Docket File #50-320
NRC/PDR
Local PDR
TMI/SEP r/f
TMI Site r/f
PSB/(TMI) r/f
NRR r/f

August 24, 1979

MEMORANDUM FOR: John T. Collins, Deputy Director
Three Mile Island-2 Support/NRR

Robert M. Benero, Assistant Director
for Materials Safety
Office of Standards Development

Donald E. Solberg, Program Manager
Fuel Cycle Research Branch
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Richard L. Bangart/Jay Y. Lee
Effluent Systems Treatment Branch
Division of Site Safety and Environmental Analysis, DOR

James R. Miller, Acting Assistant Director
for Site and Safeguards, DOR

FROM: Richard H. Vollmer, Director
Three Mile Island-2 Support

SUBJECT: BECHTEL REPORTS ON TMI-2 RECOVERY

A copy of the subject reports are attached for your information, evaluation and comments. Since few of these are currently available to us, I would appreciate having any unneeded copies returned.

Original signed by
Richard H. Vollmer

Richard H. Vollmer, Director
Three Mile Island-2 Support

Enclosure:
As stated

9710055

cc: H. Denton/E. Case					
OFFICE ▶					D/TMI-2 Su
Distribution Copies:					RVollmer/jn
(See above listing.)					
DATE ▶					8/ /79

NRC FORM 318 (9-76) NRCM 0240 ★ U.S. GOVERNMENT PRINTING OFFICE: 1976 - 626 - 726

Bechtel Power Corporation
Engineers—Constructors
15740 Shady Grove Road
Gaithersburg, Maryland 20760
301—948-2700

July 13, 1979
GPU/TMI-0023

Mr. R. W. Heward, Jr.
Manager - Projects
GPU Service Corporation
260 Cherry Hill Road
Parsippany, New Jersey 07054

Subject: Containment Recommissioning
Preliminary Assessment of Potential Cost & Schedule
Three Mile Island Unit 2
Containment Recovery Engineering
Bechtel Job 13587-003

Dear Mr. Heward:

Transmitted in accordance with your request are ten copies of the Preliminary Assessment of Potential Cost & Schedule for the Recommissioning of the Three Mile Island Unit 2 Containment Building and Systems. The assessment is based on a very preliminary evaluation of the extent of damage to and contamination of the materials, components and structures inside the containment. Since no entry has been made into the containment at this time, the evaluation is highly speculative. We believe that, given the assumptions and qualifications stated, this assessment forms a reasonable base which can be adjusted as knowledge of the plant status improves and as the recommissioning plans evolve.

The assessment includes costs of contracts for materials, labor and technical services associated with the recovery of the containment (e.g., decontamination, radwaste processing and disposal, reconstruction, etc.). It does not include replacement power costs, fuel costs or owner costs (e.g., GPU and Met Ed administrative, operations, or engineering payroll, etc.).

This study assumes the plant can be recommissioned without undue delays caused by outside influence. No attempt has been made to quantify the costs associated with future plant modifications desired by GPU or required by the NRC.

We would be pleased to discuss the cost and schedule assessment with you at your convenience.

Very truly yours,

RL Rider

R. L. Rider
Project Engineer

RLR:vwc
Enclosure

cc: C. W. Sandford, w/Encl
J. W. Thiesing, w/Encl

GENERAL PUBLIC UTILITIES SERVICE CORPORATION

THREE MILE ISLAND UNIT 2

CONTAINMENT RECOMMISSIONING

PRELIMINARY ASSESSMENT

OF

POTENTIAL COST

AND

SCHEDULE

BECHTEL JOB 13587-003

CONTAINMENT ENGINEERING

GENERAL PUBLIC UTILITIES SERVICE CORPORATION
THREE MILE ISLAND UNIT 2
CONTAINMENT RECOMMISSIONING
PRELIMINARY ASSESSMENT OF POTENTIAL COST AND SCHEDULE
BECHTEL JOB 13587-003

GENERAL PUBLIC UTILITIES SERVICE CORPORATION
THREE MILE ISLAND UNIT 2
CONTAINMENT RECOMMISSIONING
PRELIMINARY ASSESSMENT OF POTENTIAL COST AND SCHEDULE
BECHTEL JOB 13587-003

NOTE

A CAUTIONARY NOTE IS WARRANTED REGARDING THE USE OF THE COST AND SCHEDULE ASSESSMENT PRESENTED WITHOUT PROPER CONSIDERATION PAID TO THE ASSUMPTIONS AND QUALIFICATIONS STATED HEREIN. SINCE CONTAINMENT RE-ENTRY HAS NOT BEEN MADE AT THE TIME OF THIS ASSESSMENT, MANY UNCERTAINTIES EXIST. AS KNOWLEDGE OF THE STATUS OF THE CONTAINMENT IMPROVES, SO CAN THE ACCURACY OF THE COST AND SCHEDULE ASSESSMENT. FINDINGS COULD BE MUCH DIFFERENT FROM THOSE CONDITIONS ASSUMED AT THIS TIME, AND COULD RESULT IN LOWER OR HIGHER COSTS AND/OR A SHORTER OR LONGER SCHEDULE THAN SHOWN.

I. GENERAL

GENERAL PUBLIC UTILITIES SERVICE CORPORATION
THREE MILE ISLAND UNIT 2
CONTAINMENT RECOMMISSIONING
PRELIMINARY ASSESSMENT OF POTENTIAL COST AND SCHEDULE
BECHTEL JOB 13587-003

I. GENERAL

This preliminary assessment of potential cost and schedule for the recommissioning of the Three Mile Island Unit 2 containment building and systems is based on a very preliminary evaluation of the extent of damage and contamination to the materials, components and structures inside the containment. Since no entry has been made into the containment at this time, the evaluation is highly specualtive. In order to arrive at a basis for the estimate and schedule, a review has been made of the available information developed by GPUSC, B&W, the NRC and the Bechtel Containment Engineering Group. This information is summarized in Section II, Assumptions and Qualifications.

It is assumed that proper safety assessments will be performed and necessary regulatory approvals will be obtained in a timely manner needed to support the recovery plan.

The scope of this estimate includes efforts related to re-entering and cleaning up the containment, including waste disposal; removing and disposing of the fuel; refurbishing or replacing in-containment systems, structures, and components; and preparing the unit for restart. No allowances have been made for potential plant modifications which might be required prior to returning the unit to service. Potential costs are discussed in Section VII.

The schedule shown in Section IV includes three phases and support activities as follows:

- o Phase I Containment Re-entry and Decontamination
- o Phase II Reactor Coolant System (RCS) Cleanup
- o Phase III Reconstruction and Recommissioning

Phase I involves maintaining the long-term cooling of the unit and cleaning and processing of the contaminated water in the auxiliary building, the containment sump and the reactor coolant system. It also includes preparation for re-entry, the re-entry and data acquisition tasks, and decontamination of the inside of the containment.

Phase II involves preparations for and removal of the reactor vessel head, inspection of the core, removal of the fuel and vessel internals and decontamination of the reactor coolant system.

Phase III involves requalification testing and in-service inspection of the reactor coolant and safety systems, replacement or refurbishment of components and materials, replacement of vessel internals, preoperational testing, loading fuel and startup testing.

Support activities for each phase will involve the resolution of safety issues, completion of plant modifications needed to satisfy the licensing review for recommissioning of TMI-2, and disposition of radioactive materials and spent fuel.

GENERAL PUBLIC UTILITIES SERVICE CORPORATION
THREE MILE ISLAND UNIT 2
CONTAINMENT RECOMMISSIONING
PRELIMINARY ASSESSMENT OF POTENTIAL COST AND SCHEDULE
BECHTEL JOB 13587-003

SUMMARY OF COST AND SCHEDULE

NOTE: The preliminary assessment of potential cost and schedule for the TMI-2 recommissioning is summarized below. This specifically relates to the assumptions and qualifications stated in Section II. As knowledge of the containment status improves, the cost and schedule assessment is subject to change.

Cost Estimate

		(Dollars in Millions)
A.	Cleanup and Radwaste Processing	33
B.	Re-entry and Hands-on Containment Decontamination	41
C.	Shielding, Rigging and Vessel Head Removal	5
D.	Core Inspection	2
E.	Fuel Removal and Disposition	23
F.	Vessel Internals Removal and RCS Decontamination	9
G.	Requalification and In-Service Inspection	5
H.	Reconstruction	26
I.	Refurbishment or Replacement of Major Equipment	15
J.	System/Component/Structure Modifications	Not Incl.
K.	Analysis, Safety Assessment, Licensing and Other Services	40
L.	Miscellaneous and Radwaste Disposal	37
	Subtotal	236
	Contingency (33%)	79
	Total Containment Recovery Costs	315

Schedule Milestones

		Months From Containment Entry
o	Containment Re-Entry	0
o	Vessel Head Removal	11
o	Fuel Removal	20
o	RCS Decontamination	26
o	ISI Complete	32
o	Fuel Load	37
o	Commercial Operation	42

NOTE: Reader is cautioned that the application of the above information should be subject to the caveat on Page 1.

II. ASSUMPTIONS AND QUALIFICATIONS

GENERAL PUBLIC UTILITIES SERVICE CORPORATION
THREE MILE ISLAND UNIT 2
CONTAINMENT RECOMMISSIONING
PRELIMINARY ASSESSMENT OF POTENTIAL COST AND SCHEDULE
BECHTEL JOB 13587-003

II. ASSUMPTIONS AND QUALIFICATIONS

The cost estimate and schedule is significantly influenced by the many factors which cannot be precisely defined at this time. It is expected that the information presented herein will be modified as new data is developed. Among the major factors affecting cost and schedule are the following:

1). The amount of isotopic inventory in the containment,

2). the ability to requalify major components for reuse, and

3). the extent of plant modifications required to restart TMI-2

In order to arrive at this conceptual estimate, the following specific assumptions have been made:

- Work will proceed on two, 10-hour shifts per day, seven days per week using the "rolling four 10's" as discussed in Section VI.
- Systems, components and structures installed to accommodate plant cooldown, cleanup and reconstruction are considered temporary and will be removed prior to return of TMI-2 to commercial operation.
- Extraordinary political or legal actions will not be a major hinderance to TMI-2 recommissioning.
- The reactor pressure vessel, primary loop piping, reactor coolant pump casings, steam generators and pressurizer will not require replacement.
- Supports, bolts, studs and embeds for major components of the nuclear steam supply system will be adequate for reuse.
- Most of the cable tray can be left in place and reused.
- All of the containment wire, cable and conduit will be replaced.

- All containment instrumentation will be replaced.
- Containment piping will generally be adequate with some replacement of hanger components, snubbers, etc.
- Most of the metal reflective insulation can be reused.
- No sharing of Unit 1 systems or facilities will be permitted.
- Offsite radwaste disposal is assumed to be in the Western United States (i.e., maximum transportation cost is assumed).
- An offsite fuel processing or storage repository will be available.
- The containment can be purged in accordance with the release limits contained in the original plant technical specifications.
- Limits on tritium releases will not impact the schedule for radwaste processing.
- Worker radiation dose limits will be as presently stated in accordance with federal regulations and plant health physics procedures.
- New construction involving radwaste processing systems or for the storage of radwaste will require flood protection.
- High level waste processing systems will be installed in seismically designed structures.
- Future contract labor cleanup cost of the auxiliary building is not included.
- The cost estimates are escalated approximately ten percent per year through 1981, the anticipated center of gravity of the work.
- Contractor services (water, power, etc.) are to be provided by Metropolitan Edison and their costs are not included in the estimate.

Owner's costs, or those costs which are not associated with contracts and procurement of goods and services directly related to the TMI-2 recommissioning activities, are not included in this report. Examples of owner's costs (and potential credits) are:

- Replacement fuel costs are excluded.
- All Metropolitan Edison and GPU operating expenses (e.g., engineering, administration, overhead, etc.), except health physics and security, are excluded.
- Cost of federal, state or local permits and licenses are excluded.
- Cost of replacement power is excluded.
- Financing costs are excluded.
- Professional services such as legal, financial, etc. are excluded.
- Potential insurance reimbursements are not considered.
- No credit has been taken for unburned energy in the spent fuel.
- Although many items procurred for the TMI-2 recommissioning could have significant salvage value, no credit for temporary equipment salvage is assumed.

III. COST ESTIMATE

III. COST ESTIMATE

The TMI-2 containment recommissioning costs are presented as twelve separate estimates covering the three work phases. Although there is little definitive information available, qualitative or quantitative descriptions are provided for the major cost components. The scope does not represent the only basis for recommissioning the containment, but does describe a reasonable concept for the purpose of this cost estimate, given the qualifications and assumptions in Section II.

A. Cleanup and Radwaste Processing

The cost for this current long term cooling and radiation management phase includes the emergency measures associated with plant cooldown, the installation of radwaste processing systems, and remote decontamination utilizing the containment spray system.

1. Plant Cooldown Provisions and other Emergency Operations

   Auxiliary building charcoal filter trains
   Condenser air ejector filtration
   Auxiliary diesel generators
   Spent fuel pool tankage
   Auxiliary decay heat removal system
   Steam generator B closed loop cooling
   Alternate RCS pressure control system

2. Liquid Waste Processing Capability (10 GPM minimum)

   Evaporator
   Calciner
   Filtration and resin demineralizers
   Solidification and drumming systems
   Processed water storage (four 250,000 gallon tanks)

During this phase it will probably be necessary to process up to 3,000,000 gallons of contaminated water, including water that is recycled from the containment sump, and the remote steam, chemical, and water sprays recycled through the containment spray system.

Because the processing of waste will be accomplished at a faster rate than the capability for off-site shipment and disposal, interim on-site staging of packaged radwaste will be necessary. The following items are included for this:

High level waste staging facility - 5,000 square feet
Intermediate level waste staging facility - 25,000 square feet
Outside protection area for low level
radwaste interim storage - 80,000 -100,000 square feet

Estimated Cost $ 33 Million including

680,000 craft hours
140,000 supervision hours

B. Re-Entry and Hands-on Containment Decontamination

Containment re-entry and decontamination costs include the construction of service-related facilities, the removal of contaminated components which cannot be reused, radiation mapping, data acquisition, and hands-on cleanup of the entire containment:

1. Service Facilities

Personnel hatch No. 2 contamination control structure
Containment equipment hatch contamination control and service building
Containment equipment hatch personnel access control facility
Contaminated dry cleaning facility
Shielding materials
Material handling equipment
Installation of in-containment decontamination service systems and facilities

2. Containment Decontamination

Health physics training of all workers
Anti-contamination clothing and breathing apparatus
Lighting and communication systems
Shielding, robotics, and special tools
Rags, mats, and cleaning solutions

9.1073

3. Contaminated Equipment Removal

Containment air coolers
Ductwork
Refueling machines
Fuel storage racks
Valve operators
Conduit, wire, and instrumentation
Letdown coolers

It is assumed that decontamination activities will create approximately 1,000,000 gallons of liquid waste. Equipment removal and decontamination waste materials are expected to generate about 400,000 cubic feet of dry compacted waste.

Estimated Cost $ 41 Million including

750,000 craft hours
150,000 supervision hours

C. Shielding, Rigging and Vessel Head Removal

In order to remove the reactor vessel head it may require shielding provisions above the reactor vessel head, the steam generators, and the pressurizer. Installation of a working trolley on the polar crane and erection of a rigging platform with special tools for CRD unlatching and head detensioning are also included. Final reactor head cleaning may be accomplished utilizing a decontamination tank or a shielded area around the head storage stand at elevation 347' in the containment.

Estimated Cost $ 5 Million including

40,000 craft hours
8,000 supervision hours

D. Core Inspection

Core inspection needed to support fuel removal and anticipated historical documentation of post-incident core status will be done primarily by operators, engineers and technicians. (Cost with Section K). Estimated costs included with this operation are for procurement and installation of TV cameras, videotape systems, borescopes, fiber optic devices and special instrumentation.

Estimated Cost $ 2 Million including

30,000 craft hours
6,000 supervision hours

E. Fuel Removal and Disposition

It is assumed that the fuel and debris will be placed in shipping cans for shipment in standard spent fuel casks and transported to an off-site fuel processing/storage repository. Other options may be pursued such as storing the fuel in the on-site storage pool, in order to defer the costs of fuel shipping and disposal. For this estimate special activities associated with reactor fuel removal and disposition are:

1. Special Tooling

   Loose fuel and debris removal tools
   Underwater vacuum
   Large and small piece handling tools
   Stuck fuel assembly tools
   Loose piece shipping cans
   Large piece shipping cans
   Fuel assembly and control rod shipping cans

2. Fuel Pool Modifications

   Remove fuel transfer equipment
   Install fuel assembly and fuel debris canning station
   Install fuel staging area
   Install fuel assembly cask loading station

3. Shipment and Disposal of Fuel

   Acquire fuel assembly casks
   Acquire loose fuel disposal casks
   Obtain satisfactory repository, implement a satisfactory disposition procedure and ship fuel pieces

Estimated Cost $ 23 Million including

20,000 craft hours
8,000 supervision hours

F. Vessel Internals Removal and RCS Decontamination

Following fuel removal, the steam generators will be cleaned of debris. The reactor head will then be reinstalled and the reactor coolant system chemically flushed. Following chemical flushing, the internals will be removed and further decontaminated prior to refurbishment or disposal.

Total reactor coolant system flushing and chemical cleaning is expected to produce approximately 3,000,000 gallons of liquid radwaste.

It is planned to remove, decontaminate, and either rewind (for reuse) or dispose of the reactor coolant pump motors during this phase. Special packaging and transportation provisions for the oversize and overweight pieces, have been considered in preparing the estimate.

Steam generator tube sheets and tubes will also be inspected and repaired at this time.

Estimated Cost	$ 9 Million	including
	50,000	craft hours
	10,000	supervision hours

G. Requalification and In-Service Inspection

Most activities associated with this phase will be carried out here by technical services peiple. Costs included are for procurement of the ISI tooling and inspection equipment, field inspection, the ILRT and SIT testing, and craft labor support for the inspection and testing technicians.

Estimated Cost	$ 5 Million	including field services and miscellaneous support of
	20,000	craft hours
	8,000	supervision

H. Reconstruction

Major containment reconstruction will take place following removal of the fuel and includes the following major activities:

1. Refurbishment of reactor coolant system components and reinstallation of major components noted in the following section.

2. Reinstallation of the containment air coolers and associated ductwork.

3. Installation of electrical items:

   Wire and cable
   Conduit
   Lighting and communications
   Penetrations
   Motors
   Electronic instrumentation

4. Inspection, repair, or replacement of mechanical equipment such as spring hangers, snubbers, isolation valves actuators, instruments, letdown heat exchangers, and other active mechanical components.

5. Reinstallation of reflective insulation removed for in-service inspection.

6. Surface preparation and recoating of the containment.

7. Replacement of spent fuel storage racks.

8. Support activities and construction materials required in the performance of the work.

Estimated Cost $ 26 Million including

680,000 craft hours
140,000 supervision hours

I. Refurbishment or Replacement of Major Equipment

Subject to the findings of the requalification analysis and inspection program, it is anticipated that refurbishmentment (and in some cases, possibly replacement) of certain major components may be necessary. The long lead time for major components may warrant initiating procurement activities, even if inspection later reveals the components can be reused. Major components considered are:

Reactor coolant pump motors and impellers
Reactor internals
Reactor pressure vessel head
Control rods, drive mechanisms and associated cabling
Pressurizer safety and relief valves
In core instrumentation
Fuel handling machines

Estimated Cost $ 15 Million
(based on purchase of new equipment)

3.1.075

J. System/Component/Structure Modifications

No allowances have been made at this time for modifications which may be required to recommission TMI-2. A list of potential modifications is outlined in Section VII.

K. Analysis, Safety Assessment, Licensing and Other Services

For the purposes of this estimate, which predates detailed planning for Phase II (reactor coolant system cleanup) and Phase III (reconstruction and recommissioning), an allowance has been made for various technical and other related project support activities. Among the categories for which contract support may be required are the following:

Nuclear Steam Supply System (NSSS) reanalysis
Requalification analysis
Safety analysis and licensing
Waste management
In-service inspection
Quality assurance
Technician support for core inspection and fuel removal
Decontamination procedures
Offsite laboratory analysis
Support of public hearings
Reanalysis of balance-of-plant systems
Engineering to support reconstruction
Preoperational and startup testing
Planning, scheduling and cost estimating
Management of construction services
Procurement services

Estimated Cost $ 40 Million including

1,100,000 services manhours

L. Miscellaneous and Radwaste Disposal

The principal cost for these support activities are:

1. Additional health physics requirements for Unit 2
2. Additional Unit 2 plant security
3. Shipment and disposal cost of radioactive waste
4. Removal of temporary facilities

Estimated Cost $ 37 Million including

180,000	craft hours
40,000	supervision hours
400,000	security force hours
400,000	health physics hours

IV. SCHEDULE

IV. SCHEDULE

The schedule assumes that a somewhat conservative approach is taken with respect to containment cleanup and radwaste processing and to core inspection and fuel removal. This is intended to anticipate performance of work inside the containment in a manner which is in accordance with maintaining worker radiation dose "as low as reasonably achievable" (ALARA).

Major milestones have been established and are discussed below.

1. Containment Reentry

Since it is predicted that at 8 months following the incident about 1.0×10^6 curies of radioactive fission products, exclusive of noble gases and airborne iodine, would be in the containment sump, the reactor coolant system, or plated out, containment reentry for the purposes of accomplishing detailed radiation surveys, data acquisition and containment decontamination would not be made until the following have been accomplished:

- the containment has been purged
- the water presently in the containment sump has been removed and processed
- the reactor coolant system has been flushed
- attempts have been made to remotely decontaminate the containment (e.g., using the containment sprays).

2. Vessel Head Removal

Because of the high level of contamination expected throughout the containment, vessel head removal would not be made until the following have been accomplished:

- the 305' and 347' floors have been sufficiently decontaminated to allow full time occupancy of the containment (with full-face respirators)
- the 282' floor has been decontaminated to levels which minimize significant recontamination of the upper floors

- the polar crane has been inspected and placed in a serviceable condition or the trolley replaced

- sufficient shielding placed or the refueling cavity flooded to reduce radiation levels near the reactor vessel head to acceptable levels

3. Fuel Removal

It is assumed that significant core damage has been experienced and that much of the fuel will have to be handled with special tooling, placed in shipping containers and shipped to a processing/storage repository. It is not possible to define this task until core inspection has been performed. However, for the purpose of the scope for the cost and schedule associated with this activity, the following is assumed:

- 40% intact fuel assemblies

- 30% damaged fuel assemblies

- 25% disassembled fuel assemblies

- 5% largely destroyed fuel assemblies

4. Reactor Coolant System Decontamination Complete

It is assumed that some fuel or debris from the core has been distributed into other parts of the reactor coolant system, such as the bottom of the reactor vessel and the steam generator upper tube sheets. The reactor coolant system decontamination phase includes the following:

- Removal of the reactor vessel lower internals

- cleanup of the bottom of the vessel

- cleanup of the steam generator tube sheets and tubes

- removal of the reactor coolant pump motors and impellers

- chemical decontamination of the reactor coolant system

5. Inservice Inspection Complete

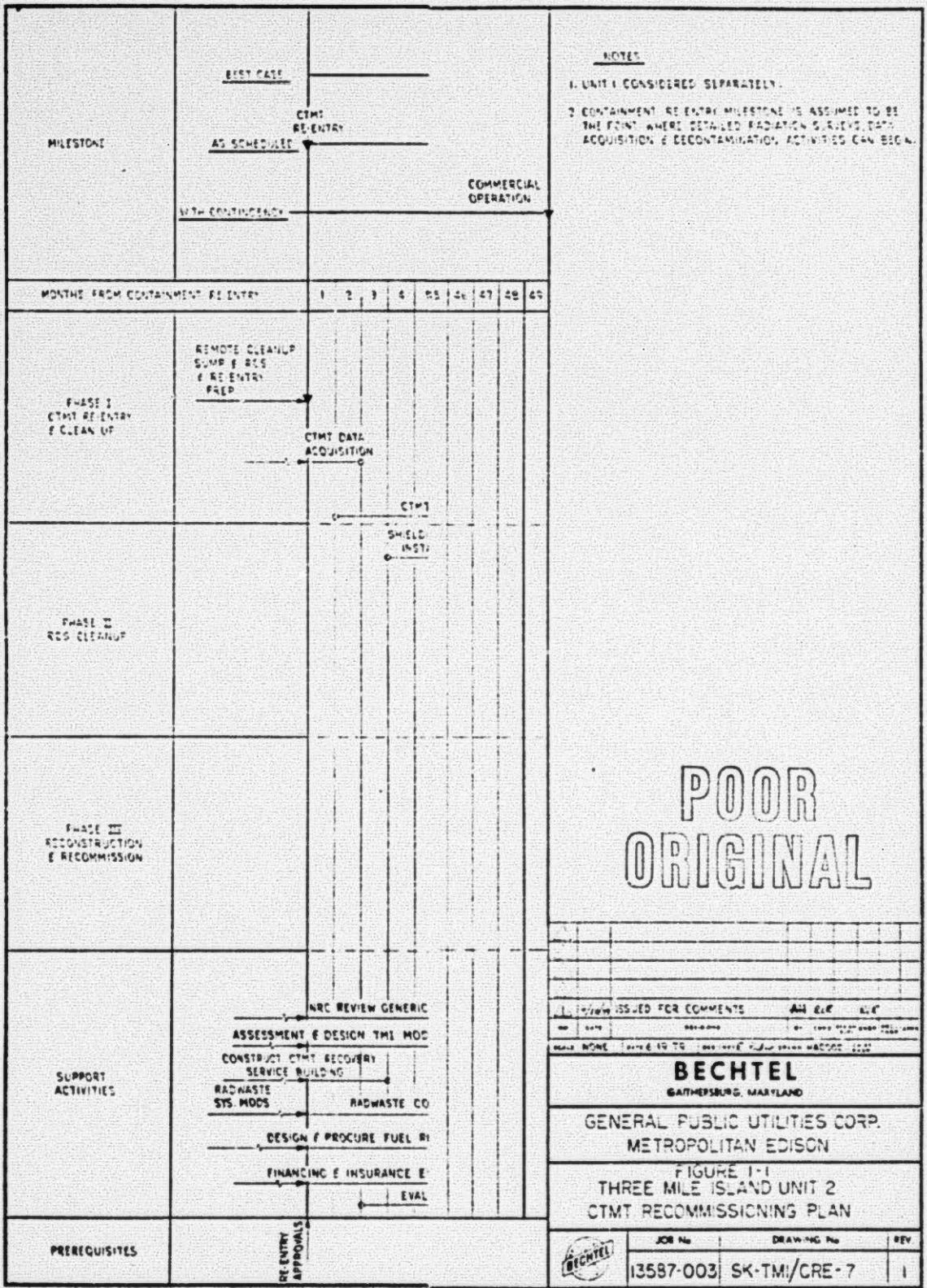
The reactor coolant system components and piping will be inspected for requalification. This inspection will be complemented by extensive supporting analysis. As noted in Section II, it is assumed that the major nuclear steam supply system components can be requalified and will not have to be replaced.

6. Fuel Load

It is assumed that fuel load will not take place until preoperational testing, containment integrated leak rate testing, inservice inspection, operator training, and the NRC safety review have been completed.

7. Commercial Operation

After startup testing has taken place and the power demonstration run has been made, commercial operation would be declared (per schedule information supplied by GPUSC).



NOTES:

1. UNIT 1 CONSIDERED SEPARATELY.
2. CONTAINMENT RE ENTRY MILESTONE IS ASSUMED TO BE THE POINT WHERE DETAILED RADIATION SURVEYS, DATA ACQUISITION & DECONTAMINATION ACTIVITIES CAN BEGIN.

NO.	DATE	REVISION	BY	CHK	APP
1	11/6/79	ISSUED FOR COMMENTS	AH	GLC	GLC

MATERIAL NONE

BECHTEL
GAITHERSBURG, MARYLAND

GENERAL PUBLIC UTILITIES CORP.
METROPOLITAN EDISON

FIGURE 1-1
THREE MILE ISLAND UNIT 2
CTMT RECOMMISSIONING PLAN

JOB No.	DRAWING No.	REV.
13587-003	SK-TMI/CRE-7	1

V. CASH FLOW

V. CASH FLOW

The TMI-2 containment recommissioning cash requirements are predicated on the recovery schedule, manpower levels, anticipated engineering and procurement activity, and a uniform allocation of contingency. It is assumed that processed radwaste will be continuously shipped offsite during the cleanup and that the fuel will not be stored at the site prior to disposal. Changes in any of these conditions or other schedule perturbations would affect the anticipated cash flow.

GENERAL PUBLIC UTILITIES SERVICE CORPORATION
THREE MILE ISLAND UNIT 2
CONTAINMENT RECOMMISSIONING
CASH FLOW

(Dollars in Millions)

Cost Category	Prior to * CTMT Entry	Year After Containment Reentry							Total
		Year 1				Year 2	Year 3	Year 4	
		1st Qtr	2nd Qtr	3rd Qtr	4th Qtr				
A. Cleanup and Radwaste Processing	21	8	4						33
B. Reentry and Cleanup		6	9	9	8	9			41
C. RPV Head Removal					1	4			5
D. Core Inspection						2			2
E. Fuel Removal and Disposal						14	9		23
F. Internals Removal and RCS Cleanup						7	2		9
G. Requalification							5		5
H. Reconstruction						3	20	3	26
I. Major Equiment Purchase		1	1	1	1	3	8		15
J. System Modifications (not included)									--
K. Analysis, Safety Assessment, Licensing	11	3	4	4	4	9	3	2	40
L. Miscellaneous (Including Radwaste Disposal)	8	4	4	4	4	9	3	1	37
	40	22	22	18	18	60	50	6	236
Contingency	13	7	7	6	6	20	18	2	79
Total	53	29	29	24	24	80	68	8	315

* Subject to variance, depending on timing of containment reentry.

VI. SUPPORT INFORMATION

VI. SUPPORT INFORMATION

1. Pricing Basis

Where possible, pricing is based on historical costs, current site conditions (i.e., wages ....), existing price schedules, and other published data. Certain cost allowances have also been used where scope definition is uncertain. All current (1979) pricing has been escalated at ten percent per year for approximately two years. Highlights of the significant pricing items are as follows:

Composite Manual Labor Rate: $23.00 per hour

Includes escalated composite wages, overtime, shift differential, supervision.

Engineering and Technical Service Rate: $36.00 per hour

Includes wages, per diem, travel, computer services and other engineering materials, and overhead and profit.

NSSS Component Replacement Cost:

B&W purchase order pricing (1976 basis) plus 60% escalation.

Other Component Replacement Cost:

TMI-2 historical cost (1974-75 basis) plus 80% escalation.

Radwaste Transportation: $ 7,000 per trip

Based on round trip rates for standard weight shipments to the western United States; escalated approximately 20%.

Radwaste Disposal:

Based on current disposal rates escalated 20%; high level waste rates not available, allowed $200 per cubic foot.

Liquid Waste Processing $2.00 per gallon

Includes cost of chemicals, detergents and the operational cost of the evaporators, demineralizers, etc.

Miscellaneous Tools and Supplies: Included at $3.00 per hour

Fuel Shipment and Disposal: $225 per kilogram

Based on DOE estimate (escalated) for a one time charge to receive and store spent fuel with no credit allowed for the unburned energy in the fuel.

2. Schedule Basis

The TMI-2 containment recommissioning schedule and assessment are dependent on site labor conditions. It is assumed that work will be done under the President's Agreement, rolling 4 day work weeks with 2 ten hour shifts. The two shift work operations are intended to make worker levels manageable and efficient; while achieving 7 day work weeks for critical path operations.

It is expected that health physics planning and decontamination procedures will be designed to manage exposure limits, reduce turnover, and maintain good worker morale and productivity.

The total decontamination and reconstruction effort will require approximately 3,000,000 hours of craft labor and site supervision, and 1,100,000 engineer and technical service hours. A manpower loading chart, shown in this section was used as the basis for the cash flow information presented in Section V.

3. Contingency Analysis

Contingency, as used in this assessment, is defined as an amount which should be added to the direct estimate to provide for uncertainties which exist within the estimate. The addition of the contingency to the direct estimate results in a current best estimate of that portion of the cost of recommissioning the TMI-2 containment covered in the scope of this assessment as described in Sections I, II, and III. These uncertainties are a result of the preliminary nature of the scoping details, the potential for pricing changes, and the assessment of productivity as discussed below.

Contingency has been assessed after a review of the following items:

a. Productivity

This is subject to variance depending upon conditions in the containment (radiological, environmental, access space, etc.), administrative controls (health physics, security, etc.), support required (shielding, scaffolding, materials handling into and out of the containment, etc.), worker dose limits and radiation levels, timely availability of special materials and equipment and many other items which could impact work plans.

b. Pricing

This is subject to variance depending on contract provisions such as expediting delivery of critical items, composite wage rate having a different mix than assumed (for the technical support as well as for the manual craft support), and other items which could affect the pricing basis.

c. Scope Detail

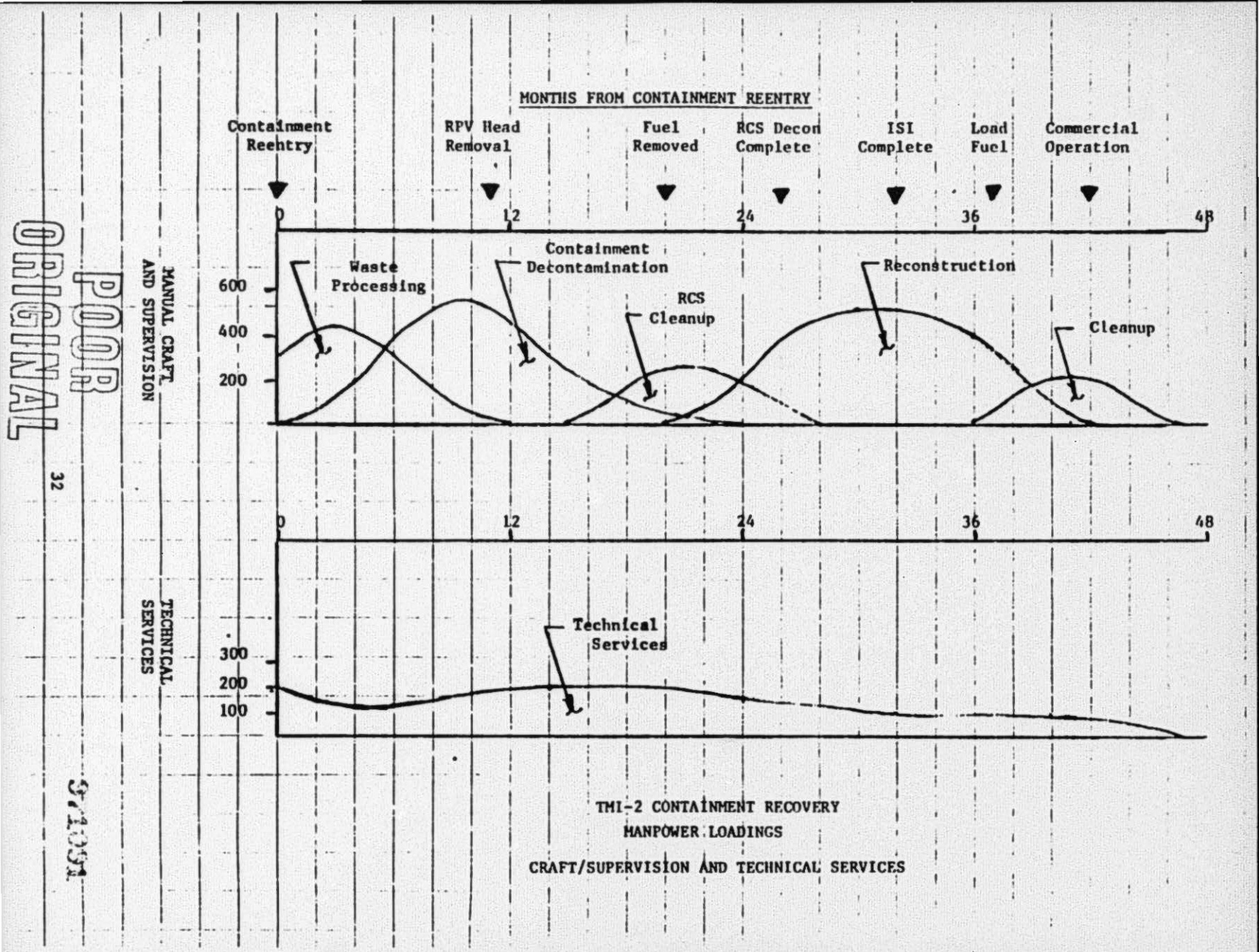
This is subject to variance as the recommissioning plan evolves. As knowledge of the status of the containment improves, alternate methods than those presented in this assessment may become necessary or may be more viable. Particular uncertainties exist at this time regarding processing, packaging and shipping of radwaste products; service systems and structures required for containment decontamination; methods required for decontamination; methods for handling, packaging and shipping of spent fuel; the amount of required reconstruction in the containment (e.g., wire and cable, equipment, recoatings, etc.); and, the types and amount of supporting technical and analytical assistance required for recommissioning.

4. Radwaste Processing/Disposal Quantities

The radwaste processing/disposal chart was used to estimate the volume and type of radwaste which is expected to be processed, shipped and disposed of at an off-site burial facility. Since the methods for on-site processing have not been completely defined and tested at this time, the quantities are subject to change.

5. Core Damage Assessment

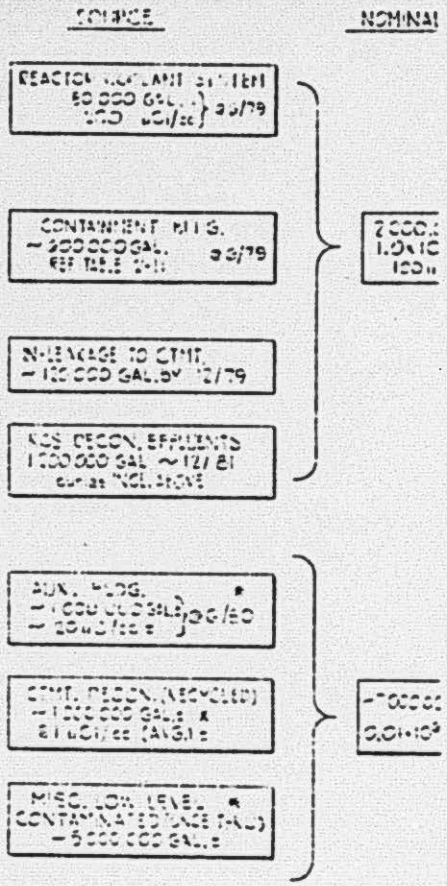
A review was made of available information from B&W, GPUSC, and the NRC in order to develop the schedule duration to be allowed for core inspection and fuel removal. For the purposes of this estimate and schedule, the core status as discussed in Section IV, Item 3 has been assumed.



TMI-2 CONTAINMENT RECOVERY

MANPOWER LOADINGS

CRAFT/SUPERVISION AND TECHNICAL SERVICES



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BECHTEL
GAITHERSBURG, MARYLAND

GENERAL PUBLIC UTILITIES CORP.
METROPOLITAN EDISON
THREE MILE ISLAND - UNIT 2

FLOW CHART - CONTAINMENT
RADWASTE PROCESSING/DISPOSAL
FIG. 4-4

JOB No.	DRAWING No.	REV.
15857-005	SK TMI/CRE-8	3

VII. POTENTIAL COST AND SCHEDULE ITEMS

VII. POTENTIAL COST AND SCHEDULE ITEMS

Many factors are very uncertain at this time which may have significant impact on the ultimate cost and/or schedule. Among these are:

1. Radiation Conditions

   Noble gas release technical specification revisions which may or may not require special treatment beyond filtration and release.

   Possible fuel debris in the RCS which may limit access to steam generator heads and pressurizer.

   Reactor coolant drain tank and letdown heat exchanger radiation levels which require additional in-place shielding.

   Radiation levels at containment air coolers which may require special removal casks.

2. Corrosive Structural Damage

   Reactor, steam generator and pressurizer base plates and anchor bolts which may require refurbishment.

   Other embedments and structural support components which may have possible deterioriation.

   Major components (e.g., reactor vessel, steam generators) which may require extensive refurbishment for requalification.

3. Manpower

   Man-rem exposure limitations which may exhaust available manpower.

   Critical crafts which may not be available to support reconstruction effort.

4. Licensing

Radwaste processing systems and other recovery support facilities which may require a construction permit and an operating license.

TMI-2 state and local issues which may impede the project's progress.

Resolution of Babcock & Wilcox generic issues which may not be supportive of the TMI-2 recommissioning schedule.

5. Legal and Political

Transportation restrictions which may involve special restrictions for TMI-2.

Fuel repository restrictions which may involve special considerations.

Processed waste disposal and discharge requirements which may involve special restrictions for TMI-2.

Injunctions and intervenor activity which may impact the TMI-2 recommissioning schedule.

6. New Plant Modifications

Many generic safety issues will be debated prior to the recommissioning of TMI-2. It is premature to attempt to quantify costs associated with modifications that may eventually be mandated by the NRC or deemed appropriate by GPU. Examples of such issues are contained in NUREG-0560, NRC Staff Report on the Generic Assessment of Feedwater Transients in Pressurized Water Reactors Designed by B&W, May 9, 1979, or modifications currently proposed for TMI Unit 1 by GPU.