

Plan for Reevaluation of NRC Policy on Decommissioning of Nuclear Facilities

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ABSTRACT

This report supplements and updates the information presented in NUREG-0436, Rev. 1, of the same title and dated December 1978. Supplement 1 defines new terminology for the decommissioning alternatives. It updates the status and schedules for developing the information base, the draft generic environmental impact statement, and the rulemaking. In addition, schedules for regulatory guides to support the rules are presented.

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FOREWORD TO SUPPLEMENT 1

The information in this report, including any comments, will be placed in record for consideration by the Commission in establishing criteria and new standards for decommissioning. Persons wishing to comment on this report should mail their comments to:

Decommissioning Program Manager
Division of Engineering Standards
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Washington, D.C. 20555

1.0 Introduction

This reevaluation plan for decommissioning was published first in March 1978 and then revised in December 1978. The purpose of this supplement is to present some new information, summarize the status of the program and update the schedules.

2.0 Terminology

Some confusion and misunderstanding has resulted from the variation of terminology used in the decommissioning field. For example, the words decommission, decontaminate and dismantle have been used interchangeably for the decommissioning alternative consisting of the immediate removal of all radioactive material to permit unrestricted release of the property. The word dismantlement has been used to describe decontamination activities that involve no actual dismantlement. Similarly, the words safe storage, protective storage, lay away, mothball and temporary intombment have been used to name the alternative of decommissioning consisting of placing and maintaining property safely in storage as a precursor to final decommissioning.

In the interest of ending the confusion it appears desirable to strictly define decommissioning and the major alternatives for accomplishing it. Furthermore the use of pseudoacronyms for the alternatives avoids words which may have several meanings.

2.1 Definition of Decommissioning

Decommission means to remove the property safely from service and dispose of the radioactive residue.

2.2 Definitions of Decommissioning Alternative

DECON means to immediately remove all radioactive material to permit unrestricted release of the property.

SAFSTOR means to fix and maintain property so that risk to safety is acceptable for period of storage followed by decontamination and/or decay to an unrestricted level.

ENTOMB means to encase and maintain property in a strong and structurally long-lived material (e.g., concrete) to assure retention until radioactivity decays to an unrestricted level.

3.0 Information Base

Considerable progress has been made in compiling the information base needed to support rulemaking, see Schedules for Objectives A, B, C and D.

3.1 General (See Schedule, Objective A)

A bibliography¹ and review of regulations² were completed earlier. Now draft staff reports on the very important topics of financial assurance³ and acceptable radioactive residues^{4,5} have been done. Two of these draft reports have been widely circulated within and outside NRC to accumulate preliminary

comments. Also, a contractor report⁶ on financing strategies for decommissioning has been completed. A separate study has been initiated on the technology and costs of terminal radiation surveys. Preliminary results⁷ of this important study have been published.

3.1.1 Financial Assurance

Three basic approaches, used singly or in combination, to implement financial assurance appear satisfactory based on the preliminary staff evaluation³ and the contractor report.⁶

1. Prepayment. Cash or other liquid assets that will retain their value for the projected operating life of the facility may be deposited into a segregated account prior to facility startup. Prepayment will probably be the only satisfactory alternative to cover costs involving long-term surveillance.
2. Sureties. Bonds, letters of credit and lines of credit that guarantee that the costs will be paid may be used. It appears questionable that bonds of the size and for the time (\$50 million for 40 years) involved with power reactors will be available. However, they appear to be available for facilities that involve smaller costs and periods.
3. Sinking Funds and Insurance. The sinking fund or funded reserve requires a prescribed amount of funds, subject to annual revision, be set aside annually such that the fund plus accumulated interest would be sufficient to pay for the costs at the time of decommissioning. The weakness of the sinking fund approach is that in the event of premature shutdown the decommissioning fund would be insufficient. Therefore, the sinking fund would have to be supplemented by insurance which would pay the difference. There is some indication that such insurance could be made available.³

Some reviewers, mainly associated with nuclear power plants, of the above approaches to financial assurance have voiced concern that the options of an unsegregated sinking fund, negative salvage, or payment at the time of decommissioning are not included. Their major argument is that the options selected are more expensive. While this is true, none of the options significantly increase the cost to consumers. Decommissioning increases the cost of nuclear power to consumers by approximately 2 to 5 percent. While a segregated sinking fund may be twice as expensive⁶ as payment at the time of decommissioning, it is not significantly more costly to consumers.

3.1.2 Radioactive Residues

Discussions with the staff at EPA relative to acceptable radioactive residue limits indicate that:

1. potential doses from decommissioned facilities should be less than those from operating ones.
2. doses (whole body equivalent) above 5 mrem per year are probably unacceptable,

3. justification would be required for doses more than 5 mrem per year, and
4. a plan for complying with the criteria could utilize realistic rather than conservative pathway analysis.

Realistic analyses involve recognition that occupancy is less than 100 percent of the time, that the source of sustenance is not limited only to the decommissioned site, that self shielding reduces the dose and that resuspension is decreased by weathering as a function of time.

As consideration of the application of the above criteria to various nuclear facilities has progressed, it has become clear that the dose range is more practical than specific dose. For some nuclide mixes and facilities it may be impractical and unnecessary to meet the 5 mrem per year criteria.

It appears that a goal for the release of decommissioned property on an unrestricted basis should be for potential exposure to an individual as low as reasonably achievable in the range of 1 to 10 mrem per year.

Reviewers of this proposed goal have expressed concern that radiation cannot be detected at that level or that it would be prohibitively expensive to make measurements at that level. These concerns do not seem to be well founded as shown below:

Recent preliminary work⁷ has been completed at ORNL on the terminal radiation survey for the case of the decommissioning an 1175 MWe PWR. This study shows that the technology is readily available to make a statistically-designed, terminal radiation survey with a reasonable degree of confidence and at a moderate cost, less than \$250,000 at the 5 mrem per year level. This cost represents only a fraction of a percent of the total cost of decommissioning a large reactor. Furthermore, it indicates that the cost at a release level of a dose of 25 mrem per year is only about 10 percent less than the 5 mrem per year case. It was found that the cost at a release level of a dose of 1 mrem per year would be extremely high and not easily estimated.

In addition, a historical review shows that in the 1960's that written criteria for acceptable levels of radioactive residuals for the release of decommissioned property did exist and were utilized.^{8,9} The criteria were based on a goal of a limiting exposures to a few percent of the radiation protection standard of 500 mrem per year in uncontrolled areas. Such radiation rates are similar to those expressed as a dose of 1-10 mrem per year.

Unfortunately, it was decided in 1973 to drop the written criteria and go on a case-by-case basis for the release of property.⁹ This lack of written criteria resulted in confusion and inconsistency which still continues.

In 1974, guidance for termination of reactor licenses was issued, Regulatory Guide 1.86,¹⁰ but the release criteria were limited to surface contamination. These criteria would produce a dose similar to the 1-10 mrem per year suggested here.

In summary, criteria similar to those suggested here have been used extensively over an extended period of time without undue hardship on parties decommissioning nuclear facilities. The technology for making measurements at this required level appear to be available at moderate cost.

3.2 Reactors (See Schedule, Objective B)

The basic report on technology, safety and costs of decommissioning a PWR¹¹ was published earlier. This has now been supplemented by an addendum¹² which provides sensitivity information as a function of reactor size. A similar report, containing the basic information and a sensitivity study, has now been completed for a BWR.¹⁴ The BWR report was nearly 9 months later than planned, and this has delayed the overall program. The contractor produced a highly detailed report at the expense of the schedule.

Also, a study was completed on the facilitation¹³ of the decommissioning of light water reactors.

Work is now underway on a study of the decommissioning of multiple reactor facilities. This will clarify differences in the safety and costs for stations with up to 10 reactors as compared to a single reactor in the completed studies. Another study has been initiated on research and test reactors, and a report is planned on reactors that have been involved in accidents.

3.3 Fuel Cycle and Non-Fuel Cycle Nuclear Facilities (See Schedule, Objective C)

The study of the decommissioning of a fuel reprocessing plant¹⁵ was completed earlier. Information appropriate to uranium tailings became available in the environmental impact statement for mills.¹⁶ Reports have now been done on small mixed oxide fabrication plants¹⁷ and low level waste burial grounds.¹⁸

The study of a uranium fuel fabrication plant¹⁹ is nearly completed and one on a uranium hexafluoride conversion plant has been initiated.

Work is also underway on non-fuel cycle nuclear facilities. This will deal with some of the more significant problems in decommissioning facilities involved in handling source and by-product materials for research, medical and industrial uses of radioactive materials.

3.4 Supporting Information (See Schedule, Objective D)

Reports were completed on the feasibility of recycling metals from decommissioned facilities.^{20,21} Work has been initiated on three important research tasks which will provide information in the future to improve decommissioning activities: (1) long lived activation products in reactor materials, (2) characterization of radionuclide contamination throughout LWR's, and (3) decontamination as a precursor to decommissioning LWR's.

4.0 Rulemaking (See Schedule, Objective E)

Major progress has been made in the development of the general policy and rules on decommissioning.

4.1 State Workshops

Another set of regional workshops on decommissioning was held in September 1979 to assure the input of state officials to the decommissioning plan.²³ These were a follow-up to those held in September 1978.²² The major impact from these workshops on the program resulted from the first set. This impact is described in earlier versions of this report (NUREG-0436, Revision 1, December 1978).

4.2 Environmental Impact Statement

The initial approach to completing the draft generic environment impact statement, DGEIS²⁴, was to utilize contractor assistance as much as possible. Because the statement is highly policy oriented, the contractor was unable to provide as much assistance as had been hoped. As a result the staff has had to rewrite most of the document and will send it out for a second NRC internal office review. This, together with the late BWR report, Section 3.2, has resulted in an overall schedule slip of 10 months.

The current status is that the working paper of the DGEIS will be circulated for internal review in July 1980. Then, comments will be resolved and the document will be issued for public comment in September 1980.

4.3 Policy Statement and Proposed Rules (See Schedule, Objective E)

Collectively the studies and evaluations discussed above suggest that all nuclear facilities will require consideration in rulemaking revisions on decommissioning. Current regulations cover the requirements and criteria for decommissioning in only a limited fashion. For many types of nuclear facilities the rules are mute.

The rulemaking for decommissioning could be accomplished as a separate part of NRC's regulations. However, the proposed action would directly affect licensing activities under Parts 30, 40, 50 and 70 of Title 10 of the Code of Federal Regulations (10 CFR). This implies that amendments to the separate parts rather than a separate new part would be less disruptive of existing procedures and processes.

In the light of the complexity of this rulemaking it appears desirable to issue first a policy statement covering the proposed actions scheduled for publication in May 1981. This would then be followed by the proposed amendments to the various rules in September 1981 and the effective rules in September 1982.

In preparation for these activities, the decommissioning staff at NRC has prepared a draft paper²⁵ which summarizes their preliminary thoughts on regulatory changes for decommissioning. This was done to stimulate participation by the NRC staff broadly, the public, industry, the states and other government agencies. The first version of this paper was prepared for the State workshops in September 1979. It was revised and updated in December 1979 and, most recently, in July 1980 mainly to reflect the information given here in Section 2.0 on terminology, Section 3.1.1 on financial assurance and Section 3.1.2 on radioactive residues.

Actions separate from this plan are already underway in reference to decommissioning of uranium mills and mill tailings¹⁶ and low level waste burial grounds (CFR Part 60).

5.0 Regulatory Guides (See Schedules, Objectives F and G)

A number of regulatory guides have now been planned to support the proposed amendments to the rules. Work has already been initiated on some of these. This includes separate guides for reactors and for fuel cycle facilities on (1) format and content for decommissioning plans, (2) financial assurance plans, (3) residual radioactivity levels at decommissioned sites, and (4) definition of decommissioning modes and methods.

6.0 Schedules

DECOMMISSIONING PLAN

6/6/80

OBJECTIVE A: DEVELOP GENERAL INFORMATION BASE FOR DECOMMISSIONING NUCLEAR FACILITIES

MILESTONES	FY '78		FY '79		FY '80												FY '81												FY '82											
	Half		Half		O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S
	1	2	1	2																																				
1. PLAN FOR REEVALUATION NRC POLICY ON DECOMMISSIONING - NUREG-0436			REV. 1																																					
2. BIBLIOGRAPHY - NUREG/CR-0131			D	F																																				
3. REVIEW OF APPLICABLE REGULATIONS - NUREG/CR-0671			D	F																																				

D=DRAFT

△=SCHEDULED

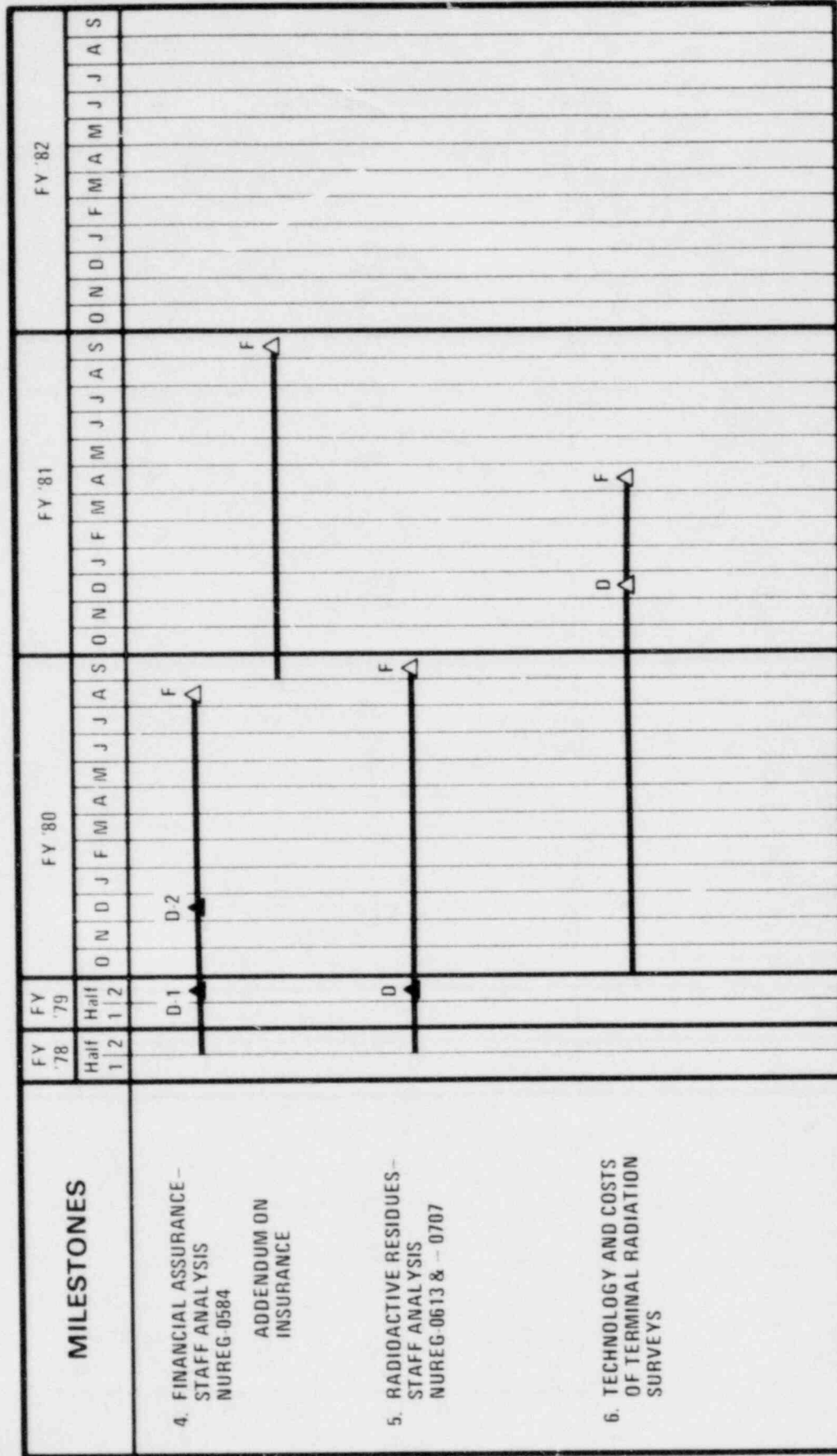
F=FINAL

▲=COMPLETED

S=SUPPLEMENT

DECOMMISSIONING PLAN

OBJECTIVE A (CONT'D): DEVELOP GENERAL INFORMATION BASE FOR
DECOMMISSIONING NUCLEAR FACILITIES



D=DRAFT Δ=SCHEDULED
F=FINAL ▲=COMPLETED
S=SUPPLEMENT

DECOMMISSIONING PLAN

6/6/80

OBJECTIVE B: DEVELOP INFORMATION BASE FOR DECOMMISSIONING NUCLEAR REACTOR FACILITIES

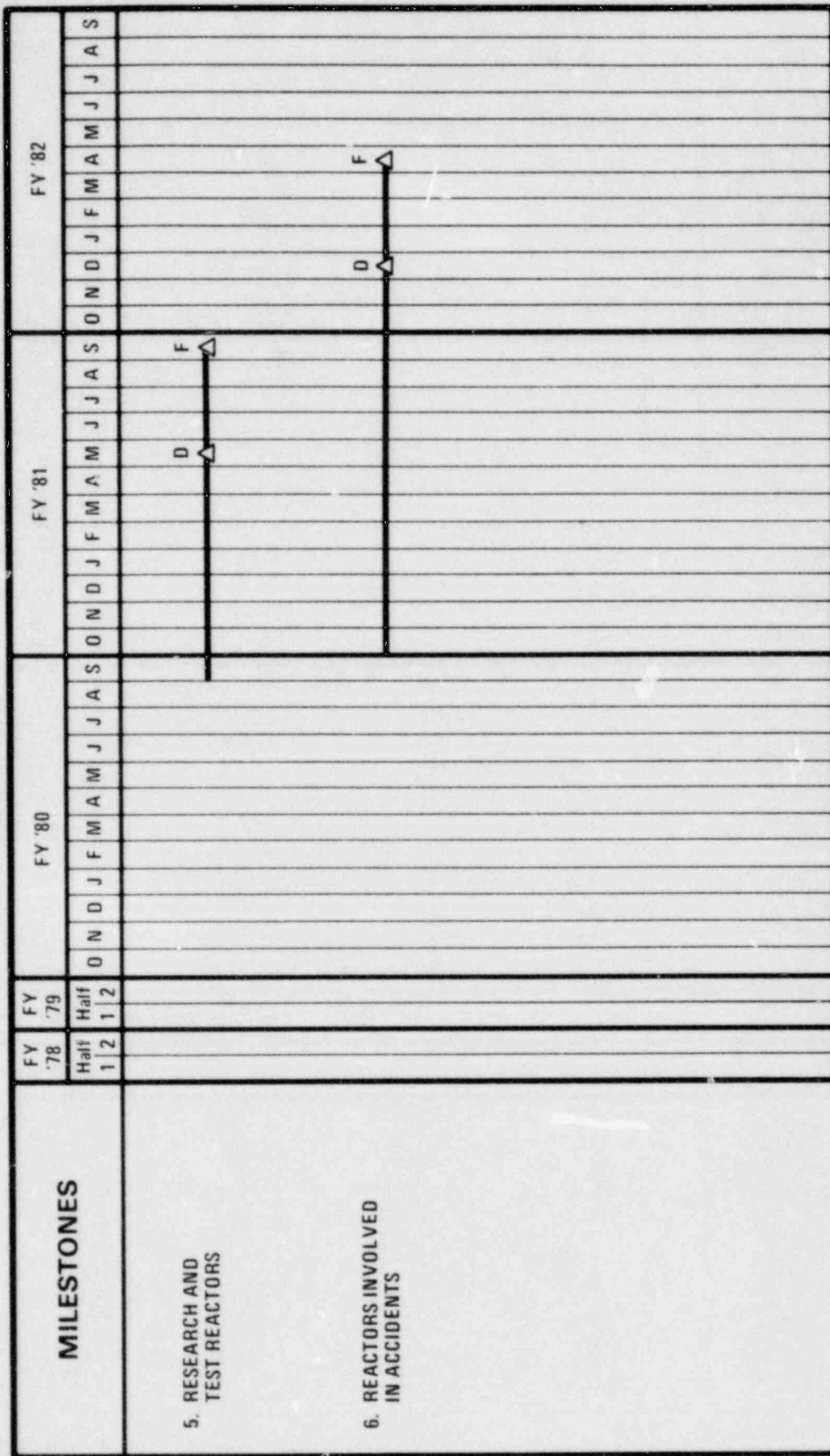
MILESTONES	FY '78	FY '79	FY '80												FY '81												FY '82											
	Half 1	Half 2	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S
	1	2	1	2																																		
1. PRESSURIZED WATER REACTOR -NUREG/CR-0130		D	F	A																																		
2. BOILING WATER REACTOR -NUREG/CR-0672									D				F																									
3. FACILITATION OF DECOMMISSIONING OF LIGHT WATER REACTORS -NUREG/CR-0569		D	F																																			
4. MULTIPLE REACTOR FACILITIES												D		F																								

D-DRAFT △-SCHEDULED
 F-FINAL ▲-COMPLETED
 A-ADDENDUM

6/6/80

DECOMMISSIONING PLAN

OBJECTIVE B (CONT'D): DEVELOP INFORMATION BASE FOR DECOMMISSIONING NUCLEAR REACTOR FACILITIES



D=DRAFT Δ=SCHEDULED
 F=FINAL ▲=COMPLETED
 S=SUPPLEMENT

DECOMMISSIONING PLAN

6/6/80

OBJECTIVE C: DEVELOP INFORMATION BASE FOR DECOMMISSIONING FUEL CYCLE AND NON-FUEL CYCLE NUCLEAR FACILITIES

MILESTONES	FY '78	FY '79	FY '80												FY '81												FY '82											
	Half 1	Half 2	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S
	1	2	1	2																																		
1. FUEL REPROCESSING PLANT-NUREG-0278	F																																					
2. SMALL MIXED OXIDE FABRICATION PLANT-NUREG/CR-0129		D F																																				
3. LOW LEVEL WASTE BURIAL GROUND-NUREG/CR-0570																																						
4. URANIUM MILL - DRAFT GEIS-NUREG-0511																																						

D=DRAFT Δ-SCHEDULED
 F=FINAL ▲=COMPLETED
 S=SUPPLEMENT

DECOMMISSIONING PLAN

6/6/80

OBJECTIVE D: DEVELOP SUPPORTING INFORMATION FOR DECOMMISSIONING

MILESTONES	FY '78	FY '79	FY '80												FY '81												FY '82											
	Half 1	Half 2	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S
	1	2	1	2																																		
1. FEASIBILITY OF RECYCLE OF METALS FROM REACTORS - NUREG-0134		D																																				
2. FEASIBILITY OF RECYCLE OF METALS FROM ENRICHMENT PLANTS - DRAFT GEIS - NUREG-0518																																						
3. LONG LIVED ACTIVATION PRODUCTS IN REACTOR MATERIALS - RESEARCH																																						
4. CHARACTERIZATION OF RADIONUCLIDE CONTAMINATION THROUGHOUT LWR'S - RESEARCH																																						
5. DECONTAMINATION AS A PRECURSOR STEP IN DECOMMISSIONING LWR'S - RESEARCH																																						

D=DRAFT Δ=SCHEDULED
 F=FINAL ▲=COMPLETED
 S=SUPPLEMENT

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DECOMMISSIONING PLAN

6/6/80

OBJECTIVE F: PREPARE REGULATORY GUIDES FOR DECOMMISSIONING LIGHT WATER REACTORS (LWRS)

MILESTONES	FY '80												FY '81												FY '82											
	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S
1. FINANCIAL ASSURANCE PLAN FOR DECOMMISSIONING LWRS																																				
2. RESIDUAL RADIOACTIVITY LEVELS AT DECOMMISSIONED LWRS																																				
3. DEFINITION OF DECOMMISSIONING MODES AND METHODS FOR LWRS (REVISION OF REGULATORY GUIDE 1.86)																																				

C=ISSUED FOR COMMENT

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DECOMMISSIONING PLAN

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OBJECTIVE G: PREPARE REGULATORY GUIDES FOR DECOMMISSIONING FUEL CYCLE AND NON-FUEL CYCLE NUCLEAR FACILITIES

MILESTONES	FY '80												FY '81												FY '82											
	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	N	O	D	J	F	M	A	M	J	J	A	S
1. FINANCIAL ASSURANCE PLAN FOR DECOMMISSIONING FUEL CYCLE FACILITIES																																				
2. RESIDUAL RADIOACTIVITY LEVELS AT DECOMMISSIONED FUEL CYCLE AND NON-FUEL CYCLE FACILITIES																																				
3. DEFINITION OF DECOMMISSIONING MODES AND METHODS FOR FUEL CYCLE FACILITIES (EQUIVALENT TO REG. GUIDE 1.86)																																				

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DECOMMISSIONING PLAN

6/6/80

OBJECTIVE G (CONT,D): PREPARE REGULATORY GUIDES FOR DECOMMISSIONING FUEL CYCLE AND NON-FUEL CYCLE NUCLEAR FACILITIES

MILESTONES	FY '80												FY '81												FY '82											
	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S
4. FORMAT AND CONTENT FOR DECOMMISSIONING PLANS FOR FUEL CYCLE FACILITIES																																				
5. DEFINITION OF DECOMMISSIONING MODES AND METHODS FOR NON-FUEL CYCLE FACILITIES (EQUIVALENT TO REG. GUIDE 1.86)																																				
6. LICENSE TERMINATION AND CLOSE OUT SURVEYS FOR MISCELLANEOUS MATERIAL LICENSES																																				

C=ISSUED FOR COMMENT

△=SCHEDULED

F=FINAL ISSUE

▲=COMPLETED

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