



Washington Public Power Supply System
A JOINT OPERATING AGENCY

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December 18, 1978
EDM-RGC-78-356

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Dr. R. J. Mattson, Director
Division of Systems Safety
U. S. Nuclear Regulatory Commission
Washington D. C. 20555

Subject: ATWS COST ESTIMATES -
WPPSS NUCLEAR PROJECT NO. 2

Dear Dr. Mattson:

I and members of my staff appreciated the opportunity to meet with you and your staff in conjunction with other industry representatives on December 6 to discuss ATWS cost estimates. We are of the opinion that the exchange was very beneficial and provided a better understanding of the impact of various ATWS fixes for all concerned.

As a result of our involvement in the ATWS issue over the past several months, we have developed the attached cost estimates for various levels of system modifications to accommodate an ATWS event. As we noted in our presentation to the ACRS Subcommittee on ATWS in October, we consider ATWS to be a Licensing issue and not a plant safety concern.

The attached cost estimates are based on our interpretation of what may be requested by the staff to satisfy your concerns regarding ATWS. The levels we have addressed include the 13 items contained in your November 15 letter to the Atomic Industrial Forum (Mr. John Ward, Chairman, Committee on Reactor Licensing and Safety). We have not independently addressed each item of your letter, but have instead attempted to incorporate them into systems which cover a spectrum of fixes ranging from justification of the existing design to an ultra-conservative mitigation system per NUREG-0460. All assumptions, definitions and the overall bases for cost estimates are included in the attachment.

Should you desire further information regarding our cost estimating methods, we would be pleased to discuss the subject with you, or to cooperate with the AIF in preparing an industry presentation on cost estimating methods.

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Dr. R. J. Mattson
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We trust that the attached information will be of use to you in evaluating the costs of ATWS. Should you have any questions regarding our transmittal, please contact me.

Very truly yours,



R. G. COCKRELL
Manager, Engineering Division

RGC:GCS:ct

Attachment

cc: John Ward, Chairman, AIF Committee on Reactor Licensing and Safety
L. S. Sandlin, WPPSS, Manager Project Planning and Measurement

ATWS COST ESTIMATE
FOR WNP-2

This document summarizes the cost impact for five levels of fixes for ATWS if applied to WPPSS Nuclear Project No. 2. Basic assumptions relating to the ATWS fixes are identified along with an outline of the five levels which provide the basis for the cost estimate.

The five levels outlined define a spectrum of arbitrary and possible fixes ranging from justifying existing designs to an ultra-conservative mitigation system design per NUREG-0450. The outline in no way implies that what is included in each level provides an optimum level of fix, or that the fix is necessary, i.e., the levels are frameworks from which to illustrate potential costs and schedule impacts for the WNP-2 plant.

The costs provided are total costs which WPPSS estimates would incur for the various levels. The total estimated cost for each level is divided into two categories - direct costs and other costs. Direct costs include materials, installation and A/E engineering to install each fix. They are engineering estimates not detailed construction estimates. General Electric's costs for materials and front-end engineering for each level of fix is included in the direct costs as "materials".

The other incremental costs include the following:

- Construction Management (unique to WNP-2)
- Owner's Cost (startup and testing, safety and licensing, engineering, project management, quality assurance, insurance, property taxes)
- Contingency (on direct cost, construction management, owner's cost)
- Escalation (on direct cost, construction management, contingency)
- Sales Tax (direct cost, escalation, contingency, construction management)
- Financing and Interest During Construction

The total estimated cost does not include any costs associated with fuel, delay or replacement power, operation and maintenance, or system cleanup costs due to inadvertent trips of automated standby liquid control systems.

A cost matrix is included to show where thirteen specific NRC items related to ATWS fixes are included in each level. The specified NRC items are listed in the attachment to the November 15, 1978 letter from R. J. Mattson (NRC) to J. Ward (AIF).

Basic Assumptions for ATWS Fixes

1. No other system failure other than the one causing ATWS for levels 1 through 4. However, the initiating event may be a loss of offsite power.
2. A two minute operator action time is used to manually start SLC pumps for level 3.
3. Wetwell temperature limitations are not exceeded for all levels.
4. Maximum water temperature for proven quencher operation is not exceeded, i.e., no quencher test costs for elevated temperatures for all levels.
5. Compliance with NUREG-0460, which assumes ATWS is a design basis accident, requires the mitigation system to be safety grade - single failure proof, Class IE power for level 5b.
6. The circuitry required for initiating ATWS fixes from Level 2 through 4, inclusive, are designed with the same reliability as the mechanical portion of the SLC system, i.e., not single-failure proof.
7. Compliance with NUREG-0460 (Level 5) requires the additional assumptions of a) failure of HPCS and b) 10% of MSRVS failing to close. Level 5a assumes that analyses will show the 300 gpm Automatic Boron Injection System will mitigate the consequences of both of the above assumptions. Level 5b assumes that the 300 gpm ABI may not mitigate the consequences of these two ultra-conservative assumptions.

WNP-2 LEVEL DEFINITIONS

Level 1: Justify Existing Design

- a. Tighter operational limits on the condensate storage tank to allow for more than 235,000 gallons minimum for RCIC/HPCS usage.
- b. Some additional control room information (e.g. alarms)
- c. Engineering analysis

Level 2: Improved Control - Alternate Reactor Shutdown System (ARSS)

- a. Two additional reactor low level and two additional reactor high pressure sensors of the same quality as those used for the Reactor Protection System (RPS) but independent of RPS.
- b. The additional instrumentation will initiate a Recirculation Pump Trip (RPT) using a one out of two twice logic. The RPT is equivalent to the Monticello design.
- c. ATWS Rod Insertion (ARI) will be initiated by the above circuitry to vent the air scram header using two additional solenoid valves. ARI is qualified to IEEE-279, 1971.

Level 3: Level 2 Plus Mitigation (Manual 86 gpm SLC)

- a. ARSS with Monticello RPT
- b. Two existing 43 gpm SLC pumps with a second suction line from the SLC tank and a second injection point (jet pump instrumentation line) added. The SLC pumps will be automatically provided with power from the emergency diesel after a loss of offsite power. Switch will be changed to allow both pumps to start simultaneously.
- c. Revision of procedures and training of operators for manual initiation of SLC pumps.
- d. Feedwater pump trip initiated by ARSS.

Level 4: Level 2 Plus Mitigation (Automatic 86 gpm SLC)

- a. ARSS with Monticello RPT
- b. Two existing 43 gpm SLC pumps with a second suction line from the SLC tank and a second injection point (jet pump instrumentation line) added. The pumps will be automatically started by ARSS circuitry.
- c. Feedwater pump trip initiated by ARSS.
- d. RCIC/HPCS initiated by ARSS.
- e. Analysis for modification of low level and low pressure MSIV set points.

Level 5a: Mitigation System - 300 gpm Automatic Boron Injection (ABI) System

- a. Four additional reactor low level and four additional high pressure sensors to provide two redundant trains of automatic logic and satisfy NUREG-0460 criteria.
- b. A RPT complying with criteria of NUREG-0460 will require additional trip coils to trip EOC breakers, which will cut power from both normal power supply and the low frequency motor generators.
- c. Four 150 gpm SLC pumps, 300 gpm per train, each pump with separate suction line from SLC tank. The second injection point (HPCS line) will be as close to the reactor vessel as possible.
- d. Feedwater pump trip initiated by ATWS circuitry.
- e. HPCS/RCIC initiated by ATWS circuitry.
- f. ATWS Rod Insertion qualified to IEEE-279, 1971 and initiated by ATWS circuitry.

Level 5b: Level 5a with Additional High Pressure Makeup and Heat Sink

- a. Level 5a
- b. Special ATWS Makeup (SAM) equivalent to HPCS
- c. Suppression Pool Interim Cooling (SPIC) equivalent to additional RHR system along with heat sink.
- d. Diesel generators to supply emergency power for ABI, SAM, and SPIC.

ATWS Cost Matrix

The following table identifies where, by means of an (x), the cost of each NRC item is used in costing out each of the five levels of fixes for ATWS.

NRC Items (1)	ATWS Fixes (2)				
	Level 1	Level 2	Level 3	Level 4	Level 5
1	--	X	X	X	X
2	NA	NA	NA	NA	NA
3	--	X	X	X	--
4	--	--	--	--	X
5	--	--	X	X	--
6	--	--	--	X	--
7	NA	NA	NA	NA	NA
8	NA	NA	NA	NA	NA
9	NA	NA	NA	NA	NA
10	NA	NA	NA	NA	NA
11	--	--	--	X	--
12	--	--	X	--	--
13	--	--	--	--	X

(1) NRC items refers to the Items in the attachment to letter from R. J. Mattson (NRC) to J. Ward (AIF), dated November 15, 1978.

(2) The five levels of ATWS fixes are outlined on the attached sheets.

ATWS Cost/Schedule Summary

<u>Level</u>	<u>Design, Procure & Install</u>	<u>Total Estimated Cost</u>
1	7-10 months	\$ 0.5M
2	9-12 months	\$ 1.3M
3	9-12 months	\$ 2.5M
*4	18-24 months	\$ 4.0M
*5a	36-42 months	\$ 29.4M
*5b	42-48 months	\$150M

- Notes:
- No delay/downtime costs included for all of the above.
 - *No delay/downtime costs included, however, installation costs assume installation is after plant startup.
 - All assume fix is applied to an as-built (or operating) plant.
 - No operation/maintenance costs included for any of the above.
 - No costs included for system cleanup due to inadvertent trips of Automatic Standby Liquid Control Systems.

ATWS WNP-2

Level 1

Summary

<u>FPC Code</u>	<u>Totals</u>
10 Structures and Improvements	\$ -0-
20 Reactor Plant Equipment	-0-
30 Turbo-Generator Units	-0-
40 Accessory Electrical Equipment	55,000
50 Misc. Power Plant Equipment	45,000
60 Station Equipment and Switchyard	-0-
70 Distributable Directs	-0-
A/E Engineering Design	<u>60,000</u>
Total Direct Cost	160,000
 Construction Management	
A/E Portion	56,000
Owner Portion	50,000
Owner's Cost	40,000
Contingency	122,300
Escalation	18,800
Sales Tax	23,200
Financing and Interest During Construction	<u>17,400</u>
Total Estimated Cost	487,700

Excludes Fuel Costs & Replacement Power

Excludes Operation and Maintenance Costs

ATWS WNP-2

Level 2

Summary

<u>FPC Code</u>	<u>Totals</u>
10 Structures and Improvements	\$ -0-
20 Reactor Plant Equipment	50,000
30 Turbo-Generator Units	-0-
40 Accessory Electrical Equipment	250,000
50 Misc. Power Plant Equipment	-0-
60 Station Equipment and Switchyard	-0-
70 Distributable Directs	-0-
A/E Engineering Design	<u>180,000</u>
Total Direct Costs	480,000
 Construction Management	
A/E Portion	100,000
Owner Portion	90,000
Owner's Cost	70,000
Contingency	296,000
Escalation	68,000
Sales Tax	57,400
Financing and Interest During Construction	<u>67,100</u>
Total Estimated Cost	1,228,500

Excludes Fuel Costs and Replacement Power
Excludes Operation and Maintenance Costs

ATWS WNP-2

Level 3

SUMMARY

FPC Code

Totals

10 Structures & Improvements	\$ -0-
20 Reactor Plant Equipment	350,000
30 Turbo-Generator Units	-0-
40 Accessory Electrical Equipment	250,000
50 Misc. Power Plant Equipment	-0-
60 Station Equipment Switchyard	-0-
70 Distributable Directs	-0-
-- A & E Engineering Design	<u>360,000</u>
Total Direct Cost	960,000

Construction Management

A & E Portion	200,000
Owner Portion	180,000
Owner Cost	135,000
Contingency	590,000
Escalation	150,100
Sales Tax	115,100
Financing & Interest During Construction	<u>148,700</u>
Total Estimated Cost	2,478,900

Excludes Fuel Costs & Replacement Power

Excludes Operation & Maintenance Costs

ATWS WNP-2

Level 4*

SUMMARY

<u>FPC Code</u>	<u>TOTALS</u>
10 Structures & Improvements	\$ -0-
20 Reactor Plant Equipment	400,000
30 Turbo-Generator Units	-0-
40 Accessory Electrical Equipment	600,000
50 Misc. Power Plant Equipment	-0-
60 Station Equipment & Switchyard	-0-
70 Distributable Directs	-0-
-- A & E Engineering	<u>600,000</u>
Total Direct Cost	1,600,000
Construction Management	
A & E Portion	300,000
Owner Portion	270,000
Owners Cost	200,000
Contingency	940,000
Escalation	242,400
Sales Tax	184,700
Financing & Interest During Construction	<u>240,100</u>
Total Estimated Cost	3,977,000

Excludes Fuel Costs & Replacement Power

Excludes Operation & Maintenance Costs

*Scheduled Shutdown After Fuel Loading

ATWS WNP-2

*Level 5a.

SUMMARYFPC CodeTOTALS

10 Structures & Improvements	\$ 40,000
20 Reactor Plant Equipment	3,000,000
30 Turbo-Generator Units	-0-
40 Accessory Electrical Equipment	3,400,000
50 Misc. Power Plant Equipment	60,000
60 Station Equipment & Switchyard	-0-
70 Distributable Directs	-0-
-- A & E Engineering Design	<u>3,000,000</u>
Total Direct Cost	9,500,000

Construction Management

A & E Portion	2,400,000
Owner Portion	2,160,000
Owner Cost	1,600,000
Contingency	6,265,000
Escalation	4,222,000
Sales Tax	1,357,000
Financing & Interest During Construction	<u>1,837,000</u>
Total Estimated Cost	29,341,000

Excludes Fuel Costs & Replacement Power

Excludes Operation & Maintenance Costs

*Scheduled Shutdown after Fuel Loading

ATWS WNP-2

Level 5b*

SUMMARY

	<u>TOTALS</u>
10 Structures & Improvements	\$ 7,345,000
20 Reactor Plant Equipment	30,000,000
30 Turbo-Generator Units	---
40 Accessory Electrical Equipment	1,423,000
50 Misc. Power Plant Equipment	235,000
60 Station Equipment & Switchyard	---
70 Distributable Directs	---
-- A & E Engineering Design	<u>13,100,000</u>
Total Direct Cost	52,103,000
Construction Management	
A & E Portion	9,800,000
Owners Portion	8,820,000
Owners Cost	5,410,000
Contingency	30,440,000
Escalation	25,000,000
Sales Tax	6,826,000
Financing & Interest during Construction	<u>11,756,000</u>
Total Estimated Cost	150,155,000

Excludes Fuel Costs & Replacement Power

Excludes Operation & Maintenance Costs

*Scheduled Shutdown after Fuel Loading

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12/12/78

FROM R.G. Cockrell, Mgr. Engineering Division Wash. Pub. Power Supply Sys.		DATE OF DOCUMENT 12/18/78		DATE RECEIVED 12/26/78		NO. DSS:131	
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