NUREG-0875

Comments on the NRC Safety Research Program Budget for Fiscal Years 1984 and 1985

U.S. Nuclear Regulatory Commission

Advisory Committee on Reactor Safeguards

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Advisory Committee on Reactor Safeguards
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Washington, D.C. 20555

UNITED STATES
NUCLEAR REGULATORY COMMISSION
ADVISORY COMMITTEE ON REACTOR SAFEGUARDS
WASHINGTON, D. C. 20555

July 14, 1982

Honorable Nunzio J. Palladino
Chairman
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Dear Dr. Palladino:

The Advisory Committee on Reactor Safeguards is pleased to transmit its comments on the Office of Nuclear Regulatory Research Budget proposed for Fiscal Years 1984 and 1985.

Only that portion of the budget relating to Program Support has been considered. No attempt has been made to distinguish between Program Support Funds for research and for work related to standards development, since the latter represent a relatively small proportion of the total.

The proposed funding levels considered are those included in the recommendations of the Executive Director for Operations which were provided to the Committee for its 267th meeting, July 8-10, 1982.

We will be pleased to discuss these comments with you and the Commissioners, if you desire.

Sincerely,

P. Shewmon

P. Shewmon
Chairman

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1. INTRODUCTION

Our comments are divided into three parts. Section 2 relates generally to programs for which we think greater effort or emphasis is needed. Section 3 provides specific comments on the proposed programs in each Decision Unit and, in most cases, for individual Subelements within each Decision Unit. Specific recommendations regarding the Research Program Support Budget are given in Section 4.

2. GENERAL COMMENTS

2.1 Introduction

The Office of Nuclear Regulatory Research (RES) still fails to give to certain programs the emphasis recommended by the ACRS. Several of the more important programs in this category are discussed in the remaining portion of this Section, and recommendations for funding, as appropriate, are given in Section 4.

2.2 Light-Water-Reactor (LWR) Safety Approach in Other Countries

There now exist increasingly sophisticated approaches to LWR safety, or specific aspects thereof, in many foreign countries including France, the Federal Republic of Germany (FRG), Japan, Sweden, and the United Kingdom. The NRC Staff should make a major effort to remain current concerning such developments, including not only a knowledge of differences from U.S. practice but also the detailed reasons for these differences. For example, the Japanese have specific approaches to seismic design and qualification, the British have developed many significant additional safety requirements for their version of the Standardized Nuclear Unit Power Plant System (SNUPPS), and the Germans and Swiss, among others, have developed special requirements for shutdown heat removal and sabotage protection.

The NRC Staff appears to have maintained a casual, even parochial, attitude with regard to understanding foreign safety approaches to LWRs. RES should devote enough resources to this task so that, working in concert with the Office of Nuclear Reactor Regulation (NRR), they can develop the relevant information expeditiously.

2.3 Design-Related Safety Research

In our previous report to the Commission (Ref.1)*, we called attention to an aspect of safety research that has been weak or deficient in the past

* References appear in Appendix A.

NRC program, namely design-related safety research and analysis. We noted the importance of a knowledge of design possibilities, capabilities, costs, and tradeoffs, and called attention, as examples, to the need for more effort of this kind in the areas related to severe accident rulemaking and design to reduce the potential for sabotage. The recently initiated studies of detailed plant behavior in support of the Unresolved Safety Issue, Task Action Plan A-47 (Ref.2), on the Safety Implications of Control Systems is an example of such research. Another example is an examination of the relative merits of an improved direct capability for pressure reduction in the primary system of a pressurized water reactor (PWR) compared to increased diversity and/or redundancy in the auxiliary feedwater system. Automatically controlled pressure restoration and direct control of pressure to suitably low values after a chilling transient, along with automatic restoration, if necessary, of core submergence (or other mode of cooling) might be worth investigating as a solution to the current Pressurized Thermal Shock (PTS) problem.

We believe that a thoughtful program of design-related safety research and analysis should be instituted.

2.4 Externally-Produced Floods

There is fairly general agreement that it is now difficult to quantify the contribution to risk from accidents which arise from externally-produced floods. The uncertainties in any estimate of the recurrence frequency of the "probable maximum flood" are very large, and the degree of protection afforded by the approach currently approved by the NRC Staff may vary widely from site to site.

Although we have recommended on several occasions that priority be given to research on flood probabilities in the NRC Safety Research Program, the NRC program includes no flood-related research in FY 1982 and 1983. However, we are pleased to note that about $0.5 million per year is proposed currently for flood-related research both in FY 1984 and 1985.

In addition to a continuing inability to assess the adequacy or the possible excessive stringency of the current requirements for flood protection, the low priority given to this matter by the Staff in the past leaves the NRC ill-equipped to deal with flooding in connection with the newly proposed NRC safety policy. For example, the adequacy of design basis flood conditions is being questioned in several plants as part of the Systematic Evaluation Program. Decisions regarding the allocation of resources in backfitting cases such as these may require, or could benefit from, flood probability guidance.

We believe that the NRC should maintain the necessary priority for flood-related research in FY 1984 and 1985, and should accomplish some reprogramming of money to this task in FY 1983. We recommend that the NRC

state its intention to support research in this area, set aside appropriate funds, and encourage the receipt of well thought-out proposals from recognized experts having the potential for making a significant contribution to NRC needs in this area. An area for emphasis should be that to obtain improved knowledge of increasingly severe precipitation conditions and the accompanying hydrological status (or at least a better definition of the uncertainties and their causes).

2.5 Seismic Effects in Control Room

The NRC has research programs on Human Factors, Seismic Safety, and Severe Accident Sequence Analysis, including some evaluation of the emergency operating procedures currently under development by the industry. In addition, work is underway or contemplated on prioritization of alarms.

However, a topic not specifically identified is the matter of how severe earthquakes may unpredictably and simultaneously impact a nuclear power plant in a large number of different ways, leading not only to a transient and/or possibly concurrent small LOCAs, but also to an indeterminate set of failures in non-safety systems, possible failure of some engineered safety features, a loss of most of the information normally available to the control room, and the existence of spurious information.

The vendors maintain that their newly developed symptom-oriented procedures should be adequate for the seismically induced transient/accident, as well. However, this is currently a poorly studied area, and warrants a well-focused safety research effort that takes advantage of other relevant programs.

2.6 Design Against Sabotage

On several prior occasions, we have recommended that the NRC Staff perform necessary research to obtain enough information to enable the NRC to develop a regulatory approach regarding the matter of what additional provisions, if any, should be included in LWR design to reduce the likelihood of a serious accident arising from sabotage by insiders or outsiders. The NRC Staff has performed some safety research in this area. However, the Staff states that budget constraints have limited the extent to which they are developing a regulatory policy on possible design approaches to prevent sabotage.

We believe that it is time this matter received the needed priority. We anticipate that the attempt to write a proposed rule and/or the comments from the nuclear industry will clarify further research needs requiring substantial funding beyond that currently contemplated by the Staff, if this matter is to be dealt with in a timely fashion.

3. SPECIFIC COMMENTS AND RECOMMENDATIONS

3.1 Reactor and Facility Engineering

3.1.1 Mechanical Engineering

Redirecting some of this effort toward showing the effect of allowing ductile fluid system boundary piping to work in the inelastic deformation range would be of value in clarifying the failure potential associated with malfunction of anchors and snubbers, unanticipated thermal movement, and mislocation of restraints. Since such errors cannot be totally avoided by design, there is a need to show that some structural tolerance exists for this type of error.

In addition, much of the safety significance of pressure system ruptures is dependent upon the manner in which system ruptures occur and how the rupture size is affected by fluid system forces applied to the rupture opening. Not enough has been done to relate system pressure change, fluid mass flow, and rupture geometry in a manner that would give realistic characterization of the effects of fluid system ruptures on public safety matters. Recent events at the Ginna Nuclear Power Plant, as well as prior concerns for asymmetric loads under postulated guillotine pipe ruptures, further emphasize the importance of such research. The plan for developing improved understanding of rupture behavior should be clarified prior to implementation of the FY 1984 safety research program in this area.

3.1.2 Seismic Safety Margins Research Program (SSMRP)

NRR has recently issued a strong user need request for short-term and long-term probabilistic seismic analysis methodology. Although we have been critical of the SSMRP in the past, we have been urging the development of such an analytical capability and support NRR's request. Further, we reiterate our previous recommendation that the SSMRP include a limited probabilistic seismic safety study of a boiling water reactor.

3.1.3 Primary System Integrity

The proposed program on Primary System Integrity is sound. The increased funding is primarily for work on material fracture in relation to the concern about possible pressure vessel rupture resulting from PTS.

The program should provide a basis for regulatory decisions concerning:

(a) Which, if any, available nondestructive-examination techniques would allow one to determine if the irradiated region of the pressure vessel is free of cracks that can give rise to catastrophic consequences from PTS events.

(b) The problems associated with annealing an irradiated reactor pressure vessel in place.

3.1.4 Electrical Equipment Integrity

This program continues to include fire qualification work. We still believe that the fire safety work should be supported by industry sponsors, but concede that if the need is as urgent as the NRC Staff believes, then NRC funding might be justified.

3.1.5 Process Control

This program appears to be in need of a better definition of its goals and of improved organization.

3.2 Facility Operations

3.2.1 Human Engineering and Man-Machine

The proposed budget and scope for Human Factors research have been increased significantly in FY 1984 and 1985, continuing the trend of the past few years. We believe that this trend is appropriate and that the proposed funding levels are adequate. The NRC Staff has responded satisfactorily to the concerns related to the Human Factors research program as expressed in our report to the Congress (Ref. 3). We believe that the new and modified programs proposed for FY 1984 and 1985 will be of substantial benefit; however, consideration should be given to an expanded program directed toward reducing the safety impact of human failure in maintenance and testing. We also note that there is a trend toward increasing research on human performance as compared to that on the machine aspects of the human-machine system. We believe that this trend should continue into future years.

3.2.2 Plant Instrumentation and Control

We continue to support research in this area. The proposed budget for FY 1984 and 1985 represents a significant increase over the FY 1982 and expected FY 1983 funding levels. We endorse the proposed levels of funding for FY 1984 and 1985. Nevertheless, based on our review of the ongoing and the proposed research in this area, we believe that the major activities being conducted are comparatively new and are trying to find a mission. We believe that they have not yet succeeded. What is needed is a more careful definition of the problems to be solved and the questions to be answered.

We believe that the ongoing and the proposed work should be reexamined to establish relevance to NRR licensing needs and to determine its effectiveness on a cost-benefit basis. The review should address the timeliness of

the expected results, and whether the specific projects planned are more properly an industry or NRC responsibility. We believe that NRR should be an active participant in this review.

The work as currently planned appears to put too much emphasis on the behavior of specific systems and components and not enough on the development of a statement of safety needs and performance criteria. We believe that this is a weakness that must be remedied.

We believe especially that the work that is directed toward evaluating and developing methods for defining the safety implications of control systems should be given a high priority and should be directed toward the prompt resolution of the Unresolved Safety Issue, Task Action Plan A-47 (Ref. 2), on the Safety Implications of Control Systems. It is unlikely that this will be achieved under the current work plan. We urge that additional planning effort be given to the tasks of this Subelement and that better coordination be established with users of the expected results.

3.2.3 Occupational Protection

As mentioned in our May 12, 1982 letter to the Executive Director for Operations (Ref. 4), we believe that greater effort needs to be directed to occupational protection. A concerted effort should be made to gain a better understanding of the control of radionuclides and their removal from nuclear power plant cooling systems. A clearer definition of overall goals and objectives, and a specification as to how each research project assists in the attainment of these objectives would be beneficial. Among the specific projects reviewed, the one on Optimization Studies may deserve increased funding support for both FY 1984 and 1985.

3.2.4 Safeguards

This Subelement includes a number of routine--though necessary--chores which will require continuing attention. These include support for new rules and guidance, equipment acceptance criteria, optimization of the use of inspection manpower, and study of the vulnerability of Independent Spent Fuel Storage Installations. The budget for this Subelement has been drastically reduced ($3.6 M in FY 1982, $2.2 M in FY 1983, and $1.0 M in FY 1984-1985). This appears to be appropriate, at least so far as items of the sort referred to above are concerned. However, there are several safeguards projects which deserve greater emphasis in FY 1984 and 1985. These include studies of both design and human factors to minimize the likelihood of sabotage by insiders, and studies to acquire knowledge of foreign technology for safeguards against sabotage. The budget should be set and/or apportioned to enable studies of these matters.

3.3 Thermal Hydraulic Transients

3.3.1 Semiscale and MOD-5

There are many integral facilities that simulate the Westinghouse type PWR. Among these are Semiscale, LOBI, PKL, CCTF, and SCTF. We endorse the possibility that the NRC will play a role in the integral Japanese facility, ROSA-IV. It should be noted that all of these facilities use electrically-heated rods and have received some criticism for this reason. Some of the differences in performance between nuclear and electrically-heated rods have been overcome in recent designs and the remaining differences are understood and can be compensated for by proper analysis of tests.

There is a need for an integral facility that would simulate the Babcock & Wilcox type PWR. We strongly urge that the proposed Semiscale MOD-5 be made available as soon as possible for this simulation. Without such a facility, it is difficult for NRR to perform its required regulatory functions for this family of reactors. We reiterate our previous recommendation that the NRC seek significant financial contribution from industry for this effort. Further, we believe that the Semiscale MOD-5 facility should be located at the Idaho National Engineering Laboratory so that the program can profit from the significant experimental and theoretical experience already gained with other versions of Semiscale.

3.3.2 Transient Models and Codes

We note with approval the continuing development of the advanced codes, RELAP and TRAC. Much of the basic development has already taken place although further improvements are expected. Continued code assessment is required, but the assessment program should be reviewed carefully since funding for it has been seriously reduced. As a general point, we continue to favor strongly the continued development and use of RELAP.

There are some particulars in the advanced code programs which should be mentioned. The transferability of the codes needs considerable improvement. By transferability, we mean use of the code by others rather than the original developing group. Apparently, the RELAP instruction manual is more useful than the manual for TRAC, but improvements in both are needed.

It would seem desirable to reduce significantly the number of special codes developed and used by the NRC. Some of these codes are of marginal value.

3.4 Siting and Health

3.4.1 Earth Sciences

We recommend that the proposed experimental program on Atmospheric Dispersion be deferred in order to provide funding for other higher priority research.

3.4.2 Site and Environment

There may be a need for increased support of the project on the Socioeconomic Effects of Accidents. Aspects of this work pertaining to psychological impacts appear to be particularly important.

3.4.3 Health Effects

The work in this Subelement is well coordinated with related research by other Federal agencies. Particular projects for which we recommend support are: (a) Gastrointestinal Absorption of Actinides, and (b) Relative Biological Effectiveness of Fission Neutrons at Occupational Exposure Levels. With respect to this latter project, some benefit might be gained through a detailed examination of the records of the Department of Energy (DOE) relative to neutron exposures of workers in plutonium facilities.

3.5 Risk Analysis

3.5.1 General

Although in the letter from R. B. Minogue, RES, to R. F. Fraley, ACRS, dated May 27, 1982 (Ref. 5), the NRC Staff agreed in detail or in principle with almost all of the recommendations made in our previous report to the Congress (Ref. 3) concerning the Risk Analysis (previously Systems and Reliability Analysis) Decision Unit, for many, if not most, of these recommendations the proposed level/scope of effort is not sufficiently responsive either to our recommendations or to the needs of the NRC.

3.5.2 Risk Methodology and Regulatory Analysis

The proposed effort on methodology for incorporating risk contributors such as seismic events, design errors, operator errors of commission, sabotage, and systems interactions into probabilistic risk assessments (PRAs) is inadequate for the need. The possible introduction of quantitative safety guidance into the regulatory process adds emphasis to the need for such methodology. A focused, priority effort should be placed on each

of these matters either to provide a method suitable for incorporation into PRAs on a trial basis or to identify and evaluate the sources of uncertainty which make this impractical and to suggest regulatory approaches in the light of these uncertainties.

The proposed programs on LWR Safety Approach in Other Countries, Design Against Sabotage, and Externally-Produced Floods are discussed in Section 2.

3.5.3 Reactor Risk Analysis

The ongoing program on core damage and core melt prevention and mitigation features is inadequate for the needs of the NRC. It does not include, or includes on too modest a basis, the effects of external events. It does not adequately treat or evaluate the role of uncertainties. It lacks sufficient conceptual design backup. This program should be augmented markedly, preferably in FY 1983 rather than waiting until FY 1984.

3.6 Accident Evaluation and Mitigation

3.6.1 General

We have recommended repeatedly in our reports to the Commission and to the Congress that the research in the Accident Evaluation and Mitigation Decision Unit be structured to answer questions arising in connection with reactor regulation and licensing. In our recent reports, specific attention was called to the need for organizing the research under this Decision Unit to answer questions likely to arise in connection with the Commission's stated intention to modify the licensing process to take specific account of accidents more serious than those generally identified as Design Basis Accidents. However, there is still a lack of definition of even one approach to deal with the severe accident issue. Considering the difficulty of the problem, effort should probably be made to define several alternatives. Until these efforts have produced some initial results, guidance for research of the type described will not be available.

Although efforts are said to have been made to describe a correlation between the regulatory process and the research program, we find little identification of specific questions associated with rulemaking, or with other means for dealing with severe accidents, that can be answered by the proposed research.

As a result, this Decision Unit, which represents a significant fraction of the proposed research budget, has the appearance of a heavily loaded cannon which may be aimed at the wrong target.

3.6.2 Severe Accident Analysis

In this area, there is major emphasis on code development, and on the detailed analysis of some of the more obvious accident sequences brought to light by the TMI-2 accident, and by the possibility of PTS. These deserve attention, but there should also be investigations, on a less detailed basis, of other less obvious sequences. Additional effort should go toward attempts to identify initiators and sequences not yet encountered by operating nuclear power plants.

We support the concept of some research effort that tries to consider the impact of various, possible actions by the licensee during the course of an accident involving severe core damage or core melt. However, we are skeptical that this effort is likely to evolve into detailed regulatory requirements in the forseeable future. We cannot support major expenditures in this area based on currently available information and would not use this program to justify an expensive experimental program.

3.6.3 Damaged Fuel

Phase I experiments being performed in the Power Burst Facility (PBF) will provide useful information. Current efforts are aimed at "understanding," but the processes being studied are so complicated and the research so expensive, that better definition of the questions to be answered should precede the research. We have previously questioned the amount of detail that it is possible or desirable to define in an actual accident. Significant additional attention should be given to this question in order that the research will be useful. With this in mind, we do not recommend the work planned in the Atomic Energy of Canada Ltd., Test Reactor (NRU), Annular Core Research Reactor (ACRR), or Phase II experiments in PBF at this time.

3.6.4 Containment Loading

In our previous report to the Congress (Ref. 3), we stated that the experiments underway and contemplated are elaborate and expensive, but we have not seen evidence indicating that they reflect adequately the processes that will be critical in defining the rate of damage evolution. A more coherent analysis should be made to define the most probable evolution of the accident and to identify the critical information required to assess accident progression. The code development work associated with these studies is extensive. However, not enough attention has been given to the question of how much detail is desirable or feasible. We have no additional information that changes this view.

3.6.5 Fission Product Source Term

Work under this Subelement appears to be well managed, and funding for FY 1984 and 1985 seems adequate. We urge that continuing attention be given to the information needed for licensing and regulatory decisions. A significant part of the funds requested are for development of a variety of codes, and experimental work is justified partly as being needed for validation of the codes. Careful, early planning must ensure that the codes are likely to contribute the information needed for decision-making and do not simply become ends in themselves. We believe that the peer review process being used will help to prevent this. The related research on better definition of the source terms for accidents in LWR fuel cycle facilities and in facilities using radioactive materials should be subjected to similar planning and review, and should be better coordinated with the work pertaining to nuclear power plants.

3.6.6 Improved Safety Systems

We urge that work in this area take advantage of the increasingly sophisticated approaches to LWR safety in many foreign countries (see Section 2.2).

3.7 Loss-of-Coolant Accidents

3.7.1 2D/3D Program

This program was designed to contribute to the understanding of large-break LOCAs in PWRs. The large-break LOCA has been a safety question of decreasing concern relative to other possible transients. At present, the major project in this program is the proposed construction of the Upper Plenum Test Facility (UPTF) by the FRG. If the FRG proceeds with the construction of this facility, it will require long-term expenditures by the U.S. NRC to support analyses and instrumentation. The estimated cost of UPTF has risen to such an extent that there is even greater concern with the benefit, which is quite small, for a very large expenditure. As an additional comment on UPTF, it should be noted that not only is it directed toward the Westinghouse type PWR but it also has as a major objective the study of hot-leg injection which is a feature special to the FRG type PWR. We reiterate our previous recommendation that the NRC expenditures for this program be reduced to the absolute minimum consistent with the international agreement governing this effort.

3.8 LOFT

There are discussions under way at this time regarding the formation of a consortium that would obtain considerably increased financial support from abroad for continuing a test program in LOFT. We wish to point out

again that test programs in a nuclear facility are more costly and require much longer test times than in an electrically-heated facility. There are already test facilities available with electrically-heated rods that have other significant advantages over LOFT. Our analytic capabilities are now sufficiently mature to correct for differences between electrically-heated rods and nuclear rods. It is therefore, in our view, undesirable to give favorable consideration to an extended program in LOFT.

3.9 Advanced Reactors

3.9.1 Clinch River Breeder Reactor (CRBR)

The entire Liquid Metal Fast Breeder Reactor (LMFBR) research effort is being directed to support CRBR licensing. The proposed budget for FY 1984 and 1985 appears adequate for that purpose. However, we believe that funding should be provided also for generic safety research aimed toward plants significantly larger than CRBR, if Congress continues to support LMFBR development. We repeat the recommendation in our previous report to the Congress (Ref. 3) that $1.0 million be earmarked specifically for research to aid the development of a regulatory position for post-CRBR LMFBRs.

3.9.2 Probabilistic Risk Assessment of CRBR

We recommend that the NRC Safety Research Program include a PRA of the CRBR. The background and experience gained by such a study is needed for a proper evaluation of the PRA being performed by the CRBR project as well as to provide long-term guidance for future LMFBR research.

3.10 Waste Management

3.10.1 General

We believe that the proposed funding for Waste Management Research for FY 1984 and 1985 should be supplemented by $1.0 million per year to recover part of the funds taken from this effort to support Semiscale MOD-5. Particularly, we would like to see the restoration of the cuts made in the Low-Level Waste (LLW) Program relating to Engineered Disposal and Shallow-Land Burial Alternatives, Characterization of Chemically Toxic Components of LLW, Nondestructive Tests (NDT) for Waste Packages, and the Source Terms of Radionuclides, as well as those aspects of the High-Level Waste Program relating to the Fracturing and Geomechanics of Jointed Rock. With the recommended supplement, we believe that the funding would be acceptable for planning purposes; however, a number of actions currently being contemplated by the Congress and DOE may cause even this level to be inadequate. Such actions include the accelerated schedules proposed by

both DOE and the Congress for the construction and operation of a high-level waste repository. Should these proposals be confirmed, a sizable increase may become mandatory.

3.10.2 Comments on Waste Management Programs

In the way of comments on other aspects of the current Waste Management Program, we offer the following:

(a) The Program has definitely matured over the past few years, and the methodology for selecting specific areas for study and assigning priorities for actions has improved significantly.

(b) We are encouraged by the steps being taken to subject the Program to peer review. Our only caution is that those involved in such reviews be given an opportunity to become sufficiently informed about the Program to enable them to make effective recommendations.

(c) We continue to be concerned about an apparent lack of awareness on the part of the NRC Staff and its contractors of existing data that may be relevant to some of the basic technical questions being asked in the areas of rock mechanics, mining engineering, and geochemistry. A more aggressive effort to seek relevant data, particularly from other government agencies such as the Bureau of Mines, Bureau of Reclamation, and Corps of Engineers, is recommended.

(d) Although cooperation with DOE officials at the upper levels appears good, we note a lack of a full interchange of ideas and data at the technical working level. In some cases, for example, it appears that data provided by DOE to NRC may be incomplete or "sanitized." Efforts should be made to correct this situation.

4. BUDGET RECOMMENDATIONS

Our recommendations for changes in the proposed levels of funding are given in Table 1 and explained and discussed below as they relate to the recommendations in Sections 2 and 3.

4.1 Fiscal Year 1984

(a) We recommend no change in the total budget.

(b) We recommend an increase of $1.5 million for Decision Unit 2, Facility Operations, to be allocated as follows:

- $0.5 million for a program on Seismic Effects in Control Room, as discussed in Section 2.5.

- $1.0 million for research we expect to be needed in FY 1984 on Design Against Sabotage, as discussed in Section 2.6.

(c) We recommend elimination of the experimental program on Atmospheric Dispersion in Decision Unit 4, Siting and Health, with a reduction in funding of $0.9 million.

(d) We recommend an increase of $3.0 million for Decision Unit 5, Risk Analysis, for the following purposes:

- $1.0 million for increased effort on Risk Methodology and Regulatory Analysis, as discussed in Section 3.5.2.

- $1.0 million for increased effort on Reactor Risk Analysis, as discussed in Section 3.5.3.

- $1.0 million for work relating to LWR Safety Approach in Other Countries, as discussed in Section 2.2.

In connection with the last item above, we recognize that the effort and funding may not appropriately belong solely within this Decision Unit. It should cut across existing lines and may be in part a Standard's effort.

(e) We recommend a reduction of $5.6 million in the program on Damaged Fuel in Decision Unit 6. This reduction is recommended partly to emphasize and be consistent with our dissatisfaction with this program, as expressed in Sections 3.6.1 and 3.6.3, and partly to provide funds for the increases recommended for important research in other areas. We note that this reduction would not be needed if the $10.0 million allocated to the LOFT Consortium could be used instead for other areas. Your attention is directed to our comments on the LOFT program in Section 3.8.

(f) We recommend an increase of $1.0 million for Decision Unit 9, Advanced Reactors, for research to aid the development of a regulatory position for post-CRBR LMFBRs, as discussed in Section 3.9.1.

(g) We recommend an increase of $1.0 million for Decision Unit 10, Waste Management, chiefly to restore several of the programs that were cancelled or reduced in scope to provide funds for Semiscale MOD-5, as discussed in Section 3.10.1.

4.2 Fiscal Year 1985

For FY 1985, we have proposed increases in funding for some Decision Units, corresponding generally but not in all cases to those recommended

for FY 1984. However, we have proposed no offsetting decreases, with the result that the total budget is somewhat greater than that proposed. We are not at all comfortable with the proposed rather significant decrease in funding for FY 1985 as compared to FY 1984. Although some of the existing programs will be completed or greatly reduced in size as research objectives are reached, it seems highly likely that new questions will arise between now and the beginning of FY 1985. Unless these are as dramatic as the TMI-2 accident, it would seem more desirable to budget for contingencies or for "new programs" rather than having to seek a supplemental appropriation.

TABLE 1

OFFICE OF NUCLEAR REGULATORY RESEARCH PROGRAM SUPPORT BUDGET FOR
FISCAL YEARS 1984 AND 1985
(DOLLARS IN MILLIONS)

	FY 1984		FY 1985	
	PROPOSED	ACRS RECOMMENDATIONS	PROPOSED	ACRS RECOMMENDATIONS
1. REACTOR AND FACILITY ENGINEERING	40.5	40.5	42.8	42.8
2. FACILITY OPERATIONS	16.8	18.3	17.1	18.6
3. THERMAL HYDRAULIC TRANSIENTS	27.5	27.5	22.6	22.6
4. SITING AND HEALTH	11.0	10.1	11.7	11.7
5. RISK ANALYSIS	19.3	22.3	22.2	25.2
6. ACCIDENT EVALUATION AND MITIGATION	45.4	39.8	38.6	38.6
7. LOSS-OF-COOLANT ACCIDENTS	10.5	10.5	9.2	9.2
8. LOFT	17.5	17.5	10.0	10.0
9. ADVANCED REACTORS	9.5	10.5	8.5	9.5
10. WASTE MANAGEMENT	11.9	12.9	12.3	13.3
TOTAL	209.9	209.9	195.0	201.5

APPENDIXES

APPENDIX A

REFERENCES

1. Advisory Committee on Reactor Safeguards, U.S. Nuclear Regulatory Commission, "Comments on the NRC Safety Research Program Budget for Fiscal Year 1983," NUREG-0795, July 1981.

2. U.S. Nuclear Regulatory Commission, "Unresolved Safety Issues Summary," NUREG-0606, Vol. 3, No. 2, dated May 15, 1981.

3. Advisory Committee on Reactor Safeguards, U.S. Nuclear Regulatory Commission, "Review and Evaluation of the Nuclear Regulatory Commission Safety Research Program For Fiscal Year 1983 - A report to the Congress of the United States of America," NUREG-0864, February 1982.

4. Letter from P. G. Shewmon, Chairman, Advisory Committee on Reactor Safeguards, to W. J. Dircks, Executive Director for Operations, NRC, Subject: Control of Occupational Exposures, dated May 12, 1982.

5. Memorandum from R. B. Minogue, Director, Office of Nuclear Regulatory Research, to R. F. Fraley, Executive Director, Advisory Committee on Reactor Safeguards, "262nd Meeting of the ACRS - Actions, Recommendations, and Requests," dated May 27, 1982.

APPENDIX B

GLOSSARY

ACRS	Advisory Committee on Reactor Safeguards
CCTF	Cylindrical Core Test Facility
CRBR	Clinch River Breeder Reactor
DOE	Department of Energy
FRG	Federal Republic of Germany
FY	Fiscal Year
LLW	Low Level Waste
LMFBR	Liquid Metal Fast Breeder Reactor
LOBI	Loop for Blowdown Investigations (Italy)
LOCA	Loss-of-Coolant Accident
LOFT	Loss of Fluid Test
LWR	Light-Water Reactor
NDT	Nondestructive Test
NRC	Nuclear Regulatory Commission
NRR	Office of Nuclear Reactor Regulation
PBF	Power Burst Facility
PKL	Primarkreislauf-Hydraulic Test Facility in Germany designed to model plant systems behavior during Loss-of-Coolant Accidents and Transients
PRA	Probabilistic Risk Assessment
PTS	Pressurized Thermal Shock
PWR	Pressurized Water Reactor

RELAP	Advanced System Code used to model Loss-of-Coolant Accidents
RES	Office of Nuclear Regulatory Research
ROSA-IV	Rig of Safety Assessment (Japan)
SCTF	Slab Core Test Facility
SNUPPS	Standardized Nuclear Unit Power Plant System
SSMRP	Seismic Safety Margins Research Program
TMI-2	Three Mile Island, Unit 2
TRAC	Transient Reactor Analysis Code
UPTF	Upper Plenum Test Facility

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