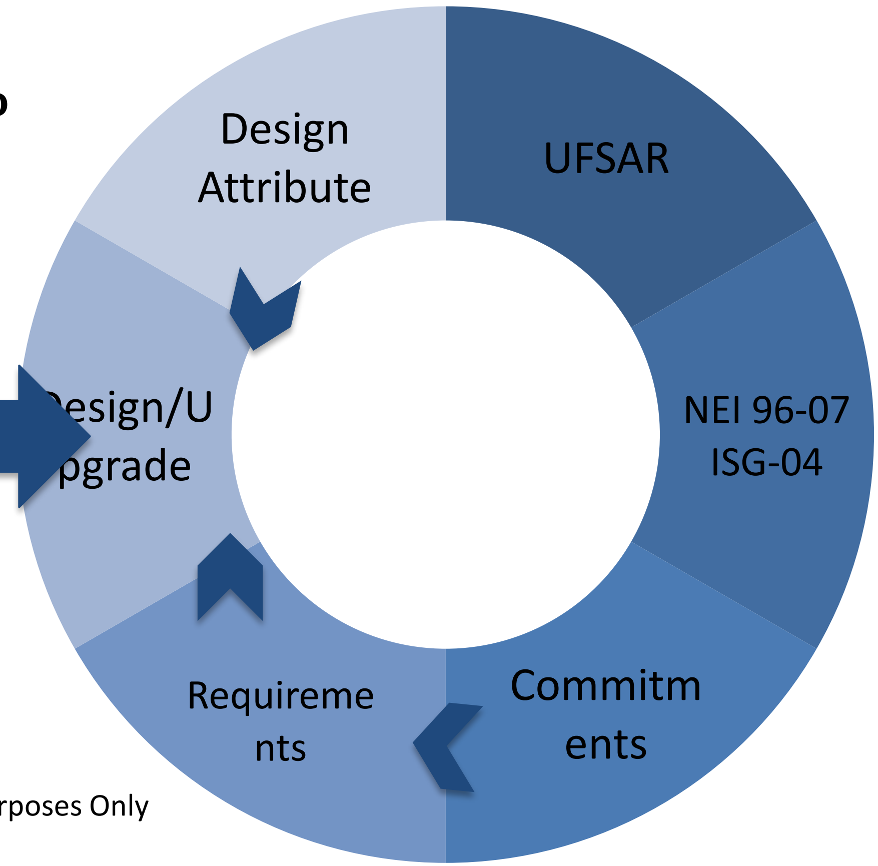


Figure out Licensing Constraints Up Front so you don't Design Yourself into a Costly Corner - $$$

License Informed Upgrades - Technology Informed 50.59s



For Information Purposes Only

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CAN OTHER BURDENS BE REDUCED via CM?

- Are there other systems in Tech Specs that can be removed?

- Are there Setpoints that can be better bound to reduce:
  - Surveillance Frequencies (if drift range is large enough not to change in 18-24mo)
  - Uncertainties
  - Spurious Actuation (which can trip plant)
  - Nuisance Alarms (which result in LERs)

- Are there other calcs that can be reduced or removed:
  Seismic, Finite Element Analyses, Accident Calcs, Electrical, etc..
  Example: For FHA, do a "worst case assembly" analysis to bound the accident dose to avoid future calc revisions when replacing equipment.

- Can ICCs be more broadly applied throughout the plant?
  Can parameters be bounded such that additional calcs can be avoided in a mod (Plant Parameters Document tied to calcs)?
  Example: You're changing the load on a 120V bus to accommodate a mod, but the PPD linked calc says that I don't have to do a new calc as long as I stay within 480V.

WHAT ADDITIONAL BURDENS WOULD YOU LIKE TO SEE REDUCED?

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APPLY UNCREDITED CONSERVATISM

- What SSCs are we taking credit for that we don't have to?

  EXAMPLE: RNP never took credit for their SFP monitor from day 1 when the plant was built. They modeled dose from FHA without taking credit for the isolation function from the SFP monitor…they don't have to revise that calc when replacing that monitor! Further, that monitor is not in RNP's Tech Specs = No Surveillance Requirements = Reduced Burdens

- Are requirements already being met by another SSC or program that is less burdensome?

- Have commitments been made that are too conservative and/or are already being met in a less burdensome way?

- Are there areas/SSCs that have margins that are too conservative (too large)?

  EXAMPLE: If the 10CFR50.67 Dose Limit at the LPZ and SB is 6.3rem, do not base the dose calc on unachievable isolation response times that result in 0.05rem – that's ridiculously huge margin making it impossible to replace the equipment.

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YOUR FEEDBACK PLEASE

1. Do you believe that an increased CM role as described herein would benefit the industry?

1. Do you have any additional recommendations for reducing plant burdens?

Please feel free to send me comments, your insights are valuable!

Carmen DeLong
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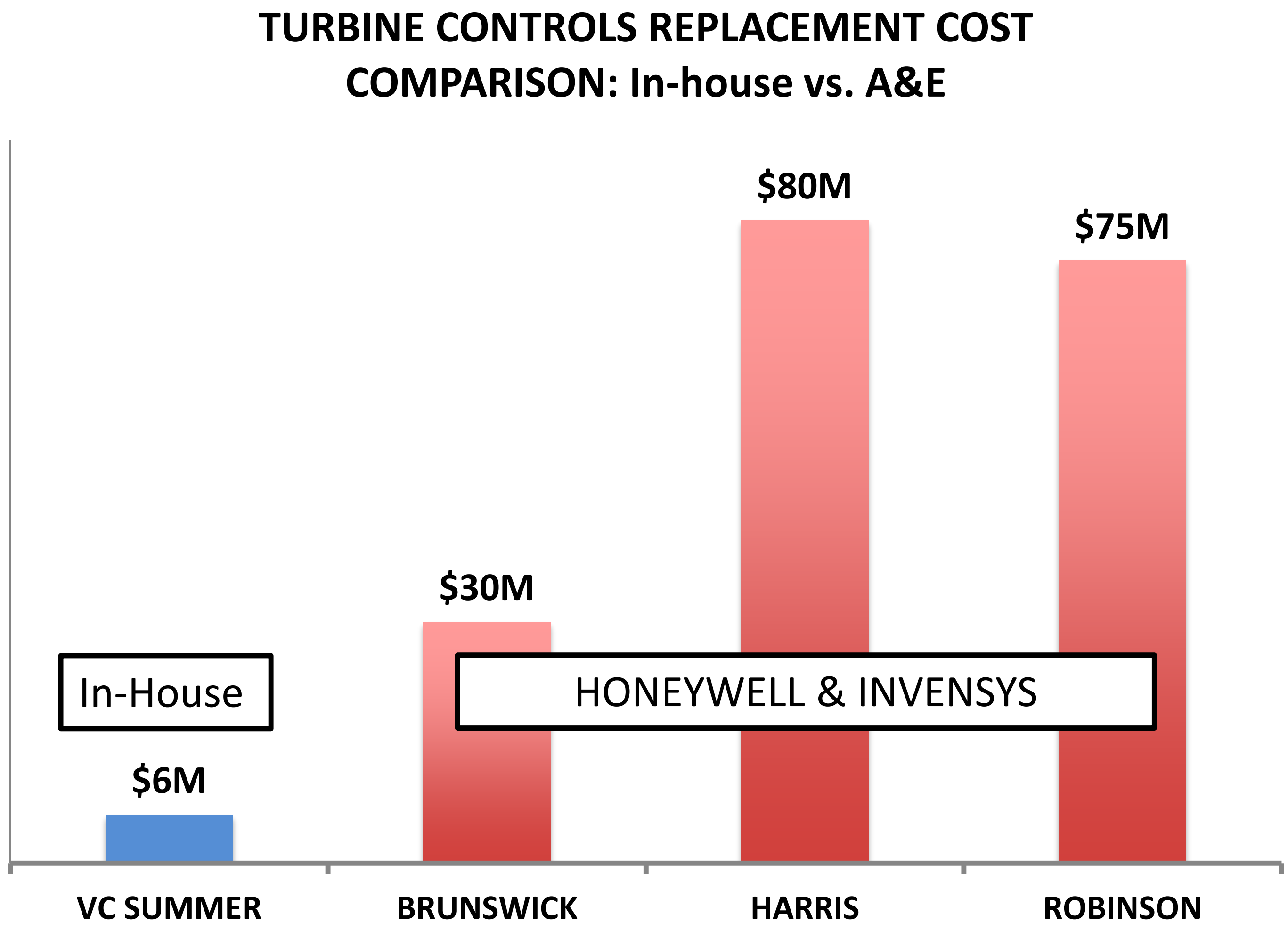
NOTE: The goal of this is to determine how to reduce burdens,
Thereby reducing the need for expensive EOCs,
Thereby reducing costs,
Thereby reducing lay-offs
….we can provide green cost effective power...
WE CAN DO IT!

IN-HOUSE vs. EOC COST COMPARISON



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