

TECHNICAL PLAN

TMI-2 CORE ACCOUNTABILITY

Prepared by:
TMI-2 Technical Planning Department
GPU Nuclear, Inc. - Bechtel National, Inc.

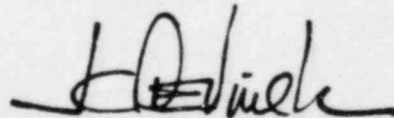
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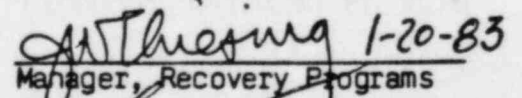
TECHNICAL PLAN

TMI-2 CORE ACCOUNTABILITY

Technical Planning Department



Director, Technical Planning



1-20-83
Manager, Recovery Programs



Director, Site Operations

INTRA-DEPARTMENTAL REVIEW AND APPROVAL

Responsible Engineer

Gordon R Skillman 12/22/82

Responsible Engineer

Sidney W. Smith 12/22/82

Manager, Reactor Disassembly
and Defueling Planning

Gordon R Skillman Jan 10, 1983

Manager, Waste Management
Planning

Cynthia M Hitz 1/13/83

Manager, Decontamination
Planning

David L. [Signature] 1/20/83

Manager, Data Management
and Analysis

A. H. [Signature] 1/18/83

Supervisor, Technical and
Administrative Services

Donald V. [Signature]

SUMMARY

This plan describes GPUNC's program to discharge its legal responsibility of accounting for TMI-2's core. Emphasis is placed on identification, where possible, of intact core components and estimation of the aggregate weight of components removed from TMI-2's core. Conversely, emphasis is not placed on weighing because of the man-rem commitment that would be required. Weighing may be performed at some other facility in the future but that is not suggested as a commitment or requirement. Rather, accountability by item is the thrust of this plan. Accountability is established by defining GPUNC's philosophical position, presenting the basis for accountability, and describing the methods to be employed for each category or group of core material.

CONTENTS

| | <u>PAGE</u> |
|--|-------------|
| SUMMARY | iii |
| CONTENTS | iv |
| 1.0 <u>INTRODUCTION</u> | 1 |
| 2.0 <u>POSITION ON ACCOUNTABILITY</u> | 2 |
| 3.0 <u>BASELINES FOR ACCOUNTABILITY.</u> | 3 |
| 4.0 <u>METHODS FOR ACCOUNTABILITY</u> | 4 |
| 5.0 <u>SAFEGUARDS</u> | 8 |
| 6.0 <u>CRITICALITY POTENTIAL</u> | 9 |
| REFERENCES | 10 |
| APPENDIX A - Memorandum of May 6, 1982, Mr. R. F. Burnett to Mr. B. J. Snyder, Three Mile Island, Unit 2, Fuel Accountability. | 11 |
| APPENDIX B - Letter of June 23, 1982, Mr. B. J. Snyder to Mr. J. J. Barton, TMI-2 Fuel Accountability. | 12 |

SECTION 1.0
INTRODUCTION

This document describes GPUNC's program for accountability of special nuclear material (SNM) during the removal of the reactor core and during decontamination and cleanup of the reactor coolant system and interfacing auxiliary systems.

GPUNC is required to account for nuclear fuel in its possession. Normally employed methods of accounting for fuel are not practical because of the condition of the fuel and the radiation levels associated with the fuel. As a result of the accident at TMI-2, a wide spectrum of conditions exist in the core. These conditions may range from intact assemblies to degraded assemblies to totally failed assemblies with attendant dispersion of irradiated fuel throughout the reactor coolant system and interfacing auxiliary systems. This plan establishes an accounting method and, at the same time, considers the existing fuel conditions and radiation levels and their impact on operating personnel.

Accountability is established by: 1) defining GPUNC's philosophical position; 2) presenting the bases for accountability; and 3) describing the methods to be applied to each category or group of core material. The issues of safeguards and criticality are also addressed.

SECTION 2.0
POSITION ON ACCOUNTABILITY

GPUNC's objective is to account for TMI-2 total core to the greatest extent practical.

The total core in the context of this document on accountability is defined as: That complex of components comprising the original as-built core. Included in the original core were the following items:

1. One hundred and seventy-seven fuel assemblies
2. Sixty-one full length control rods
3. Sixty-eight burnable poison rods
4. Eight axial power shaping rods
5. Seventy Holddown fixtures
6. Fifty-two SPND/incore thermocouple instrumentation strings
7. Two neutron sources
8. (The thirty-eight orifice rods were removed before the accident.)

GPUNC's intent (subject to data provided by future data acquisition tasks) is to account for the total weight of the combination of the original fuel plus the components comprising the total original core. The weight of each of these original core components is known or can be established to a high degree of accuracy. GPUNC will establish an "as-built" weight for the total core and will establish a record of all material removed. Reconciliation of the "as-built" weight to the "as shipped" weight will be performed as weight determination permits. Because of man-rem and ALARA concerns, this plan does not require the weighing of material removed. The primary method of accountability is "item control", although weights may be determined as described in Section 4.0.

SECTION 3.0
BASELINES FOR ACCOUNTABILITY

3.1 BASIS FOR SNM ACCOUNTABILITY

The basis for the total inventory of SNM in the TMI-2 core is the original individual fuel assemblies' inventory as provided on Form DOE/NRC 741. This inventory is modified by the uranium consumption and plutonium production and decay due to operation of the reactor and the decay time since March 28, 1979. This inventory has been calculated based on the fuel in the core during power operation. Current core isotopic inventory continues to be maintained in accordance with TMI-2 Administrative Procedure No. 1025. This is being performed to demonstrate compliance with the regulation; however, ALARA controls preclude strict compliance with these procedures. The inventory number from Procedure 1025 will serve as the baseline for the fuel accountability.

3.2 BASIS FOR CORE COMPONENTS ACCOUNTABILITY

The baseline weight of the core components will be determined by using the original "as-fabricated" weights. Where such information is not available, the components' weight will be estimated by:

- 1) Identifying the dimensions of the components from drawings and other available records.
- 2) Identifying the material used in the fabrication of the core components from drawings and other available records.
- 3) Using the core components' dimensions and materials of fabrication, the weight of each respective component will be calculated.

SECTION 4.0
METHODS FOR ACCOUNTABILITY

The material in the core will be categorized into four groups based on the unique nature of each group. As data acquisition activities continue, these categories may change.

1. Intact Fuel Assemblies - Fuel assemblies that visually appear to be intact.
2. Damaged Fuel Assemblies - Fuel assemblies with degraded upper portions but partially intact on the bottom; this also includes visually intact fuel assemblies damaged during removal.
3. Debris - Debris is generally described as "rubble". Debris is that material comprised of mechanical components, portions of mechanical components, fuel pellets, portions of fuel pellets, and generally nondescript small pieces. Debris may be located within the core area, or out of the core in the reactor coolant piping or auxiliary systems' components.
4. Dissolved or Solid Fuel Material - Fuel material dissolved or suspended in the water in the RCS and interfacing auxiliary systems, or embedded within or attached to tools, piping, walls, and floors.

4.1 ACCOUNTABILITY - INTACT FUEL ASSEMBLIES

The method of accounting for intact fuel assemblies will be "item" accountability. The general approach for accountability is as follows:

1. A fuel assembly removed intact will be accounted for by its identification number.

2. The original weight and SNM inventory content of the intact fuel assembly will be established from original plant records. (Because the weight of an intact fuel assembly is known from original plant records, it is not necessary to use any other method to determine the weight of an intact assembly during removal operations.)
3. GPUNC will record the amount of fuel and the components original, weight in the accountability records.

4.2 ACCOUNTABILITY - DAMAGED FUEL ASSEMBLIES

The method of accounting for damaged fuel assemblies will be on an item by item basis. The primary method of fuel quantity determination will be by estimation. The general approach for accountability is as follows:

1. A damaged fuel assembly will be accounted for by its identification number, if possible. If identification is not possible by this means, the relative location of the assembly in the core will be used to identify the fuel assembly and/or debris.
2. The damaged fuel assembly and any associated debris will be packaged in a cannister and the weight estimated.
3. GPUNC will record the estimated amount of fuel and the components estimated weight in the accountability records.

4.3 ACCOUNTABILITY - DEBRIS

The method of accounting for debris will vary depending on the kind of debris. Debris will range from complete mechanical components and portions of mechanical components to a gravel-like mixture of materials containing fuel pellets, portions of fuel pellets and small pieces of mechanical components. The general approach for accountability is as follows:

1. Debris that is large enough will be removed as intact pieces; the approximate area of removal will be noted; and the piece will be identified, if possible. Other debris will be identified by general description (i.e., mixture of broken fuel pellets or pieces of fuel rods), if possible; and the approximate location of removal noted.
2. The method of determining the quantity of debris will vary depending on the kind of debris. The weight of the mechanical components, either complete or partial, will be estimated based on the original component weight. The weight of the mixtures of fuel and mechanical components will be estimated based on volumetric quantity.
3. GPUNC will record the estimated amount of fuel and estimated weight of debris removed in the accountability records.

4.4 ACCOUNTABILITY - DISSOLVED OR SOLID FUEL MATERIAL

Dissolved or solid fuel material are likely to be (and have been) found in the following locations:

1. Reactor vessel bottom head and plenum
2. Once through steam generator's (OTSG) upper tube sheet and bottom head
3. Reactor coolant pumps
4. RCS piping
5. Pressurizer
6. Reactor coolant drain tank
7. Dead legs in makeup, waste disposal, and decay heat system piping
8. Filters and demineralizers in the letdown system
9. Reactor building sump and auxiliary building sump

These forms of fuel may be accounted for by either estimated weight, radiation dose, or gamma spectroscopy. The general approach for accountability for these forms of fuel are:

1. Fuel material dispersed in the plant will generally be located by remote means; e.g., radiation dose using the cerium to fuel ratio, gamma spectroscopy, or neutron detection methods. As the material is removed, the approximate location from which it is removed will be noted.
2. After the fuel material has been collected in a safe container, the quantity of the fuel material will be determined. A sample may be taken to assist in determining the amount of fuel present. The weight of material removed will be estimated.
3. GPUNC will record the estimated amount of fuel and estimated weight of material removed in the accountability records.

SECTION 5.0

SAFEGUARDS

GPUNC will continue to comply with the requirements of 10 CFR 73 regarding establishment and maintenance of a physical protection system for the SNM now in its possession. GPUNC does not believe that diversion is likely for the following reasons:

1. The location and condition of the core and core debris make diversion difficult.
2. The security and radiation monitoring capabilities at TMI-2's protected area boundary would detect any core material because of its continued high activity.
3. Accountability for fuel material (item control and/or weight estimate) will be performed by the sender and may, in some cases, be performed by the receiver. Where estimates are made by the receiver, the receiver's records will help verify the material quantity. A diversion of material in shipping would be noted by a significant difference between GPU and the DOE-selected receiver.
4. The fuel material has a very low enrichment and plutonium content.

SECTION 6.0
CRITICALITY POTENTIAL

Criticality potential will be addressed in the engineering relating to canisters, and the collection and shipping of the reactor fuel.

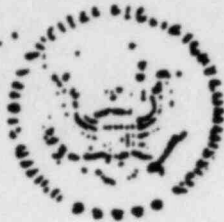
SECTION 7.0

REFERENCES

1. 10 CFR 70 "Domestic Licensing of Special Nuclear Material".
2. 10 CFR 71 "Packaging of Radioactive Material for Transport".
3. 10 CFR 73 "Physical Protection of Plants and Materials".
4. Memorandum of May 6, 1982, Mr. R. F. Burnett to Mr. B. J. Snyder, Three Mile Island, Unit 2, Fuel Accountability
5. Letter of June 23, 82 Mr. B. J. Snyder to Mr. J. J. Barton, TMI-2 Fuel Accountability.

APPENDIX A

Memorandum of May 6, 1982, Mr. R. F. Burnett to
Mr. B. J. Snyder, Three Mile Island, Fuel Accountability
(attached)



UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

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MAY 08 1982

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MEMORANDUM FOR: Bernard J. Snyder, Program Director
TMI Program Office, NRR

FROM: Robert F. Burnett, Director
Division of Safeguards, NMSS

SUBJECT: THREE MILE ISLAND, UNIT 2, FUEL ACCOUNTABILITY

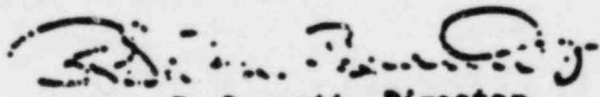
The Chairman has stated that defueling the Unit 2 reactor core at Three Mile Island, in a safe manner, should have the highest priority. In this context, we have reviewed available information regarding the expected forms, quantities and condition of irradiated nuclear material at the site and have concluded:

1. There is no credible scenario for theft or diversion of the irradiated nuclear material, and
2. Any physical activity involving the fuel, other than packaging the irradiated special nuclear material in a safe package, would increase the hazard to personnel at the site.

Since material control and accountability requirements for the damaged core are not the primary concern for the safe removal of special nuclear material from the site, we have determined that fuel accountability at the site can be limited to item control. In this regard, a count of the assemblies or groups of assemblies that can be removed as a unit should be made. For that material that cannot be removed as a unit, a net weight of each shipment should be obtained.

Since the damaged reactor core will be transferred to DOE custody for study and evaluation, measurements for SNM content can be made at the receiver's site, where facilities are available.

10 CFR 73.37, "Requirements for Physical Protection of Irradiated Reactor Fuel In-Transit," must be followed. Specific deviation from certain requirements may be given on a case-by-case basis, if justified.


Robert F. Burnett, Director
Division of Safeguards, NMSS

APPENDIX B

Letter of June 23, 1982, Mr. B. J. Snyder to
Mr. J. J. Barton, TMI-2 Fuel Accountability
(attached)

UNITED STATES
 NUCLEAR REGULATORY COMMISSION
 WASHINGTON, D. C. 20555

72-0170
 AUG 01 1982

JUN 23 1982

ocket No. 50-320

Mr. John J. Barton
 Acting Director of TMI-2
 GPU Nuclear Corporation
 P.O. Box 480
 Middletown, PA 17057

G. R. SKILLMAN
 AUG 04 1982

Dear Mr. Barton:

SUBJECT: TMI-2 Fuel Accountability

Subsequent to the November 4, 1981 meeting between NRC and GPU on fuel accountability, the NRC has developed more definitive guidelines for accountability during defueling of the Unit 2 core. In reviewing available information regarding the expected forms, quantities, and condition of special nuclear material (SNM), we have determined that fuel accountability at the site can be limited to item control. In this regard, a count of the assemblies or groups of assemblies that can be removed as a unit should be made. For that material that cannot be removed as a unit, a net weight of each shipment should be obtained.

Since the damaged reactor core will be transferred to DOE custody for study and evaluation, measurements for SNM content can be made at the receiver's site, where facilities are available.

For the physical protection of the SNM during transportation to the DOE facility, the requirements of 10 CFR 73.37, "Requirements for Physical Protection of Irradiated Reactor Fuel In-Transit," must be followed. Specific deviation from certain requirements may be given on a case-by-case basis, if justified in writing to the NRC.

Sincerely,

Bernard J. Snyder
 Bernard J. Snyder, Program Director
 Three Mile Island Program Office
 Office of Nuclear Reactor Regulation

cc: H. Feinroth, DOE
 W. Bixby, DOE
 R.F. Burnett
 H. Bartz

L. King
 J. Larson
 See attached list

| TMI-2 Distribution | |
|-------------------------|-------------------------------------|
| AT's 820122 | |
| Subject: TMI-2 | |
| Fuel 20120114 | |
| Approved: J. R. DeLoach | |
| DLB: B. J. ... | |
| Due Date: 8/15/82 | |
| Dist. | C/A |
| Arnold-AD, DC. | <input checked="" type="checkbox"/> |
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| Fillow | <input type="checkbox"/> |
| Benson | <input type="checkbox"/> |
| Thurston | <input type="checkbox"/> |
| Brodsky | <input type="checkbox"/> |

M. Henly ✓