NUREG/CR-1922
SAND81-7059
AN

ASSESSMENT OF THE DEVELOPMENT AND COORDINATION PROCESSES FOR THE NRC RESEARCH PROGRAM

FINAL REPORT*

Submitted to

Sandia National Laboratories
Albuquerque, New Mexico 87185

By

International Energy Associates Limited
600 New Hampshire Avenue, NW
Suite 600
Washington, DC 20037

Submitted: September 1980
Printed: February 1981

Sandia National Laboratories
Albuquerque, NM 87185
operated by
Sandia Corporation
for the
U.S. Department of Energy

Prepared for
Division of Reactor Safety Research
Office of Nuclear Regulatory Research
U.S. Nuclear Regulatory Commission
Washington, DC 20555
Under Memorandum of Understanding DOE 40-550-75
NRC FIN No. A1236

*International Energy Associates Limited report number IEAL-164.
Work conducted under Sandia Contract No. 46-3872.

ASSESSMENT OF THE DEVELOPMENT AND
COORDINATION PROCESSES FOR THE NRC RESEARCH PROGRAM

Table of Contents

APPENDICES

1.0 INTRODUCTION

1.1 PURPOSE AND SCOPE

The purpose of this study was to investigate: the current mechanisms used by NRC to identify research needs, and to transfer research results; to identify potential improvements in these areas; and to assess and recommend strategies for the Office of Research (RES), which would enhance the research coordination process.

The scope has been focused somewhat by two developments during the course of the study. First, it became obvious that the issues were broader than originally anticipated. They are not rooted specifically in the procedures for identification and transfer of research, but extend to the entire research development and coordination process. Some central issues involve the performance of NRC as an agency in addition to the activities of, and relationship between, RES and its user offices. To the extent that it was possible and appropriate, we have broadened our investigation to include the overall research coordination function, and its relationship to agency needs.

The second factor affecting our emphasis was ongoing change in the research coordination process, and in the agency itself, during the course of the study. As a result of this change, we were asked to assist in a specific NRC staff effort to develop research coordination procedures. We participated on the basis of our study results. We will discuss our role in that procedural effort later in this report. Since the specific procedures governing research coordination are in flux, and since we contributed to the activity that will result in their change, the emphasis in this report will not be on specific mechanisms or

procedures. Instead we will discuss primarily the balance of the conduct of the study, our findings and analysis regarding the NRC research coordination process, and our general recommendations for RES strategies that we feel would enhance its ability to provide useful and important research for NRC.

1.2 BACKGROUND AND RECENT DEVELOPMENTS

Saul Levine, Director of RES at the time this study was initiated, recognized a problem having research results utilized by the other program offices. He expected that research results transfer would not be completed until the results were directly utilized in the regulatory activities of those offices.[1] Dissatisfaction with the extent and pace of that transfer was the specific impetus for this investigation. Mr. Levine contracted with Sandia Laboratories to conduct this work. After extending the scope of the effort, IEAL assistance was sought as contractor to Sandia Laboratories.

The roots of this study, however, actually extend back prior to the formation of NRC. Some effects of this history will be discussed in Chapter 3.0 of this report. At this point, though it is useful to distinguish three phases in the history of RES with regard to formal coordination with other offices.

When NRC was first formed from the Atomic Energy Commission, there was essentially no formal requirement that its research be coordinated with its regulatory programs. In fact, some of the current regulatory programs did not yet exist at that time. RES developed research programs in these areas concurrently with the initiation of the new regulatory programs. The result was a research program widely believed to be unresponsive to regulatory offices' perceived needs.

Backlash from the lack of coordination led to a formal procedure, expressed in SECY-77-130B. This was interpreted in such a manner that RES was essentially accountable for all of its program to a "user office". The mechanism by which accountability was achieved was "endorsement" of each RES research project by a user. This "endorsement", as implemented, essentially gave veto power to the other offices on any proposed research project. As a consequence of this process, conflict over the initiation and management of individual research projects existed between RES and the other program offices. The generally unsatisfactory state of affairs during this period, from the RES point of view, was also a factor in the initiation of this study.

Within a short time after the study began, a new procedure was introduced, which resulted in the publication of SECY 79-635 to supercede SECY 77-130B. The intent of this procedure is to introduce greater flexibility into the research coordination process. It is not entirely new, rather it attempts to emphasize and clarify the (RES) intent in the former procedure. Unfortunately, it appears that some significant disagreements exist between RES and its users regarding the nature, timing, and specificity of endorsement (as required in SECY 79-635).

To further complicate matters, the Commission issued guidance on endorsement of research projects, which was based upon their reaction to the new procedures. This guidance is somewhat vague, and calls for detailed implementation by the EDO. Although we participated actively in that implementation process as part of this study, the precise form of the implementation is not yet known.

To summarize, the pendulum has shifted from little or no formal research coordination requirement, to nearly total reliance on approval of "user offices," and then back toward some measure of

RES flexibility and independence. An important point to be made, however, is that this change was founded in practice more than in procedure. Each version of the procedures differs more in emphasis and interpretation than in formal, specific prescriptions for (or against) independent RES activity. Therefore, the most important contribution to be made by this study is not a set of mechanisms or procedures. Rather, it is an analysis of the feelings and possible flaws of the past, and recommendations as to how RES might learn from this history.

2.0 APPROACH

2.1 INTERVIEWS

The primary data for our analysis was from a series of interviews with agency management, at the Assistant Director level and above in RES and user offices. Several individuals acting in research coordination roles in these offices were also consulted. It was sometimes understandably difficult to arrange time with these people, particularly in the aftermath of TMI and, more recently, during budget preparation time. We did, however, experience considerable cooperation from each of those individuals participating. Although there was not unanimity among those interviewed regarding their perceptions of the research process, a fairly consistent pattern emerged from the aggregate of interviews conducted. Appendix A is a list of those people interviewed.

The content of the interviews included discussion of the individual's perception of agency research needs (in general), criteria by which they judge the validity or utility of research, their perception of the process by which research coordination has been conducted, and options and constraints for this process. Appendix B is the guide that was used by the interviewers to structure the interviews. This format was not followed literally. Rather it was used as a guide for the interviewers to ensure completeness and consistency of the interviews.

Although these interviews provided the bulk of the data used for this study, the aggregation and analysis of those viewpoints, and the conclusions drawn from them represent IEAL judgement. As a result, we state problems and recommendations generally, and as IEAL perceptions. Although we obtained substantial data from our

interviews that support those perceptions, the gestalt is our responsibility, and could not fairly or accurately be attributed to individuals in most cases.

2.2 OTHER AGENCIES

As part of the initial identification of alternatives to the NRC research coordination system, we contacted representatives of several agencies including the Consumer Production Safety Commission, the Environmental Protection Agency, Federal Communications Commission, and the Department of Transportation. Our purpose was to determine if agencies similar to NRC use different research structures or mechanisms, and the effectiveness of these alternatives. We found that there was limited value in these interviews. Even though these agencies were selected as representative of ones which are technically oriented, with regulatory responsibilities, they differ significantly from NRC in their history, research budget, legislative constraints, etc. In addition, there appears to be a tendency for people to describe a given system as it is supposed to work, rather than how it does work. As we mentioned previously, interpretation and practice is more revealing than formal procedure. Therefore, we felt that it would not be effective to spend much additional effort validating reports of procedures used in other agencies and analyzing them, beyond the initial contact. The information that was relevant has been included in our analysis and recommendations.

2.3 ASSISTANCE TO OMPA

Subsequent to SECY 79-635, the Commission produced some guidance for research project endorsement. The Office of Management and Program Analysis was given the responsibility for implementation of that Commission guidance on behalf of the EDO. After considering the issues involved, they decided to address the broader issues of research coordination.

When OMPA was beginning their effort, our interview series was virtually concluded, and we had amassed considerable information about existing practice. Our assistance was enlisted for the procedural implementation, with the approval of the Sandia Laboratories' sponsors.

IEAL's participation in the OMPA procedure development included:

- contribution of descriptive information on the research process
- identification of problems that concern RES and user offices
- recommendation of pertinent procedures

Our assistance was one of several sources of data for OMPA and the final procedures are still under development.

3.0 ANALYSIS

Problems that have occurred with the research coordination process are identified in this chapter. Basically, any problem that was identified during the interviews is included, with IEAL interpretation. As we mentioned, these problems are not universally agreed upon by any means. On the other hand, there were several consistent issues that were easy to identify. There were also several issues that were not strongly supported by any person interviewed, yet are included based on IEAL judgment that the problem was significant. We take this approach, which tends to be inclusive, rather than exclusive, because we feel that it may be as important for RES to mitigate perceived problems as real ones. This requires knowing a broad range of perceptions.

Since the process has been changing (many feel for the better), some of these problems may be outmoded. On the other hand, we were often told that a certain problem had been solved by some procedure, only to see it later appear from below the surface.

Finally, although, this report is oriented toward the documentation of problems, this does not mean that there are not many successful RES/user interactions resulting in useful research results. However, it does mean that dissatisfaction with the process among the users was still too readily apparent to give any confidence that the process is adequate.

3.1 PROBLEM AREAS

Following is a list of problems categorized into broad problem areas. This categorization is for convenience, and is not unique. There is often a significant coupling between the categories. We attempted to place each problem in the category into which it fits best.

3.1.1 Agency Objective

IEAL attributes a major portion of the conflict between RES and its users to a lack of clearly defined, agreed upon objectives for the programs of the entire agency. Those people who disagreed with this contention pointed to a very general statement of agency objectives (i.e., "protect the health and safety of the public"), or in some cases to a very specific task action plan, budget, or other list of detailed statements. None of these has been sufficient to eliminate questions of research priority. Therefore, we maintain that an adequate set of such objectives does not exist. An adequate set would make clear to all concerned the relationship between a set of requirements sufficiently detailed to define actions (including research), and the overall objective of protecting the health and safety of the public. This could be an implicit derivation. The key to its success is that it be sufficiently understood and agreed upon to represent a consensus of the agency regarding the direction to be taken in a particular area.

The lack of such objectives, in general, has led to criticism of the NRC by the Kemeny Commission and others. The report of the President's Commission On The Accident at Three Mile Island found that there is an absence throughout the NRC of any overall system to measure and improve the quality of safety regulations.[2] What substitutes for these objectives is a reactive tendency to respond to the most pressing issue of the moment. As a result, the emphasis on such research programs as safeguards (especially for reprocessing plants), waste management, advanced reactors, and others has varied according to political sensitivities. They have no priority in the overall research program that is recognized as consistent with a technical assessment of the relationship to the public's health and safety.

In fact, this malady (lack of agency objectives) affects the effective establishment of research priorities in general. Many of the items identified as needed and missing from NRC's program in light of the accident at TMI (e.g., research on human factors, small break LOCAs, operational safety, etc.) were recognized prior to TMI, and their role understood by at least some staff. WASH-1400, for instance, identified small break LOCA as a dominant risk contributor, yet the lack of an agency consensus on objectives for LWR safety, and research related to it, contributed to the relative lack of priority accorded this area in favor of the more traditional, confirmatory, regulatory based, large break LOCA investigation. Even now, the lack of an adopted safety goal is creating disagreement within the agency over the point at which a risk is small enough not to require research. This is so even though risk assessment has been used to help establish reactor safety research priorities. In part, this is due to an unwillingness for some technical staff to accept risk criteria as the unique safety goal.

Certainly, then, in areas for which no risk assessment exists, the situation is even worse. There are no means for the Director of the Office of Research to systematically balance priorities between research areas (e.g., between water reactor safety and waste management). Clearly, the ability of the Budget Review Group to do so in a technically acceptable manner is even less. Within specific areas, the lack of accepted goals or objectives leads to irreducible conflict. Within one such area we were informed by the user office management that it was clearly their responsibility to define objectives. The corresponding RES manager, on the other hand, felt that the user had never adequately defined these objectives, and subjected them to agency-wide scrutiny, discussion, and consensus (or arbitration, at the least). In the absence of such activity, he maintained the right to establish objectives in that area which RES believes adequate to define acceptable research goals.

Further investigation of this issue was outside the scope of this effort. The need to do so might be obviated if action is taken to develop NRC safety goals, long range planning related to objectives, etc. There is currently significant discussion of these needs. It is very important, and relevant, however, to recognize the relationship between this issue and the others which follow.

3.1.2 Management

Although any definition of management effectiveness is arguable, several problem areas fall under what we will subjectively characterize as "management" problems. This is consistent with Kemeny and Rogovin Commission published observations of weak management at NRC. (The Kemeny Commission report stated that: "The Commissioners have...isolated themselves from the overall management of the NRC, and that: "The major offices within the NRC operate independently with little evidence of exchange of information or experience.")[3]

In regard to the previous discussion, improved agency management could result in activities designed to remedy the lack of objectives (e.g., "define a reactor safety goal"). Alternatively, it could dictate mechanisms to unambiguously establish a course of action in lieu of explicit objectives (e.g., "use available risk assessment techniques to establish the top 15 risk contributors -- research those and only those").

Very often, in the course of discussion, we found essential agreement between RES and the other program offices on the manner in which research coordination should be conducted, on the relative roles of the offices, and on the type of research to be performed. The discrepancy in these cases seemed to exist on the balances between items. For instance, there was close to unanimous agreement that RES should be "responsive" to user needs,

yet should have autonomy to conduct research independent of those needs. Still, there was clearly strong, emotional conflict over the sense of priority, interest, or importance that was accorded each type of research. The response of those interviewed, and of the new procedures to this perceived difference, was to focus on allocations of funds or other mechanisms to control the involvement of RES in each type of research. If there were a means to establish and to agree upon priorities for research in the best interests of the agency, given an agency objective, then an arbitrary allocation of resources to RES vs. user-sponsored research would be unnecessary.

Related to the ability to set priorities is the existence of a central authority with the ability and willingness to provide consistent direction. Since the Office of Research and its two primary user offices, NRR and NMSS, were established as equals with no staff manager above them, their inability to agree on technical priorities can and has resulted in paralysis of the system. In the absence of an ability to negotiate, other agencies rely upon binding arbitration by an administrator, or by commissioners, who have clear authority over all parties to the disagreement. In general, the necessity for this level of attention does not often occur. In fact, the existence of an overriding authority to whom each party is responsible may increase their willingness to seek consensus or compromise. The NRC management structure provides no such incentive. In fact, all the staff to whom we spoke felt that the EDO (as an office) was technically (and perhaps managerially) incapable of providing research or program direction. The Commission, likewise, was not seen as an alternative. Thus, the poor management structure and strength contributes to the lack of explicit, agency-wide objectives, goals, and priorities. It also limits the ability of the agency to act on implicit ones.

Just as there is no recourse to higher authority than the office director level, in general, there is also little responsibility or authority given to technical staff and lower level management below the office director level in some cases. All of the research coordination procedures are written to require ultimate approval at the level of office director. To the extent that such approval requires establishment of needs or priorities, this is probably a necessity. Significant work is required, however, to determine and to coordinate the technical adequacy of a proposed program to meet a given need. The time, knowledge, and sometimes the competence to perform this function is generally at the level of technical staff or branch chief. Increasing management distance from this level increases the time and the effort required for, and reduces the effectiveness of research coordination. Therefore, the lack of appropriate delegation of authority (through the agency) serves to diminish the effectiveness of research coordination. This is clearly an effect of poor management practice.

3.1.3 History

Another problem that appears to be management related is personality conflict within the agency. Some managers ascribed all research coordination problems to "simple" conflict, inability to work together. When this occurs at a lower staff level, it may be viewed as management ineffectiveness in directing the staff. Quite often, however, the conflicts begin at high management levels, between office directors for example. When this occurs, it is an example of the effect history has had on research interaction with users. In some minds, the tone of competition, rather than cooperation, between offices was set early in the interaction by strong personalities and has endured due to lack of strong central direction within the agency.

To some extent, these personalities and the current organization were shaped by the system from which they emerged. The AEC was not primarily a regulatory agency, and its nuclear safety research program was oriented differently. Some people we interviewed felt that this history in which the reactor safety research function did not need to answer to operational, regulatory needs was the source of its early (and in some cases continuing), unresponsiveness to those needs at NRC.

Other perceived holdovers from the AEC period are tendencies toward large engineered research facilities (e.g., LOFT), toward certain topical research areas (e.g., advanced reactors), and toward a possibly restrictive confirmatory bent. By the latter, we mean that reactors are viewed as safe, and research projects are planned to emphasize the confirmation of how safe they are. All of these tendencies are viewed by research users as less appropriate in a regulatory framework than in the agency in which they began, which predominantly emphasized development and demonstration.

Of course, historical roots work two ways. Although they may create resistance to change, they also provide a point of view and experience, which do not exist if there has been no history. Reactor regulation, standards, inspection, and research existed at AEC. The SAFER Division of RES and the regulatory programs in safeguards and fuel cycle (including waste management) were born at NRC, or in some cases were much more highly emphasized there than they ever were before. As a result, in the latter areas there were two programs developing simultaneously -- the regulatory program and the research program addressing the same topical areas. NMSS feels strongly that RES developed its own program in this area, without much direction from them. RES feels, with equal conviction and validity, that they tried to coordinate and were given no adequate objectives by the people

who were engaged in developing a new regulatory program. The issue at this point appears to pivot on whether the research methods developed are adaptable to a meaningful NMSS program, or whether substantial redirection is needed. If adequate objectives and priorities existed, it would be possible that either the RES or the NMSS programs or both would be redirected to accommodate the other. In the absence of such objectives by which the programs can be judged, the conflict rests squarely between the responsibilities of the offices. In other words, the dispute becomes one over "turf."

It is clear that pointed differences exist between the NRR-RES relationship and the corresponding one between NMSS and RES, and that these are firmly rooted in AEC history. In fact, more recent history colors the relationships further. Succinctly, NRR has relatively few people to license and regulate many facilities, whereas NMSS has little licensing to do (of major facilities), and relatively more resources to accomplish the necessary activity. At the same time, the Division of Reactor Safety Research (RSR) in RES has substantial financial resources, committed to predominantly large projects. They view their staff as technical experts in their given field, above all else. The SAFER Division, on the other hand, has few people and relatively many small projects, so that a comparatively small budget requires much administrative overhead. The SAFER management tends to emphasize the project management rather than the technical expertise of its staff, which may be either a cause or an effect of this ratio of people to resources.

One consequence of all of this is that NMSS has relatively much more staff time to devote to following research than does NRR. This fact, the differing nature of the research projects and project management, and the short history of SAFER/NMSS compared with RSR/NRR lead to very different attitudes and approaches

between these pairs. At the risk of oversimplifying, the major conflict between SAFER and NMSS appears to be competition over responsibilities. RSR and NRR are less in conflict, but suffer from a general perception that there is too little effort taken by either party to actively understand the affairs of the other. The result is that research predominantly responsive to the most important NRR licensing and rule-making needs may not be conducted and utilized with the appropriate priority.

3.1.4 Definition of Research

One of the first items upon which we focused attention during the interviews was a definition, or a bounding, of "research" as it pertains to NRC. Most people agreed that NRC was proscribed from conducting "basic research " but precisely what distinguishes that from its counterpart is not clear. There was little controversy on this point. What is striking, however, is the number of different ways to distinguish types of research within NRC. Possible useful distinctions can be drawn between:

- confirmatory, exploratory, and design research (where confirmatory refers to research to confirm a regulatory viewpoint, exploratory challenges the basis for the regulatory approach; and design attempts to optimize by investigating a possible alternative reactor or safety system design)
- user sponsored vs. RES sponsored
- oriented toward a regulatory need vs. a technical need (RES tends to establish needs and priorities based on an assessment of the technical requirements, while user offices tend to look at their requirements to regulate. These are not always the same needs, nor are they necessarily distinguished by user vs. RES sponsored.)
- long term vs. short term
- small budget vs. large budget

- speculative (high risk) vs. assured results (i.e., speculative research may have a significant potential payoff, but may be relatively unlikely to achieve useful results)
- research vs. technical assistance (TA)

These categories are obviously not mutually exclusive, nor are they necessarily exhaustive. What they do indicate, however, is the confusion of factors that govern the perceptions of RES and its users regarding their appropriate roles. There is a real possibility that RES and its users may nominally agree on types of research, relative priority, and responsibility, while their actual conceptions are quite different in reality. It is difficult to interpret, for instance, what a user office would do if they supported a need for independent action by RES to "initiate long term research," and then RES under that authority attempted to initiate exploratory research related to a licensing assumption. The interviews clearly revealed that such distinctions occur, and are not recognized, with regularity.

A particularly good example of the discrepancies between research definitions, and how they can result in conflict, is in the question of research vs. technical assistance (TA). We heard definitions that ranged from "Research is what RES does," to "Research is anything that takes more than three years," to "Research is when I don't have the money to do the work," to "Research is a process characterized by generation of new methods or data as opposed to applying existing ones." There also appears to be some willingness to fight over the turf that is so imprecisely divided.

On the other hand, there is much more of a consensus on the total range of agency research, and on the unique role played by RES. With the possible exception of "design research," distinct from exploratory research most users were willing or eager for RES to

undertake work that challenged the basis of regulations, speculative research, phenomenological research, etc. (However, see "Limited Resources.")

The user offices also identified RES as the body with the unique outlook, resources, freedom, and skills to independently identify far-reaching, long-range, exploratory or speculative research. (Although they may not have distinguished between these). They recognize their inability to focus sufficient attention on identification of research in one or several of these categories. Several users commented that RES itself had not sufficiently exercised their unique perspective to identify much innovative research, either.

3.1.5 Limited Resources

Although the user offices are each quite willing to have a certain RES independence in identifying research, there is some sense of conflict when priorities are discussed. The user office management nearly uniformly feels that user-sponsored or endorsed research, which is directly related to their operational needs, is of prime importance and should occupy the bulk of the available resources. RES also feels that it would like to have as much research as possible endorsed by a user, but there is some sense that the users should be far-sighted enough to endorse a significant portion of the research that is less directly tied to operational needs, and is more phenomenological or exploratory. Once again, the lack of clear definitions of research and research categories may lead the offices to believe that they are converging to a viable division of resources, while differing expectations over the expenditure of those resources may in fact lead to additional conflict. In the absence of clear definitions, we were unable to distinguish the extent to which expectations may differ.

It appears that this competition between offices or roles is a natural outgrowth of limited resources. Given those limited resources and the work to be performed, it is inevitable that someone will feel that money could be better spent. If the users really believe that operational needs are always the priority, then they will resent the money spent on non-user supported research, even if they intellectually acknowledge the necessity of that flexibility.

Harold Denton, Director of NRR, identified one of the driving forces behind this conflict. The nature of nuclear regulation at this time, in his opinion, puts a burden on the regulator to continually add evidence to a technical position that has any degree of uncertainty. There is not a corresponding burden on someone who wishes to challenge a technical position to first show why it is inadequate. The mere fact that it is uncertain makes it inadequate. Thus, in his opinion, there is limited ability to determine pragmatically how to allocate resources where they might most effectively be spent. There is, instead, a tendency to want to confirm a given position beyond what may be cost effective. In this environment, operational, confirmatory needs will never diminish to the point where there is a good deal of margin for exploratory work.

Another manifestation of the limited resource issue has been in determining the content of research endorsements. User offices feel that they must know and should have some control over the funds expended on a given RES research project. RES believes that this is "micro-management", or undue interference with an RES function. This is an important difference. We were able to elicit few identifications of research projects that were judged bad or useless outright. Instead, most of the dissatisfaction was with projects upon which resources were expended well in excess of their perceived utility. The question again appears to be related to both priorities and objectives.

3.1.6 Existing Mechanisms

There already exist a large number of research coordination procedures and groups. Many of them were identified in our interviews as being ineffective or counter-productive. They are briefly described below:

3.1.6.1 User request/endorsement procedure. Some of the problems with this process have been discussed. The primary issue for RES was the veto power and the unilateral control given to users under the former procedure. Note that this was as much a matter of interpretation as it was explicit in the procedure. In particular, one RES manager commented that the users should always have the right to speak up if they strongly disagree with a research project. What he objected to was the necessity to ask for the explicit approval of the user on each project. Other RES managers did not mind asking for user endorsement as long as some funds were available for them to use at their own discretion if user support was not forthcoming.

Under the new procedures, and anticipated procedures, the user offices are dissatisfied with the level of detail at which they are asked to approve/concur in a research project. As discussed before, they feel that funding is a legitimate concern of theirs, as is scheduling. Without the latter, they feel that they cannot adequately plan to use the research results in their time constrained regulatory development schedule. They also feel that it is important to obtain this information at the detailed task level. They believe that RES does not provide sufficient detail to the contractor to ensure the user of the desired and needed product.

3.1.6.2 Research Information Letter (RIL). Most users identity the RIL as a tool for the RES front office to use to justify

their productivity at budget review time. It is not seen as an effective tool for research results transfer, since it is too little, too late, and is not associated one for one with each research project. There was at least one user office individual who felt that they might be useful as a summary to introduce the research results to people not familiar with the work (e.g., the Commission). Contributing to their lack of usefulness is the uneven nature of the RILs, some written on miniscule topics, individually useless, and some written so long after completion of a huge project that it covers too much, too long after the fact. There also appear to be some differences within RES in the frequency, intent, and effectiveness of their use. In general, they don't appear to provide a forum for the open review and discussion of research results.

3.1.6.3 Research Review Group (RRG). The Research Review Groups also suffer from widely varying intents and uses. RES established them to provide technical feedback to the project manager from other technically knowledgeable NRC staff. They complain, however, that the persons sent to the groups on that basis have no authority to speak for their offices. The user offices feel that if it were the purpose of the RRG to obtain office concurrence, they would send a different kind of representative. Some user offices see so little value in the groups that they intend to ban or severely limit their staff's participation. The groups are also used differently by each RES project manager. The mixed reviews of their utility, therefore, does not tell too much about the potential usefulness of the RRG.

3.1.6.4 Budget. There are two significant budget-related issues. First is the lack of detail in RES budget submissions with regard to individual projects. The user offices, therefore, reject the notion that a research plan at the level of the budget approval can provide an adequate vehicle for endorsement.

Also an issue is the lack of budget followup. Large programs that are changed during the year are subject to Controller rules for reprogramming the budget. Below this level, however, there does not appear to be any real tracking of research funds to determine how the actual budget compares with the planned and approved expenditures.

3.1.6.5 Research Coordination Groups, Safeguards Technical Assistance and Research Group (STAR), Waste Management Review Group (WMRG), Contract Review Board, and Senior Contract Review Board. Each of these groups was established to accomplish specific functions that were not adequately handled by existing procedures. The STAR and WMRG, in the areas of safeguards and waste management respectively, have broad charters to review all research and TA projects for duplication and overlap, programmatic relevance, adherence to procedure, and proper justification for DOE lab procurement.

Responses of interviewees has been fairly positive with regard to these groups, although somewhat mixed. They provide the enormous advantage of agency-wide review of proposed research, independent of specific user office/RES interaction. The main issue appears to be the duplication of function between groups, and the decentralized nature of project coordination and review. The result is a system that has high overhead in some cases. WMRG review, for instance, does not substitute for user office endorsement, although many of the same principals are involved. The Contract Review Board is a fairly superficial re-check for duplication and overlap, even for those projects cleared through STAR and WMRG. Finally, we should note that although a check for programmatic relevance is performed by STAR and WMRG, the lack of systematically determined, agreed upon objectives can be expected to undermine the effectiveness of this effort.

3.1.7 Closing the Back End

This area refers to two types of activities: closure (actions taken by RES to close out a given project); and utilization (actions by a program office to use the results of research). Both of these have been sources of contention.

One of the principal criticisms that we heard from both NRR and NMSS was their perception that research projects go on ad infinitum, and closure is rarely exercised. This particularly disturbs them where original endorsements have been used to cover much more effort than was ever intended (see Limited Resources). A very real consideration for RES, however, is the manpower required either to acquire endorsement each year or to re-start programs one year at a time.

RES is not satisfied with the manner in which research results are utilized. Saul Levine expressed concern about the "delay in the implementation of RES research results into the regulatory process."[4] He attributes this delay to a lack of regulatory staff time. He goes so far as to say that his staff will draft regulatory documents based upon research results for review by the program office staff. Our investigation showed that a number of variables, including but not limited to staff unavailability results in this situation. First, the nature of much of NRC's research is confirmatory, in which the validity of methods or data in use for regulatory decision making is confirmed. In those cases, the methods are already in use, or the only impact may be a decision to accept a licensee calculation. In other cases, the conservativeness of a safety margin is confirmed, and it is often not desired to reduce regulatory requirements to take advantage of this margin. (Sometimes this is the case because of the need to have very high confidence in the results used before a licensing board, as described previously. In other instances,

a change in regulatory requirements would not be cost effective for NRC, or for the industry. In some cases, there appears to be a reluctance to reduce conservatism since that would appear to be a compromise of safety in the eyes of the public.)

Another factor inhibiting utilization of research is research that the user feels he did not request and had no say in from the beginning. Even though the results may be useful, it is much more difficult to sell them afterward if the participation of the user was not enlisted from the beginning. Often this is complicated by user office unwillingness to assign adequate staff time to follow a research project.

Some users suggested that research would see more application if RES made a better attempt to develop user-oriented products from completed research results. In other words, sometimes the form of the result, rather than its substance, hampers its utility.

Some research goes astray because there is no followup by RES. User office management sensed a feeling that many researchers aim to complete the research up to the point where an answer is known, and then do not really care if it is utilized. This, of course, is an unfair assessment of those individual researchers who have tried to convince another office of the utility of some results and the need for action, only to be ignored. (Behavior of damaged fuel, for instance, was not a concern except at RES prior to TMI, because it represented an event beyond design basis.) In other cases, however, this may be legitimate criticism.

One final aspect of research results that may lead to their being forgotten is that they represent contractor results, not RES results. The RES policy has been not to edit or to review final contractor reports prior to publication, to avoid possible appearance of censorship. Unfortunately, there is no uniform policy at

RES about appropriate review and followup of results. RRGs and RILs are looked to as partial answers by management, but the RES staff often feels that these vehicles are not well received or followed and are merely additional overhead. There are several problems associated with this issue. Sometimes contractor research results are passed on to potential user offices with inadequate review. In some cases, the inadequacy is technical, with failure to establish NRC or peer technical judgements on the validity of the results or their interpretation. In other cases, there is a lack of substantive review focused on the application of results to current regulatory problems. Some trival results are transferred by RILs, and other substantive ones (from the point of view of applications) are not emphasized. All of these factors lead to a lack of focus for the recipients of the RES product. This results in limited review and under-utilization of many research results.

3.1.8 Miscellaneous

There are several other observations resulting from our interviews, which do not fall into one of the above categories. They are discussed individually below:

3.1.8.1 Competence of Research Staff. We did not receive any criticism of the RES staff in terms of their basic competence. We did receive notice of a particular perceived shortcoming of the RES project manager, as well as a distinction between the Divisions of RES.

The shortcoming is the lack of understanding of the licensing/regulatory process by the RES management and staff, not their lack of technical competence or understanding. This may or may not represent incompetence in that position, depending upon the goals that the RES management establishes for its staff.

The user offices in general believed that the RES staff has a particular sort of ability to plan and implement research. Most of the interviewees felt that the RES staff is comprised of "researchers" who are more likely to think in generalities and broad issues, have more insight into future developments and needs, etc. Whether this was the result of their perception of the environment provided by RES or of the capabilities of individuals in the office is difficult to say.

RSR and SAFER are viewed differently by NRR and NMSS respectively. RSR is perceived by NRR to be a collection of top notch "scientists." That is, their scientific credentials are respected; however their ability to manage programs and to direct them to useful ends (for NRR) is questioned. SAFER staff is perceived by NMSS to be project managers who are knowledgeable about the process of contracting for and guiding research efforts. They appear to be more likely to regard the RES staffer as a conduit for technical management than as a subject matter expert in his or her own right. To a large extent, these perceptions are consistent with the approaches taken by the RES management. It also follows from the highly specific nature of much of the work in RSR to which an individual is assigned, as opposed to the multifaceted nature of the work for which a SAFER project manager might be responsible.

3.1.8.2 RES Office Structure. The other divisions feel that part of the reason RES has a high workload, particularly in the SAFER Division, is the large ratio of management to technical staff. This further reinforces the impression of SAFER staff as technical managers, rather than as technical experts.

3.1.8.3 Physical Separation. NRR/RSR subscribe to the view that their interaction would improve if the offices were co-located. On the other hand, NMSS and SAFER are located in the same building and do not seem to enjoy a substantially closer relationship

due to this. This observation does not, of course, control for other factors, and the NRR/RSR interface might improve if this much cited fault of NRC location were improved.

3.1.8.4 Problem with New Procedure. RES has noted that instead of reducing their overhead as it was intended to, endorsement at the research planning stage is adding to their burden. This is because the users are still requiring project SOW level information. Since this now occurs much earlier in the process, it complicates the RES task.

3.1.8.5 Use of DOE Laboratories. There are mixed feelings about the heavy use of DOE laboratories. Most technical staff recognize the tremendous effort involved in contracting commercially for services. Doing so more often would tax the responsiveness of the system, already not high. On the other hand, individual offices have varied feelings about the laboratories. One office commented that it felt the laboratories gave NRC second class service compared with the service accorded DOE, and would like to see NRC-dedicated facilities. Another office has specific preferences among the laboratories that sometimes affects its judgment regarding support of a particular laboratory-based program.

The laboratories, for their part, have no reason to be thrilled with NRC either. Contacts with the laboratories indicate a variety of their concerns as a consequence of the RES/user office coordination circumstances at NRC. These include:

- delays in funding that have cost them program/personnel continuity
- isolation from ultimate users, while responsible for responsiveness to their needs
- confusion due to multiple sources of project direction
- excessive time required to respond to program planing management input activities at the expense of techical production

- undue pressure to produce specific products, on a particular schedule, with high certainty, in a research-oriented task.

3.1.8.6 Project management. There was no disagreement regarding RES authority to direct research contractor activities. This appears, however, to be a point of great sensitivity for RES. They feel that the user offices are involved in what they refer to as "micro-management" of RES programs -- that is, concern with detail at an inappropriate level. They feel this tends to diminish the RES project manager's responsibility and authority for direction of contractor activity so as to achieve the agreed upon end. The user offices interpret their activities as a legitimate part of their endorsement and monitoring responsibilities, and do not feel that it usurps the RES responsibility for project management.

4.0 CONCLUSIONS AND RECOMMENDATIONS

Coordinating research within NRC so as to satisfy RES and its users is a difficult task under any circumstances. Currently there exist problems with the process to which there are no simple answers. In particular, we have found that almost all of the principal parties to the interaction verbalize amazingly similar goals for an adequate research program. It is in interpretation and implementation that the difficulties arise. Similarly, any of the past procedures could be interpreted to have analogous intent, and it may well be that the upcoming procedures will do nothing more than to change the emphasis on those aspects of the procedure that have been the source of the most recent trouble. In other words, in some fundamental manner, the basic procedures and platitudes regarding research coordination seem to be reasonably acceptable and not subject to dramatic improvement. This outlook does not mean that new mechanisms or procedures cannot be tried. In fact, we suggested a somewhat different approach than the current one, in consultation with OMPA. (We consider that interaction an output of this study as much as is this report.) What it does mean is that no mechanistic or procedural solution will provide a magic answer. The current state of flux of the system also reduces the value of specific procedural suggestions.

The procedures can only do as well as each office can, individually, and that is to learn from past history. That is the purpose of our presentation here. In particular, the next several months, which involve negotiating new procedures and getting a fresh start implementing them, will be a convenient and critical period in which any changes in attitude and perception may take root.

The following general recommendations and observations may help to facilitate the process:

- De-emphasize procedure, and emphasize cooperation between technical persons. Individual RES staff members and branches that have good personal interaction with their users have little trouble to report with even the old procedures.

- The RES management (at all levels) should be aware of, and act to minimize, personnel conflict with other offices.

- Actively pursue the establishment of objectives for each regulatory program. The long-range planning activity could be the rationale for constructing a strawman of these objectives. It is important that concurrence be established between the offices on these objectives. In the absence of such objectives, a mechanism should be established by which consensus on research needs and priorities may be achieved. Many other agencies rely on a committee to initiate and sponsor research. The committee includes representation from all involved parties within the agency. Putting aside individual office considerations is most crucial at this point, in particular. This is especially true if much of the endorsement process occurs here, with technical details delegated to technical staff interaction.

- Delegating more authority to the interacting technical staff will reduce office overhead, long concurrence chains, etc., and increase shared participation in the research process. In particular, RES should seek to encourage this participation and delegation of authority in the user offices.

- This delegation of authority would complement the establishment of objectives at the Office Director level. In particular, the need for, and priority of a project or program would be determined at the Director level. Technical staff level coordination occurring actively throughout the life of a program would ensure that the program, as implemented, met these needs at the appropriate level.

- As part of the establishment of objectives, RES should define more precisely the range of research activities that it will consider. This should help provide a template against which the mix of research activities can be judged for balance. The definition of various types of research in an unambiguous manner would also reduce inter-office conflict.

- Since part of the rationale for RES independence is the unique ability of a dedicated research office to challenge current methods and practice, RES must make a more active effort to identify meaningful exploratory, long-range, or high- risk research. It appears that, until now, this interest in independent and innovative activity has been somewhat dogmatic, and has not been implemented vigorously.

- It is likely that new procedures will provide some discretionary capability for RES to perform research at some level without endorsement of other program offices. Although the other offices wholeheartedly support this notion, it is incumbent upon RES to minimize emphasis upon this tool. Competition for limited resources is likely to create resentment that, at the least, may undermine efforts to have the research results accepted. In the long run, it will be preferable to have cooperative prioritization of effort to include "pure research," than to handle all disagreements in two separate funds, which exaggerates the split between the offices. In particular, use of these discretionary funds simply to reduce the effort required to coordinate is just another patchwork solution.

- The existing groups and procedures work to a large extent, but lead to the problems discussed. One of the biggest problems with their existence is that many people regard them as the answer to the problem of coordination, when in reality they are a compromise at best. In several cases, they result in unnecessary expenditure of staff time, which is then unavailable for technical effort directing or following the project. Although it is easy in the near term just to use the tools provided in the procedures, it is our feeling that the greatest long-term benefit will be achieved by re-examining the basic methods of coordinating research to emphasize shared effort toward common goals. This was a feature of our recommendations to OMPA, and it is our current understanding that it will be a feature of the new procedures.

- The interaction between NRR and RSR is very much different than that between NMSS and SAFER. Any effort to improve coordination between RES and the other two offices should note this fact and treat each case separately.

- RES should improve its efforts to understand the regulatory activities and needs of its users. Staff rotation might be one way of achieving this appreciation. The admonition to develop research priorities cooperatively extends to user needs, as well as to longer-range research. Thus, RES must understand those needs well enough to aid in

setting priorities in this area as an equal partner, just as the user offices should be encouraged to devote the time necessary to cooperate in identifying longer range, non-operational needs.

- An effort must be made to establish some consensus regarding research priorities, and then to track expenditures in such a way that priorities are adhered to. Users begin to mistrust RES when they recognize that agreed upon priorities are changed as the program continues.

- More emphasis should be placed on the normal management hierarchy. Currently, expectation of conflict encourages each party to search for "leverage" in the procedures. As a result, a lot of time is spent in endorsement prior to the existence of a program. At this point, details of program implementation are necessarily scanty, especially for more speculative research. If office directors established objectives, needs, and priorities that were adhered to, and delegated authority for the technical implementation to their staff, significant reductions in overhead would occur. The staff could be more profitably occupied with the technical details of the projects. In fact, they could coordinate more closely than is currently possible. If discrepancies arose, the problem could be handled at successive levels of the management chain in both organizations. It would be necessary for both office directors to agree that if they could not agree, that the difference would be submitted to someone, probably the EDO, for binding arbitration. Although we recognize that this is not a desirable alternative, it should be noted that this would be powerful motivation for the two equal office directors to reach a compromise. If they can not, there must exist some method to ease the stalemate, no matter how unpalatable. All other agencies we consulted had this feature.

- RES should be physically located as close to its users as possible.

- RES should follow up on its research results, determining which ones require peer review, RES interpretation, or modification. All research results should be promptly reviewed and handled appropriately to the point where RES can consider it their product. This identification of RES with its products is important if they are to be used. Not all research will be successful in the sense of producing a valid, useful result. RES has said this in the past, but sometimes fails to treat its products accordingly. RES credibility would be enhanced by careful, thoughtful treatment of its contractor's products after

their completion. This includes review, analysis, criticism, interpretation, and adaptation to usable products from the user viewpoint.

Although fixes are not easily achieved, as we said earlier, there is reason to hope that attitudes and circumstances are changing for the better. Recent developments suggest a stronger EDO is in the offering. All offices have strongly indicated their endorsement of the Office of Research as an independent entity, with flexibility to exercise that independence. Attempted co-location of NRC facilities is beginning. There are some indications of impending activity to develop reactor safety goals. Perhaps other agency objectives will follow. New research coordination procedures are forthcoming. Hopefully they, together with the suggestions here, can help to improve the coordination and utilization of research within NRC.

REFERENCES

1. Memorandum from Saul Levine, Director, Office of Nuclear Regulatory Research to Lee V. Gossick, Executive Director for Operations, U. S. Nuclear Regulatory Commission, November 28, 1979.

2. The President's Commission on the Accident at Three Mile Island. October 1979. The Need for Change: The Legacy of TMI. Washington, DC: U.S. Government Printing Office, p. 55.

3. ibid., p. 51.

4. Saul Levine, op. cit.

APPENDIX A
List of Interviewed Staff

Appendix A - List of Interviewed Staff

Frank J. Arsenault	Director, Division of Safeguards, Fuel Cycle, and Environmental Research, RES
Thomas E. Murley	Director, Division of Reactor Safety Research, RES
Robert Bernero	Director, Probabilistic Analysis Staff, RES
Lawrence Shao	Assistant Director for General Reactor Safety Research, RES
Harold R. Denton	Director, Office of Nuclear Reactor Regulation, NRR
Stephen S. Hanauver	Director, Division of Human Factors Safety, NRR
Richard H. Vollmer	Director, Division of Engineering, NRR
Roger J. Mattson	Director, Division of Safety Technology, NRR
Denwood F. Ross	Director, Division of Systems Integration, NRR
Frank Schroeder	Assistant Director for Generic Projects, NRR
Victor Stello	Director, Office of Inspection and Enforcement, IE
Robert F. Burnett	Director, Division of Safeguards, NMSS
Joseph O. Bunting	Licensing Process and Integration Branch, Division of Waste Management, NMSS
E. Kevin Cornell	Deputy Executive Director for Operations, EDO

In addition to these interviews, we met with the Director of the Office of Research, and other staff of RES, NMSS, and NRR with particular interest or background in research coordination.

We also made telephone contact with representatives of the Environmental Protection Agency, the Consumer Product Safety Commission, the Federal Communications Commission, and the Department of Transportation.

Some limited interaction with the national laboratories was attained through personal contact, and by reviewing written material from the laboratories to NRC with regard to research philosophy and practice.

APPENDIX B

Interview Guide

Interview Guide

I. Agency Needs

- Please describe your organization's missions, roles, and functions.

- In what way should research, (including technical assistance, (TA)) support your organization's missions, functions, and roles within the agency? How should it support the agency in general?

  - rulemaking, licensing, inspection, strategy (policy), understanding phenomena relevant to these: all, some?
  - generate data:
    - -- where unavailable and needed for existing analyses
    - -- to explore adequacy of existing data
    - -- to reduce uncertainty in existing data
    - -- to define bounds on assumptions
    - -- to help better understand phenomena
  - generate explicit methods or models:
    - -- where new perception of need for analysis arises
    - -- to improve precision or completeness of existing analysis
    - -- to effect better communications with licensees, public, etc.
    - -- to examine adequacy of existing assumptions, bounds, understanding, etc.
    - -- to provide a means for assessing tradeoffs between different approaches (design, etc.)

-- to improve consistency of application of standards

- How well has the research function supported the other missions, functions, and roles of the agency, in general?

- What limitations do you feel should exist on the scope of research and TA performed by the agency?

  - Should some of the possible roles not mentioned in first answer be specifically excluded? Why? (statutory, tradition, other agency's responsibility, no need unilaterally, etc.?)

- How should the roles played by research and by TA differ in meeting the needs of the agency?

  - Possible means of distinction: duration, urgency, new development vs. application of old one to organization's function, specific vs. generic, other?

II. Criteria

- What criteria would you say are desirable or necessary for a research study in order for it to be most useful to NRC?

- Who should determine whether or not the criteria are met, or are likely to be met?

- To what extent should the agency perform speculative studies relevant to the agency needs discussed above, which have a significant probability of not meeting some or all of the criteria you mentioned?

- To what extent should the agency perform "exploratory" research which questions, or transcends the basis for existing regulatic

III. Current Process

- Please describe your view of the current process by which research is conducted within NRC:

  - How is research distinguished from TA?
  - Who identifies research requirements?
  - Who develops research work plans?
  - Who establishes priorities among research projects or programs?
  - Who monitors ongoing research work?
  - Do you see RES personnel in your area as technical experts primarily, or as contract monitors, or some combination? What effect does this have on your use of ORES? Which would you prefer to see in the ORES and why?
  - How are research results transferred?
  - Who determines the value of the research results?
  - Attempt to establish familiarity of interviewee with, and his motion of the following: SECY 77-130B; revision of that procedure; RIL process; function and practice of research review groups; STAR and waste management coordinating groups; role of budget process

- How well do you feel each of these functions is performed?

  - Why? Identify the interviewee's percepetion of the cause of any identified difficulty.

- Describe specific research projects known to you, which in your opinion have been particularly successful or particularly unsuccessful in meeting your needs or those of the agency.

  - Elicit their criteria for "successful", if not apparent.

- Discuss some of the strengths and weakness of the current process by which research is carried out.

- Ask for general identification, and specific examples. Emphasis is on process here, not results, projects, etc.

- Does the current process help to meet your research needs?

  - i.e., to what extent are the needs met; and how much of this (success/failure) is attributable to the process as it currently exists?

- Overall, do you feel most research projects are successful or unsuccessful?

  - Try to identify basis for "successful" vs. "unsuccessful", and also to understand what influences respondent's perception of "most". Is he responding on the basis of certain dominant experiences, overall experiences, general feeling about research or the Office of Research, etc.?

- To what extent have potentially useful research results actually been utilized?

  - To be useful, must a research result be utilized in the implementation of regulations, in licensing, etc.? Can it be useful if it disconfirms an existing standard, method, etc.? Identify cases in which a research result which was acknowledged to be of potential value in stimulating or supporting a regulatory action didn't have that effect. Why did this occur? Was it due to a failure of the research transfer, to causes internal to the licensing/rulemaking process, or other?

IV. & V. Options and Organizational Constraints

- By what process should the determination be made that a technical need be addressed through research or through TA?

- Do you have suggestions which would improve the current research system? In particular, address the following components:

  1. identification of research needs
  2. establishment of research priorities
  3. conduct of research
  4. transfer of research results

- Are there totally different configurations for the agency, or for the roles and responsibilities of organizational entities, which you feel would measurably improve agency research?

  - Try to establish what answer would be if only the effect on the research function were considered. Example: If the NRC organization is redefined so as to vest more authority in the EDO, could this have a beneficial effect of agency research? What about a strong chairman? Would you be in support of reorganizing the research authority? How? What about institution of standing committees represented by each major office, in each program area to coordinate agency research? Other ideas? Drawbacks?

- What effect would these configurations have on other agency functions?

DISTRIBUTION:

U. S. Nuclear Regulatory Commission (300 copies for AN)
Division of Document Control
Distribution Services Branch
7920 Norfolk Avenue
Bethesda, MD 20014

J. F. Larkins (10)
Office of Nuclear Regulatory Research
Mail Station 1130SS
U. S. Nuclear Regulatory Commission
Washington, DC 20555

4400 A. W. Snyder
4410 D. J. McCloskey
4412 J. W. Hickman
4413 N. R. Ortiz
4414 G. B. Varnado
4416 L. D. Chapman
4420 J. V. Walker
4440 G. R. Otey
4441 M. Berman
4442 W. A. Von Riesemann
4443 D. A. Dahlgren
4444 S. L. Thompson
4445 L. O. Cropp
4450 J. A. Reuscher
8266 E. A. Aas
3141 L. J. Erickson (5)
3151 W. L. Garner (3)
For DOE/TIC (Unlimited Release)
3154-3 R. B. Campbell (25)
For NRC distribution to NTIS