DNFSB/TECH-10

AN ASSESSMENT CONCERNING SAFETY AT DEFENSE NUCLEAR FACILITIES
The DOE Technical Personnel Problem

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The author wishes to acknowledge the efforts of Steve Krahn in organizing this paper and providing significant technical input. Substantial technical assistance was also provided by Wayne Andrews and Timothy Dwyer; additional assistance was provided by Ralph Arcaro, Cynthia Miller, Matthew Moury, Daniel Ogg, Robert Warther, and outside experts Lieutenant General Kenneth Cooper, USA, (Ret.), Captain John Drain, USN (Ret.) and Rear Admiral Ralph West, Jr., USN (Ret.). Special thanks is also extended to the Board's General Counsel, Mr. Robert Andersen.

While the facts presented herein are a matter of record, the views and summary expressed are those of the author; they are not to be construed as representing the views of other Defense Nuclear Facilities Safety Board Members.

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Introduction

In 1995, the Defense Nuclear Facilities Safety Board (Board) reported to Congress as follows:

> *"In each of its first four annual reports, the Board recognized the most important and far-reaching problem affecting the safety of DOE [Department of Energy] defense nuclear facilities is the difficulty in attracting and retaining personnel who are technically qualified to provide the management, direction, and guidance essential for safe operation of DOE defense nuclear facilities. It remains the most critical problem today."*[1]

In establishing the Board, in 1988, Congress indicated that it was well aware of this problem. Thus, the Senate Conference Report that accompanied the Board's enabling legislation stated:

> *"The Board is expected to raise the level of technical expertise in the Department substantially . . . ."*[2] [Emphasis added]

While improvements of an incremental nature have been made by the DOE as a result of Board actions, they are very far from having changed the level of technical expertise "substantially." In all DOE organizations responsible for safety of defense nuclear facilities, there remains a serious lack of sufficient numbers of DOE personnel who are technically qualified. This applies at Headquarters and in the field in both line and oversight organizations. Moreover, as discussed below, the prospects of improvement appear dim unless the Secretary and senior DOE managers make a firm commitment to solve the problem and give personal, priority attention to following through on that commitment.

The focus of this report is on two inseparable matters: (1) the number of DOE technical personnel who are fully qualified for their safety responsibilities and (2) safety at defense nuclear facilities. There is no representation in this report that DOE does not have adequate numbers of personnel assigned to DOE organizations responsible for safety at these facilities. The Board has no direct responsibility to determine the adequacy of the total numbers in these organizations -- only that there be enough who are fully qualified technically to assure safety. The Board's responsibility does not extend to other matters except where such matters affect safety. Thus, for example, it includes reliability insofar as it affects safety, but not beyond.

The report does not discuss the possible future of the DOE about which there has been conjecture. Irrespective of what changes may or may not be made, there is one imperative requirement; it is that the government should have among its employees the technical and managerial expertise capable of assuring protection of public and worker health and safety at its defense nuclear facilities and that it be suitably organized to do so. This need exists today and is not being met in the full degree needed. This problem requires correction urgently; the imperatives of safety will not wait on other organizational arrangements.

There is, however, one possible change that requires a brief discussion in the context of safety -- namely regulation. A DOE advisory committee recently recommended to the Secretary that its defense nuclear facilities be subjected to a greater degree of external regulation than now applies to them.[3] Implementation of this recommendation would not alter the need for DOE to build up the full "in-house" technical capability that is called for in this report.

Background

The technical personnel problem described in this report has persisted generally for several decades throughout the nuclear programs of DOE and its predecessor organizations, the Energy Research and Development Administration (ERDA), and the Atomic Energy Commission (AEC). Attention has been called to the problem repeatedly -- most intensively in the aftermath of the nuclear accidents at Three Mile Island and Chernobyl. The roots of the problem are deep-seated; so much so that they go back to the very origins of the AEC.

The AEC was "born decentralized," matching the strong convictions of its first chairman, David Lilienthal. It had a very small headquarters organization and large government organizations in the field, at sites like Oak Ridge, Richland, and Savannah River. The technical aspects of programs and activities were, for the most part, handled by the AEC's laboratories and industrial contractors. Government organizations confined their activities mostly to contractual, budgetary, and administrative matters. The tradition of this division of functions has tended to endure, with a few significant exceptions, through the decades to the present.

As a result of this division of functions, the succeeding government organizations in AEC, ERDA, and DOE did not build up the cadres of strong technical capability "in-house" to the degree needed to provide effective technical line management direction and guidance. Lacking this essential capability, the DOE has not performed effectively as a knowledgeable and "demanding customer" (Appendix A) for the technical aspects of laboratory and contractor performance.

This deficiency in capability is especially important regarding the protection of public and worker health and safety at defense nuclear facilities and activities. Two successive Secretaries of Energy have acknowledged their personal responsibility that such protection be provided.[4,5] Yet the DOE organizations to which safety authorities have been delegated, in both Headquarters and field, do not have sufficient resources of technical personnel to exercise such authorities effectively. This deficiency has been consistently cited in comprehensive studies of DOE performance (Appendix B). For example, in a 1987 report, a committee of the National Research Council stated:

> *"The committee concludes that the Department, both at headquarters and in its field organizations, has relied almost entirely on its contractors to identify safety concerns and to recommend appropriate actions, in part because the imbalance in technical capabilities and experience between the contractors and DOE staff is of sufficient magnitude to preclude DOE from comprehensive DOE involvement in the operation of the production reactors. The committee recommends that the Department acquire and properly assign the resources and talent necessary to ensure that safe operation is being attained."*[6]

The managerial approach by DOE that was called for in this recommendation is opposed by individuals within DOE and its laboratories and contractors. The opposition is so influential and has

persisted so long that it requires discussion. In the most fundamental terms, those who object to government direction, guidance, and oversight, appear to desire a *laissez faire* relationship between the government and laboratories and contractors. They discount the value of the government providing technical direction, guidance, and oversight for organizations comprised of highly competent, carefully chosen professionals. The objections to such government activity take several forms and are based on misconceived convictions that: (1) it tends to stifle imagination and initiative; (2) it is counterproductive to have the actions of bright professionals (i.e., contractor and laboratory) questioned by those of presumably lesser intellectual endowments and experience (i.e., in government); and (3) it is uneconomical.

Those who object emphasize the overall safety record of DOE's nuclear weapons program to date, but they fail to note that the program has operated for decades with restrictions on the release of information. Thus, the public was seldom made aware of safety-related problems encountered or of conditions inimical to safety that ought not to have been allowed to exist. For example, there have been major fires at DOE plutonium processing facilities.[7] Some of these events have either gone unreported to the public, or have been explained in significantly less detail than would have been required if the veil of secrecy had been removed. One could speculate that these accidents could have had a significant impact upon the nuclear weapons program had they been fully examined with complete objectivity and in the public domain.

Safety-related problems have persisted into the 1990s. For example, the Board's Staff has made several careful reviews of the technical procedures being used by contractor personnel at Pantex in disassembling nuclear weapons. The procedures, while based on those provided by the weapons laboratory personnel, who are the technical experts for weapon operations, were being changed by personnel at Pantex without having the changes reviewed and approved by the weapons laboratory. This is unacceptable in a nuclear program. As the Board stated in Recommendation 93-1, *Standards Utilization in Defense Nuclear Facilities*,[8] "There are certain basic principles that apply to the handling of nuclear materials regardless of their form." One of these "basic principles" is that all changes to safety-significant procedures should be thoroughly reviewed and approved by the designated technical authority. Moreover, many reports sent by the Board to DOE regarding the nuclear weapons program provide vivid examples that are counter to the opinion that highly-qualified professionals, no matter how well-intentioned and dedicated, can be allowed to conduct nuclear weapons operations without independent, technically-qualified checks on the processes and procedures involved. The safety of activities involving nuclear weapons requires the government to act as a demanding customer, fully-qualified technically to assure that nuclear safety of the highest order is being achieved.

In 1988 the Secretary recognized the pitfalls of letting the contractors and laboratories operate as they had been and began to take corrective action. Reacting to the report issued by the National Research Council,[9] DOE formed the Advisory Committee on Nuclear Facility Safety (ACNFS). The goal of the ACNFS was to provide a degree of independent safety oversight within the Department.

Moreover, in that same year, Congress also took action and passed legislation that established the Board to provide external safety oversight of the DOE's defense nuclear facilities and activities.

The Board began operation in late 1989, with the aforementioned admonition from Congress regarding raising the level of technical expertise within DOE. While subsequent actions by the Board and DOE have resulted in some improvements, they have been neither comprehensive nor sufficiently effective at promoting the safety culture changes necessary at DOE activities. The single most important safety problem at defense nuclear facilities is the lack of sufficient numbers of technically-qualified DOE personnel -- both at Headquarters and in the field.

It is important to take note of a significant and potentially instructive exception to all of the foregoing, namely, the naval nuclear propulsion program (also known as Naval Reactors, or NR). Since 1949, this program has been a joint effort by DOE (or its predecessors) and the Navy. A distinguishing attribute of NR is its strong headquarters organization that is comprised of civilians and a limited number of military personnel -- all of whom are line managers responsible and accountable to the program manager. They are led by a nuclear-experienced naval officer who is given long tenure as Director. All but a few of its personnel are engineers or scientists; these technical personnel have been carefully selected for excellence in academic performance and other attributes. Field activities are managed as virtual extensions of Headquarters; heads of field organizations have extensive experience at Headquarters prior to their appointment.

The NR organization, so constituted, provides strong technical direction and guidance based on close interaction with the ensemble of laboratories, industrial contractors, shipyards, and training establishments that comprise the program. Congress regarded its safety record as outstanding; independent reviews have substantiated this opinion.[10] Thus, the program was not placed under the cognizance of the Board. Even though DOE operates the program jointly with the Navy, there is little evidence that DOE has studied the program for lessons that might be applicable to DOE's other defense nuclear programs. For a discussion of the lessons to be learned regarding personnel matters, see Appendix C.

Principles Which Should Shape DOE Technical Personnel Needs

There are three large organizations in DOE Headquarters with key responsibilities for the safety of defense nuclear facilities: two are line organizations; one headed by the Assistant Secretary for Defense Programs (DP) and the other headed by the Assistant Secretary for Environmental Management (EM). As line organizations, it is their responsibility to achieve safety. The third organization is headed by the Assistant Secretary for Environment, Safety and Health (EH). Its safety responsibilities are to: (1) independently confirm that safety is achieved by the line management organizations, (2) develop safety standards, and (3) provide "technical assistance" to line organizations concerning governmental, safety, and health matters (note that in providing such assistance there is a danger of compromising DOE EH effectiveness in making objective safety assessments of line performance). Supplementing these Headquarters organizations are many field

organizations representing DOE to government-funded laboratories and contractors at the sites. The functions of these DOE field organizations are of a line character, that is, they are supposed to be assuring that safety is achieved.

Each of the DOE organizations cited above must have appropriate levels of expertise "in-house" to provide technical guidance and direction to laboratories and contractors under their cognizance and to effectively assess the performance of the latter in technical dimensions as regards safety. To do this, technical capabilities of DOE personnel must be at a level generally commensurate with that of laboratory and contractor personnel. DOE itself has stated this in formal policy:

> *"A level of staffing and competence must be provided that is commensurate with discharging the responsibilities of the program . . . Organizations responsible for Department operations need to have . . . personnel who possess technical competence, commitment, discipline, and high standards of professional and personal excellence."*[11]

Without an equivalent level of technical competence, DOE managers cannot effectively engage in technical dialogue with their laboratory and contractor counterparts. The greater the disparity in competence, the greater the technical ascendancy the latter will have over the DOE. In such an environment, it will be difficult, if not impossible, for DOE managers to negotiate effective agreements with their contractor counterparts on safety-related matters.

There is a need to address, more specifically, the level of DOE technical competence that must be achieved. The level should be geared to the degree of technical difficulty inherent in the technology being applied and with the potential severity of the adverse consequences on public and worker health and safety that can result from misusing the technology. This is consistent with the tailored approach to safety management discussed by the Board in two recent technical papers.[12,13] Generally, the potential for adverse consequences is most acute for activities involving nuclear weapons (such as their assembly, disassembly, and maintenance). Thus, DOE technical personnel responsible for such activities should have a first-class engineering or scientific education, thorough education and training in nuclear weapons technology, and experience in the practical application of such technology consistent with effective performance of their assigned duties.

Many doubt that it is realistic to expect that such a high level of qualifications can be achieved by DOE personnel. One rejoinder to such doubts has long been available in the NR program. Objective examination of the qualifications of all personnel, both civilian and military, in this program would provide a convincing demonstration that the criteria of excellence cited above are being met -- and have been met for decades. Until a serious and consistent attempt to meet them is made in DOE's defense nuclear complex, success in this area will continue to be limited at best.

Principles Which Govern DOE's Relationship with the Board

As will be made evident elsewhere in this report, compensation for many weaknesses and shortages among DOE technical personnel has been provided in recent years by bringing the technical competence of the Board and its staff to bear directly on the problems at issue. On the positive side, it has been highly advantageous that this capability has been available. On the other hand, there is need to recognize the serious adverse effects that could result from excessive DOE dependence on the Board's technical expertise. To be able to understand these effects, it is necessary to discuss some principles which govern the relationship between DOE and the Board. These principles have been discussed by the Board in its Annual Reports to Congress.

The first is that DOE has total responsibility for the safety of its facilities. DOE must have the technical competence, in substance and not merely in appearance, to carry out that responsibility without unduly relying on the independent oversight provided by the Board. The Board has no authority to assume or share the line responsibility that DOE has for safety. The Board's function is that of providing independent safety oversight from a position outside DOE. It is, by nature, a "back-up" function. By bringing its staff to bear directly on the DOE technical problems, however, the potential exists for the Board to lapse into an assumption of aspects of DOE's functions, both line and internal oversight. This is most likely to happen in areas where DOE is technically weakest. If so, it would be accompanied by the following effects that are adverse to safety in its larger dimensions: (1) DOE would no longer be in full control of safety; (2) the independent, external back-up status of the Board would be compromised and vitiated; and (3) specific DOE weaknesses would be "papered over" and the incentive to correct them removed or lessened. In short, inordinate application of Board capability to compensate for DOE technical weakness would serve to camouflage the DOE weakness and perhaps even compound and reinforce such a weakness.

Secondly, as a well-known aphorism states, "One cannot inspect safety or quality into an activity or product from the outside." As an outside organization, it is unrealistic to expect the Board either to inspect or to assess safety into DOE defense nuclear activities. Some very specific safety improvements have resulted due to the Board's activities. However, to be fully effective and enduring, changes must result from DOE "internalizing" Board recommendations and observations and applying them across the broad spectrum of its defense nuclear responsibilities. What is to be expected is that the Board's activity will spur similar, self-initiated actions on the part of DOE line and oversight organizations.

Discussion

Evidence that a Problem Exists

As noted earlier, the Board has informed Congress, in each Annual Report issued to date, that the most important safety problem at DOE defense nuclear facilities relates to the number and qualifications of technical personnel. However, these forceful statements have not generated a commensurate degree of concern and attention in DOE and have not led to effective corrective action. In these circumstances, it is necessary to describe several matters that provide evidence that a safety problem exists. These matters will be described in summary form below. More detailed discussion is provided in appendices.

1. DOE has been slow in carrying out a set of Board recommendations that called for actions to remedy DOE technical personnel problems. In June 1993, the Board issued Recommendation 93-3, *Improving DOE Technical Capability in Defense Nuclear Facilities Programs,*[14] which provided a comprehensive set of recommendations to correct technical personnel problems within DOE. A key provision of the Recommendation is that, for each position requiring a technically qualified incumbent, a determination would be made both of the requirements for the position and of the qualifications of the incumbent; then the difference (or "delta") would be determined. Determination of these "deltas" is especially important. Objectively made, the determination will provide the following: (1) increased knowledge of the breadth and depth of the technical personnel problem on a comprehensive basis; (2) an understanding of the education and training that may be needed on an individual basis; (3) data for developing specific and general programs of education and training that may be required; and (4) a means for deciding which individuals cannot be upgraded to meet the requirements of their positions, and how to make out-placement provisions for them.

Implementation of these "delta determinations" is being initiated only now, three years after the Recommendation. While the determinations were to have been completed and remediation efforts commenced by December 1995, the "delta determination" process did not even begin until then. An important reason for this is that the preliminary steps adopted by DOE were not completed on schedule. One such step was to establish generic qualification standards for positions of varying types. At the site-specific and facility-specific level, many of these standards are still not completed. Until the "delta determinations" have been made, the Board cannot assess how objectively they have been made or whether effective corrective actions have been taken.

There are already indications that the initial DOE efforts to make these "delta determinations" may prove unacceptable. One indicator is that the sum of the qualification standard requirements (at the general, department-wide, and site-specific or facility-specific levels), once they are fully developed, may not be demanding enough, especially with regard to their technical content. Several standards are suspect for being too weak in their technical requirements; among the poorest are the important Technical Qualification Standards for the functional areas described as "Technical Manager" and "Project Management." These particular standards are simply not written to be technically oriented,

and they should be. A second indicator is that the "delta determinations" are to be made by the same supervisors who, in many cases, have already either selected the incumbent for his or her position or otherwise have assessed him or her as well qualified. A third indicator is that the technical capabilities of many supervisors are suspect, and the Technical Qualification Program does not set higher standards for these individuals. Identifying these prospective difficulties and the measures to cope with them heightens the probability of further delays in making adequate and timely determinations.

When viewed as a whole, DOE's actions to implement Recommendation 93-3 to date are not accomplishing the overall goals of the Recommendation and have been uneven in quality and effectiveness. Taken together, these indications call into question DOE's resolve to address the shortcomings identified by the Recommendation.

2. DOE has been ineffective in carrying out the recommendations of a DOE internal staffing study of personnel needs in organizations under the Assistant Secretary for Defense Programs. More than a year and a half ago DOE made a commitment to the Board, as part of the Implementation Plan[15] for Board Recommendation 93-6, *Maintaining Access to Nuclear Weapons Expertise in the Defense Nuclear Facilities Complex*,[16] to make an immediate study to determine the effect of the loss of personnel on the capabilities of the DP organization. Some eight months later, the final draft of the plan[17] stated the following:

- A requirement existed for 30 to 40 additional full-time equivalents (FTEs), in addition to the ten already approved by the Secretary;
- The personnel needed to be distributed between nuclear facility safety and nuclear explosive safety positions, to increase technical qualifications across the complex; and
- The new positions should be equally split between Headquarters and the field.

The report went on to state that the need for additional personnel was acute in both the area of Nuclear Explosive and Weapons Safety, as well as the area of Nuclear Facility Safety. Regarding Nuclear Explosive and Weapons Safety, the report stated:

> *"[A] number of phenomena point to the need to increase current levels of nuclear explosive safety-related technical expertise . . .(1) the loss by early retirement of many of the most experienced personnel in the field; (2) the need for improvements in Nuclear Explosive Safety Study (NESS) technical input documentation; (3) the requirement for more rigorous selection, qualification, training, and certification of Nuclear Explosive Safety Study Group (NESSG) participating and reviewing personnel; and (4) the need to improve compliance with the relatively new requirement to incorporate more rigorous qualitative risk assessment methodologies into the Nuclear Explosive and Weapons Safety Program. All these factors support the immediate requirement for additional personnel resources with technical expertise in the field of nuclear explosive safety and related disciplines."*[18]

When discussing Nuclear Facility Safety, the conclusions were similar. The report stated:

> *"[T]wo major areas of deficient performance were identified. The first is the slow pace of the Safety Analysis Report (SAR) Upgrade Program and the indifferent quality of the documents developed under the program. The second category of problems is the ongoing difficulties encountered in implementing and maintaining nuclear safety limits, such as Operational Safety Requirements (OSRs), Technical Safety Requirements (TSRs), administrative limits, etc. . . . Particular emphasis was placed on the SAR Upgrade Program, . . . which is hampered by a significant lack of safety analysis review capability within the Department. This has resulted in a number of adverse phenomena: (1) lack of an overall management understanding of the need for this vital safety documentation, and a subsequent drawing out of the schedule for completion thereof; (2) absence of a technically competent review capability for SARs and other safety-related documentation, resulting in further delays and the inability to perform adequate quality assurance; and (3) as a consequence of both of the above problems, inconsistent and inadequate technical direction being provided to contractors . . . significant and ongoing problems exist with implementation of new and existing safety and operating limits in the field. These problems can be directly tied to insufficient levels of talent in the DOE field organizations. Some of these problems include: (1) OSRs/TSRs for facilities that cannot be followed as written, . . . (2) the required periodicity for OSR/TSR surveillances is often not met; and (3) non-safety significant requirements are sometimes mixed in with safety significant requirements leading to a diminution of impact. These contingencies continue to persist because of insufficient numbers of qualified [DOE Facility Representatives] and inadequate levels of technical expertise for them to fall back on within the DP organization."*[19] [Emphasis added]

Nearly a year has passed since DP completed its first draft of this staffing study and briefed the Board on its contents. Since then the Board has learned that DP has hired only eleven safety-related personnel (i.e., one person more than the original ten authorized by the Secretary); nowhere near the 30-40 additional FTEs noted earlier. Further, it required eight months for DOE to provide the Board with a formal copy of the DP Staffing Study, which was a deliverable under the Board's Recommendation 93-6. The Study delivered was couched as a proposal to DP and DOE management. To the Board's knowledge, it has not been formally accepted by either. These facts highlight DOE's lack of resolve in executing the findings of the study.

3. A large number of on-site assessments made by the Board's staff have shown a lack of technical qualifications among DOE personnel. Assessments made by the Board's staff at defense nuclear facilities often include evaluations of the qualifications of DOE personnel. Such assessments are then sent as trip reports to cognizant DOE officials. For example, in mid-1993 the Board apprised DOE of problems at the Amarillo Area Office (DOE-AAO) as follows:

". . .there have been only modest advances in the program to identify appropriate training in the areas of nuclear engineering and nuclear safety required for Field Office and Area Office personnel and there is no plan to acquire that training and education. This condition is particularly apparent at the Amarillo Area Office where there is a relative lack of personnel with nuclear engineering experience and training."[20]

A year later the following further comments were made in a letter to the Secretary regarding the Amarillo Area Office:

"The Board wishes to call your attention to staffing deficiencies at the Amarillo Area Office ([DOE-]AAO) that are adversely affecting the performance of safety-related functions assigned that office."

"Even with these [vacant senior manager and engineering positions] filled, it is not evident that sufficient technical and management competence in middle management and staff at the [DOE-]AAO will be available to support the pace of activities at the site."[21]

It is pertinent to point out that the Amarillo Area Office is the DOE field office located at the Pantex plant where nuclear weapons are assembled and disassembled.

Prompted by these two reports, and constant pressure from the Board's Site Representatives, DOE-AAO did take action and a number of new facility representatives have been hired; a senior technical advisor to counsel the DOE-AAO Manager on technical matters has been hired, and a senior nuclear engineering professional has been hired, who has contributed substantially on safety-related matters at the site.

Another recent example is the Board's Recommendation 94-4, *Deficiencies in Criticality Safety at Oak Ridge Y-12 Plant*,[22] concerning criticality* safety and conduct of operations deficiencies at the Y-12 Plant in Oak Ridge, Tennessee. One portion of that Recommendation focussed on the performance of DOE site office personnel. Since the issuance of Recommendation 94-4, the DOE Oak Ridge Operations Office has taken significant measures to upgrade the technical expertise present at its Y-12 Site Office (DOE-YSO). Six new facility representatives have been hired and an experienced criticality safety specialist has been brought in to oversee contractor efforts in this important area.

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* 'Criticality' is that condition in which an assembly of nuclear material is capable of producing a self-sustaining or divergent neutron chain reaction.

Both the DOE-YSO and DOE-AAO examples clearly indicate that, where DOE managers make a personal commitment to increase the technical capability of their organizations, significant progress can be made. It is important to remember, however, that both of these instances of technically weak staffs were identified by the Board and its staff -- neither case was identified or acted upon by DOE itself. This failure is a technical competence issue in its own right.

Excerpts from Board's staff trip reports that address similar technical personnel problems at several other field offices are provided in Appendix D.

4. DOE managers were ineffective while hiring large numbers of technical personnel in 1994 and 1995. As noted earlier, Congress called on the Board to "raise the level of technical expertise in DOE substantially." DOE managers of defense nuclear organizations should, of course, have adopted this same objective in hiring personnel. They appear not to have done so in 1994, when DOE hired 950 individuals to fill positions in organizations responsible for defense nuclear activities. The Board's staff and its outside experts analyzed the qualifications of 445 of these "hires," using qualifications described by their resumes and other documents. They compared the qualifications of each with the requirements of the position for which the individual was hired. The result of such analyses showed a normal statistical distribution about a mean of only average capability for the population.

Closer examination of 1994 hires by grade level reveals another characteristic of the hiring process that was highly counterproductive with respect to raising the level of DOE technical expertise. If one examines the distribution of the sources of hires among grade levels, it is clear that in the higher grade levels (Senior Executive Service, GS-15, and GS-14), the most hires, by a very wide margin, were either promotions or lateral transfers within DOE (Figure 1). An increase in technical expertise was not achieved either by promoting individuals of marginal (average) capability or by transferring them from one position to another. Moreover, a valuable opportunity was lost. If DOE had used the opportunity to hire individuals of outstanding capability, the beneficial effects would have been twofold: (1) the individuals would have raised the level of technical expertise as reflected in individual contributions, and; (2) from positions of higher responsibility, they would have increased the effectiveness of existing cadres.

One is obliged to conclude that the DOE managers involved misused a large opportunity to "raise the level of technical expertise in DOE substantially" and, instead, augmented its numbers with those of average qualifications. The following are excerpts from the study made by the Board's Staff (Appendix E):

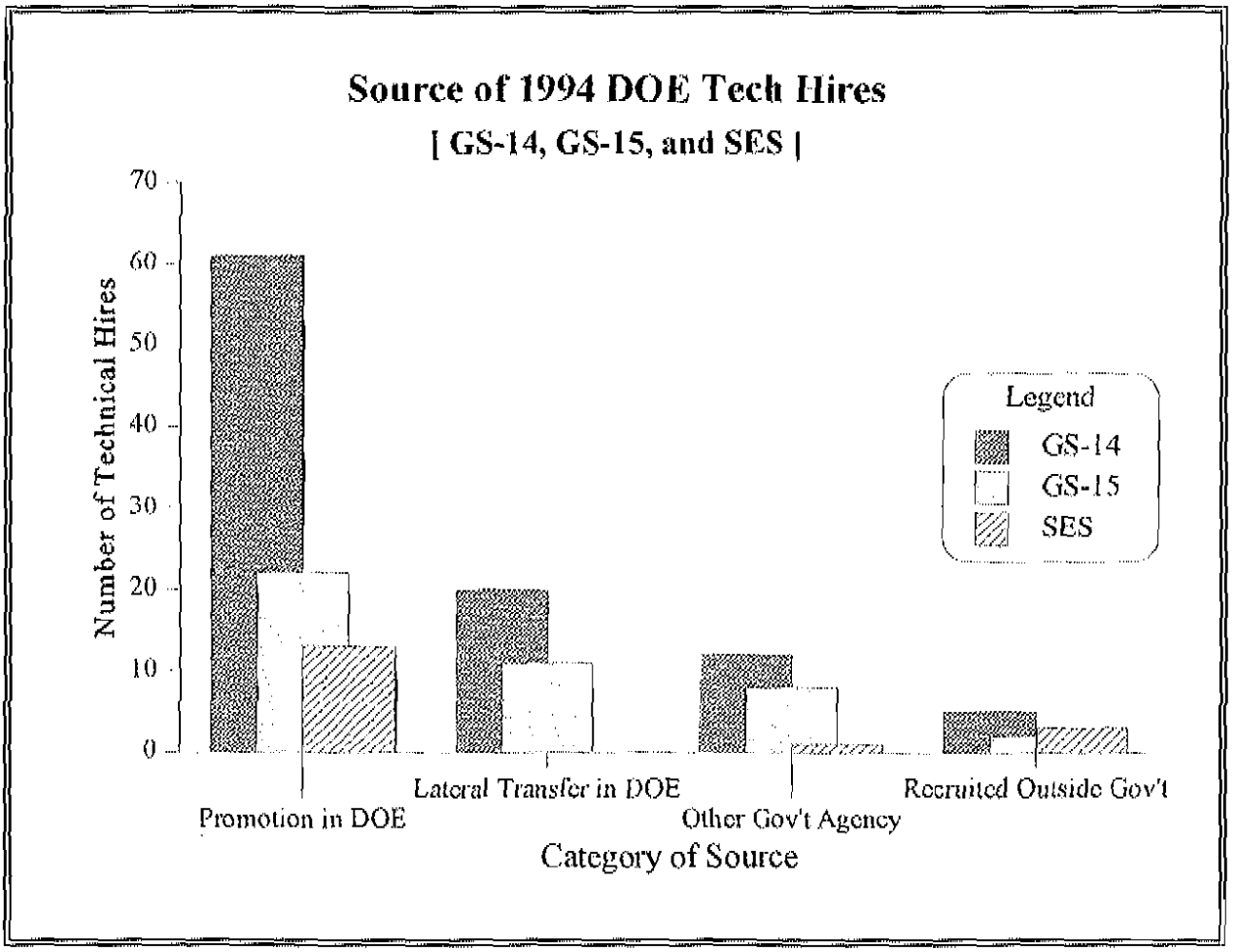

Figure 1

"DOE failed to take advantage of the unique opportunity this hiring authority provided to substantially raise the technical capabilities of the DOE staff.

- *Overall DOE hiring practices did not result in hiring a significant number of technical personnel who were highly qualified; no excepted service personnel were hired.* [Emphasis added.]

- *The technical applicant screening process used by DOE in 1994 tended toward selection of minimally qualified candidates, selection of highly qualified candidates occurred with no greater frequency than that expected through a random process.*

- *The selection process for those technical individuals hired by DOE in 1994 did not adequately emphasize the quality of candidate technical education."*

The data indicate that Board efforts to encourage DOE to raise the technical expertise of the Department through acquisition of technically qualified individuals were not effective in 1994. A briefing was given by the Board to the Assistant Secretary for Human Resources on the results of this study. Thus far, there has been no comment from DOE that questions the analysis, nor evidence that DOE itself has made a comparable study. Moreover, a subsequent analysis by the Board's Staff of 470 DOE hires covering the first three quarters of 1995 indicates that the level of competence is below, or at least no better than that for 1994.

Unfortunately, there is reason to doubt that the DOE managers understand the impact of their actions. For example, DOE's report to Congress on its 1994 activities includes the following:

> *"The Office of Environmental Management has aggressively pursued staffing 850 positions allocated to the field to support safe and efficient site operation. As of the end of December 1994, almost 600 of these positions had been filled from a qualified national pool. For positions at the GS-15 level or higher, a process was developed which involved the selecting official, field office Assistant Manager mostly affected by the position, and the appropriate Deputy Assistant Secretary in Headquarters. This process was approved by the Assistant Secretaries for Environmental Management and Human Resources as well as the Associate Deputy Secretary for Field Management. The Office of Environment, Safety and Health has filled 35 of their 100 new allocated positions. Most of these new hires will assist the contractor oversight function, and these personnel will be permanently stationed at 13 field locations."*[23]

The impression created by this report is that DOE believes it has done well in increasing its technical competence for the future when, in fact, it has exacerbated an existing, serious problem.

5. DOE has relied on the Board to an inordinate degree for technical guidance and assistance. There are many ways in which DOE has done this. For example, DOE has: (1) failed to identify many safety problems and to initiate corrective actions before the Board had to call them formally to the attention of the Secretary; (2) demonstrated undue difficulty in planning and scheduling specific corrective actions in response to Board recommendations and safety-related initiatives, in general; and (3) has frequently had difficulty in carrying out agreed-upon actions on schedule.

By the end of calendar year 1995, the Board had issued 33 formal recommendations. Most of them addressed important safety problems of a broad or generic character; that is, they were either applicable to many facilities and activities, or should have been perceived by DOE as such. If DOE had identified these problems, and if it had begun to take responsible corrective action, then the Board, in most instances, would not have felt compelled to make a recommendation in the first place.

Thus, a Board recommendation is a primary indication that DOE did not have the technical experience to recognize the problem identified, the technical personnel to correct it, or both. The problems that led to most Board recommendations were neither technically difficult nor managerially complex. Even a limited technical capability coupled with forceful management should have sufficed to recognize the need for corrective measures and set them in motion (Appendix F).

DOE has had difficulty in developing the Implementation Plans that the Secretary is required to submit to the Board for each Recommendation. For instance, Recommendation 90-2, *Design, Construction, Operation and Decommissioning Standards at Certain Priority DOE Facilities*,[24] which was issued in March 1990, called for DOE to do the following for high priority nuclear facilities and activities: (1) identify the applicable nuclear safety standards; (2) evaluate their adequacy; and (3) assess the extent to which they were implemented. This was not a difficult job from a technical perspective; yet, DOE made five unsuccessful attempts to develop an Implementation Plan before one was finally accepted by the Board. In the end, the Board found it necessary to provide DOE the assistance of its own Technical Director and General Counsel in order to get progress. It took more than four years to develop an acceptable plan.

The Implementation Plan for 90-2 has not been carried forward effectively for several reasons, which include, but go beyond lack of technical expertise. Simply put, DOE does not yet have the demonstrably adequate, standards-based safety program envisioned some six years ago. This has caused the Board to issue a follow-on to 90-2, Recommendation 95-2, *Safety Management*.[25] In 95-2 the Board noted that an important attribute of the integrated safety management program which DOE is now trying to put in place is that it establishes a clear need for DOE technical expertise even beyond that which the department now has "in-house." The inevitable result will further exacerbate the technical personnel problem.

6. Radiological protection as prime example of inadequate levels of technical expertise within DOE. Further evidence that a problem exists relates to Recommendation 91-6, *Radiation Protection for Workers and the General Public at DOE Defense Nuclear Facilities*,[26] which addresses the many deficiencies in DOE's radiation protection program. In a situation similar to that illustrated for Recommendation 90-2 above, DOE proved incapable of putting together an Implementation Plan acceptable to the Board, without the assistance of senior members of the Board's staff.

One provision of Recommendation 91-6 was that DOE establish a board of outside experts to review its radiation protection program. DOE established such a committee, led by Dr. John W. Poston, Sr., which reported the results of its study to DOE in January 1995.[27] The report drew important attention to the lack of technical expertise in radiation protection in DOE. The following excerpts relate to technical personnel problems:

- *"There seemed to be no correlation between contractor activities, number of sites, number of contractor personnel, etc., and the number of individuals responsible for radiation protection. In some cases, the expertise in*

radiation protection actually was vested in the support contractor personnel instead of the responsible Department staff." [Emphasis added]

- *"The team noted instances where support contractor staffing significantly exceeded the Department staffing. Such a heavy reliance on support contractor assistance could lead to delegation of responsibility and authority which is not consistent with the Department policy nor in its best interest."* [Emphasis added]

- *"The team noted a propensity for hiring individuals from within the Department complex or from other government agencies to fill positions in the radiation protection organization. The team concluded that, in some cases, individuals hired into the positions were not necessarily qualified to function effectively within a radiation protection organization."*

- *"In contrast to contractor organizations, the team concluded that, in DOE, training often has been used as a substitute for the appropriate educational background in radiation protection."*

- *"The team recommends that qualified radiation protection personnel be allocated to meet the strategic goals of the Department and the radiation protection plan. Each position related to radiation protection should be clearly definable by job title, qualifications (i.e., education) and experience, and job-specific requirements. Each incumbent should meet all of the requirements for the position. This information should be documented and maintained within each organization."*[28]

Finally, almost a year after the Poston Committee submitted its report to DOE, the Board received a formal briefing of the DOE's Management Action Plan that responded to the Committee's recommendations. The proposed action plan did not adequately address or outline actions to be taken to eliminate staffing deficiencies concerning DOE personnel with radiological protection responsibilities.

Another review[29] of the numbers and quality of personnel in DOE's radiation protection program also revealed many deficiencies. The defense nuclear complex consists of at least 10 major and numerous minor sites around the country. To protect their workers and the public at these sites, DOE contractors employ more than 3400 radiation protection personnel (more than 1300 of them at the management or supervisory level).[30] DOE is attempting to manage this program with just 44 full-time positions at these 10 sites,[31] though DOE recognizes this as unrealistic. A report by the Senior Radiological Protection Officer of DOE's Office of Oversight states that these 44 positions "represent an insufficient Federal resource . . . ."[32]

The problem goes beyond that of numbers; it concerns quality also. As of mid-1995, the DOE Office of Oversight report showed that only four of DOE's 44-person site radiation protection staff have been certified by the American Board of Health Physics. These four individuals focus their activities at three DOE sites; therefore, most sites have no certified radiation protection professionals among the federal ranks. By contrast, DOE's contractors average about ten certified radiation professionals at each major site. Delving deeper into the qualifications of the 44 DOE personnel discloses an even bleaker picture. A sampling indicates that 17% of the DOE professional radiation protection staff do not have a college degree; another 17% have a bachelor's degree, but not in a technical major. Thus, the sampling suggests that a minimum of one-third of the DOE radiation protection program personnel do not have the strong educational background needed to cope effectively with the agency's problems.

Radiation protection is integral to protecting the health and safety of the public and workers. However, DOE does not presently have the technical expertise "in-house" to provide adequate technical direction for the radiation protection programs at its various sites. Ongoing and planned activities, such as processing radioactive wastes, decontaminating systems and facilities, and completing environmental restoration present the possibility for increased levels of radiation exposure unless rigorous "as low as reasonably achievable" (ALARA) practices are instituted. Such practices presuppose that an adequate level of radiation protection expertise exists within DOE.

There is no better or clearer example of DOE's inattention, or lack of dedication, to its responsibilities for providing adequate numbers of technically qualified personnel than this one in radiation protection, which is paramount to worker and public safety.

7. Summary. The above evidence points to a problem of major proportions regarding DOE technical personnel associated with defense nuclear activities. Since the problem concerns the safety of activities at defense nuclear facilities, this evidence should raise doubts of sufficient magnitude to bring about a thorough inquiry into the matter and the promptest possible corrective action.

Apparent Causes of the Problems

Many causes can be cited for the lack of sufficient numbers of fully qualified DOE technical personnel in defense nuclear facilities. Most are longstanding cultural problems. A substantial number are interrelated.

1. Disposition among DOE managers not to regard strong technical education and experience as essential. Board Members have, from time to time, discussed the technical personnel problem with DOE managers. These discussions have left the impression that many DOE managers believe that management qualifications are sufficient unto themselves to enable one to manage nuclear activities effectively, despite a lack of solid technical credentials. This belief has been discredited in the commercial nuclear power industry and in other mature nuclear programs. For example, an important effect of the establishment of the Institute of Nuclear Power Operation (INPO) has been

to raise the level of technical competence among utility organizations that own and operate commercial nuclear power plants.

2. Some managers appear to believe that safety responsibilities, which accrue to DOE by law, can somehow be made to devolve upon laboratories and contractors. Because of a lack of technical competence, DOE technical managers have attempted to abdicate their safety responsibilities by allowing those responsibilities to be transferred to their laboratories and contractors. Belief in the efficacy of such an arrangement is the counterpart of the conviction that DOE managers of technical activities need not have strong technical credentials. An independent study of the National Research Council, in 1987,[33] criticized DOE for relying on laboratories and contractors as a substitute for DOE technical expertise. However, as pointed out elsewhere in this report, DOE policy seems to be to increase this dependence on laboratories and contractors in safety-related matters.

This DOE tendency is deeply ingrained; it represents a tradition of reticence with respect to providing authoritative technical direction to its laboratories and contractors and to holding them accountable to execute such direction, once provided. The tendency stems, in important part, from the disparity in technical capability between DOE and these contractor organizations. DOE Orders and standards are also often impacted, with the DOE role being described as "provide oversight;" which is open to broad interpretation varying from an active to a passive role.

3. Lack of understanding that, in nuclear activities, accidents of disastrous proportions can be triggered by incidents of seemingly small consequence. Many key DOE management personnel do not have technical education and experience. Therefore, they do not have a sufficiently developed understanding of how apparently small lapses in discipline of operations, departures from safety standards, and malfunctions of apparatus can often have serious safety consequences. The remedy for such deficient understanding is developed through reflection upon the two most recent large nuclear accidents, Three Mile Island and Chernobyl. Neither of these was caused by one large error -- both were the consequence of a number of minor failures, exacerbated by technical and management misjudgements. Managers who lack an appreciation for the major consequences that can result from minor deficiencies cannot adequately judge the impact of inadequately qualified technical personnel upon nuclear program activities.

4. Impediments to out-placing DOE personnel found deficient in technical qualifications. Within DOE it is generally regarded as extremely difficult to remove personnel whose background or performance is deficient. This opinion has been voiced to the Board by senior DOE officials on a number of occasions. With time, therefore, the number of poor performers increases. The problem becomes acute when a remedy of adding qualified personnel is foreclosed or circumscribed by budgetary constraints. A provision of Recommendation 93-3, and a premise of the DP Staffing Study[34] was that DOE would develop a method of addressing this problem. Now, some three years later, it appears DOE has done little about it.

5. Failure to heed the lessons learned from Three Mile Island. In the aftermath of Three Mile Island, the DOE conducted a comprehensive self-assessment of the safety of DOE nuclear reactors.[35] In the letter to the Under Secretary which forwarded the report, the chairman of the study committee wrote, "A paramount need is to increase the number of technically qualified personnel in both headquarters and field organizations." The report also recommended a study similar to that completed for reactor safety be made of the safety of DOE nonreactor nuclear programs. The recommended study, which presumably would have included defense nuclear facilities, was not made. DOE thus missed an opportunity, beginning in 1981, to systematically build up its technical manpower capabilities in nuclear programs to an appropriate level.

6. Failure to understand that the added costs of achieving excellence in the technical qualifications of personnel are relatively small. There are costs associated with maintaining technical cadres of individuals with high competence. They include potentially higher salaries, costs of formal education, costs of practical training, etc. Such costs will not seem worth the price to those for whom budgetary considerations transcend all others. However, these costs are not inordinate. For example, for the past two fiscal years, the Board's own educational and training expenses have been less than one percent of their obligations; yet this level of expenditure has permitted the Board to maintain a staff that is recognized as highly-qualified and continues to grow in educational qualification.

7. Unjustified confidence engendered by lack of serious weapons accidents to date. The lack of a significant number of weapons accidents to date in DOE nuclear activities contributes to an attitude that the *status quo* is sufficient to ensure against their happening in the future. This attitude is analogous to that in NASA's space program before catastrophes struck (such as Apollo One and Challenger), and in the commercial nuclear power program before Three Mile Island. Likewise, the numbers of significant incidents that might have become accidents at defense nuclear facilities have not been used as a countervailing measure to eliminate this attitude.

Few in DOE are now aware that there have been two major fires at the Rocky Flats Environmental Technology Site (previously called the Rocky Flats Plant) -- one in 1957 and the other in 1969.[36] The first fire started when metallic plutonium casting residues spontaneously ignited in a glove box. The fire spread to an exhaust filter plenum, consumed a considerable quantity of filter, and damaged the duct work and fan system. The fire burned for about a day. Plutonium was spread throughout most of the building and a portion was probably released through the exhaust system. The second fire started in a glove box in a plutonium foundry line. The fire burned for about six hours, spreading combustible material in several hundred interconnected glove boxes in the building. The damage to the building and equipment was extensive and the building was grossly contaminated with plutonium. The Atomic Energy Commission estimated that the financial loss for the damage to buildings and equipment, including the cost of decontamination, was about $1 million for the 1957 fire and $45 million for the 1969 fire.[37]

Other documented examples from DOE history include: detonations in shaping high explosives for nuclear weapons;[38] numerous criticality excursions in the processing of nuclear materials, one as recently as 1978;[39] and problems during nuclear weapons dismantlement that have led to facility contaminations that have yet to be restored.[40] Each of these occurrences was investigated by DOE (or its predecessor agencies) at the time, and corrective actions were taken. However, the continued occurrence of problems of this nature points to an ongoing need for an aggressive, technically competent DOE federal workforce.

8. Unwillingness by DOE personnel to look for guidance beyond defense nuclear programs. The programs that guard against accidents in defense nuclear activities such as assembly and disassembly of nuclear weapons should embody only the best methods of selecting, educating, and training personnel, the best technology, and the best management methods and techniques. It may be that laboratories and contractors systematically look beyond their own organizations to learn from others, but DOE organizations tend not to. As noted earlier, the NR program has had an outstanding record of safety for decades. The organization is especially well known for its success in selecting, educating, and developing government personnel (both military and civilian) who conduct the program. Key DOE officials have been repeatedly urged by the Board to study this program for lessons to be learned in technical management practice.

9. Difficulties of attracting technical expertise to DOE. A difficulty sometimes mentioned as contributing to the DOE technical personnel problem is that DOE has trouble attracting expertise. The problem has two aspects: DOE's poor reputation for hiring technical expertise and using it effectively, and the potentially limited supply of nuclear-trained personnel with the requisite qualifications.

There are many examples of government organizations effecting a major reform to develop excellent "in-house" technical talent. An especially relevant one is the major overhaul carried out by DOE's predecessor, the AEC, in its civilian nuclear power program. The demand for the overhaul came from the Joint Congressional Committee on Atomic Energy.[41] It was effected with the guidance and support of Commissioner Ramey and under the outstanding leadership and technical guidance and direction of Mr. Milton Shaw. A distinguishing feature of the revamped program was a highly competent "in-house" capability for technical management of a wide-ranging breeder reactor program that involved many laboratories, reactor plant manufacturers, architect-engineering firms, and utility companies. The government talent was assembled by aggressive recruiting, using high standards, notwithstanding the poor reputation of the AEC for technical competence in matters relating to reactor development.

AEC was competing with the commercial nuclear industry for talent during a period of high demand for the then-limited number of nuclear-qualified personnel. The difficulty today is no greater than it was then. Moreover, DOE is competing for expertise against these same kinds of organizations as AEC was. So, too, are government organizations like the Nuclear Regulatory Commission and the Board itself. Starting with no staff at all, the Board has assembled an outstanding one. As an

indication of the Board's technical talent, 20% of the technical staff hold degrees at the Doctoral level and an additional 64% have Masters degrees. Moreover, most technical staff members (except interns) possess practical nuclear experience gained from duty in the nuclear weapons field, the commercial reactor industry or the U.S. Navy's nuclear propulsion program. The key to assembling such a highly qualified technical staff is senior management attention to the task. Acquisition, maintenance, education, and training of a highly qualified staff have been among the highest priorities, one to which Board Members have given close and continuous, personal attention. Board Members themselves review applications for employment. Board Members and the Technical Director interview each applicant seen as meriting such consideration. On several occasions senior Departmental managers have committed to applying similar effort and rigor to their recruitment programs.* The results achieved, to date, do not reflect such a commitment.

But there have been isolated successes, within DOE itself, as mentioned previously. It is particularly instructive to examine in more detail the case involving DOE-YSO. On September, 27, 1994, the Board issued Recommendation 94-4, *Deficiencies in Criticality Safety at Oak Ridge Y-12 Plant.*[42] The subject of the technical competence of Federal staffing at DOE-YSO was integral to this Recommendation, which stated, in part:

> *"(3) DOE should evaluate the experience, training and performance of key DOE and contractor personnel involved in safety-related activities at defense nuclear facilities within the Y-12 Plant to determine if those personnel have the skills and knowledge required to execute their nuclear safety responsibilities . . ."* and
>
> *"(4) DOE take whatever actions are necessary to correct any deficiencies identified in (3) above in the experience, training, and performance of DOE and contractor personnel."*[43]

The Board reiterated its concerns regarding technical staffing at DOE-YSO during a public meeting held at Oak Ridge in November of 1994.[44]

In response to these Board actions, the Manager of the Oak Ridge Operations Office negotiated with DOE Headquarters and was immediately granted permission to advertise and fill five safety-related positions. The Recommendation 94-4 Implementation Plan (IP)[45] committed DOE to follow up with detailed reviews of the staffing requirements in DOE-YSO. Within six months after the Board had issued this Recommendation, through a combination of nationwide advertising/hiring and DOE reassignments, DOE-YSO was able to add eight new, technically competent personnel. These personnel had extensive nuclear backgrounds and technical degrees -- clear indications of the type of personnel available if aggressive hiring measures are taken. In fact, the DOE-YSO Manager noted

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* For example, testimony of the Honorable Victor Reis, DOE Assistant Secretary for Defense Programs, to the Board at a Public Hearing, December 6, 1994.

that the response to the nationwide advertisements placed in trade journals was overwhelming, and resumes from this effort have been provided to other field offices trying to fill safety-related positions.

Subsequent to these initiatives, a training assistance team (TAT) was formed in accordance with the Recommendation 94-4 Implementation Plan, visited Oak Ridge in August 1995, and evaluated the technical competence of key federal personnel supporting the Y-12 Plant. The TAT found the following:

> *"[T]he base level of key Federal personnel technical expertise and competency at the Y-12 Site has significantly increased since the September 1994 event."*
>
> *"Needed technical expertise has been added to . . . Y-12 Site Office. Significant enhancements include the addition of Facility Representatives, improvements in technical support to the Facility Representatives, and improvements in communication of issues and concerns to the contractor."*[46]

DOE-YSO's efforts to augment staff technical expertise are a good example of what can be accomplished when dedicated management utilizes all of the tools at its disposal. In the short space of seven months DOE-YSO, working with both DOE Headquarters and the Oak Ridge Operations Office, advertised, screened, and selected eight personnel. Probably most striking is the fact that DOE-YSO was able to almost double the number of technically degreed personnel in the office by filling these eight positions. These personnel changes did, in the words of the Board's tasking from Congress, increase their expertise "substantially."

10. Summary. From the above, it is evident that the difficulty in hiring technically competent personnel perceived by DOE does not hold up under serious scrutiny. DOE apparently has yet to learn that acquisition of nuclear expertise requires three things: (1) recognition by top management that it is needed, (2) high personnel standards, and (3) the willpower to consistently push personnel acquisition as a high priority issue. DOE management appears, based on the above, to have problems in all three areas.

Consequences of the Problem

There are many serious, adverse consequences of the lack of sufficient numbers of technically qualified DOE personnel who are responsible for the safety of its defense nuclear facilities.

1. DOE is unable to carry out its safety responsibilities. Without enough qualified personnel DOE is unable, with the degree of effectiveness necessary to protect public and worker health and safety, to do the following: provide technical guidance and direction to laboratories and contractors, develop safety standards, know whether laboratories and contractors have assigned fully competent personnel and are otherwise performing effectively. Simply stated, DOE cannot act as a knowledgeable and demanding customer who is fully qualified to require the laboratories and

contractors to safely deliver the product and the performance for which they are being paid. DOE is forced to fall back into a relationship in which technical matters are left preponderantly in the contractors hands and into a reliance on external oversight by the Board. In matters of public safety, especially nuclear safety, this amounts to an abdication of responsibility.

2. DOE has resorted to the use of a surrogate to manage DOE contractors at the Rocky Flats Environmental Technology Site. For many years, the DOE and its predecessors proved unable to obtain effective safety performance from contractors at the Rocky Flats nuclear weapons plant. In 1995, DOE established a new contractor, Kaiser-Hill, at the site for the purpose of "integrating" the activities of other contractors there. This has the effect of interposing an additional layer of management between DOE and the contractors doing the work. It apparently presumes that DOE itself does not have the technical personnel needed to manage the site.

3. Sound safety management relationships are distorted among laboratories, contractors, DOE organizations, and the Board. Fundamental safety principles mandate that responsibility for achieving safety lie only with one organization -- the line organization, and that nothing should be allowed to vitiate that responsibility. This is fully consistent with the Secretary of Energy's own position, transmitted to the Board in response to a May 6, 1994, reporting requirement,[47] wherein DOE states,

> *"The fundamental principle governing safety management is that line management has full responsibility and authority for the safety of the facilities."*[48]

Within DOE that line extends from the Secretary to the Assistant Secretaries, to the operations officers in the field, and on to the laboratories and contractors. A backup to the line is provided by an internal safety oversight organization under the Assistant Secretary for Environment, Safety and Health.

Properly manned and managed, these two types of DOE organizations taken together must become sufficient in and of themselves for protecting public health and safety. Because they were not, Congress established the Board and placed it outside the DOE. Referring back to earlier discussion of the Board's functions, the Board provides independent external oversight of safety at defense nuclear facilities. In effect, it provides a second layer of safety oversight. Assessing the performance of both the DOE line organizations and the DOE internal oversight organization, the Board makes recommendations to the Secretary or provides other assistance to correct safety deficiencies.

The Board assesses whether these DOE organizations maintain their independence from one another. If independence is compromised and DOE's internal oversight organization becomes a surrogate for DOE's line management, then the potential exists for the internal oversight organization to be assessing their own efforts and their function as a safety backup to line management is no longer being performed. This independence must be maintained, not only by the manner in which line management functions are assigned formally, but also by the manner in which organizations interact with one

another. The most important threat to safety occurs when both the DOE line and internal oversight perform ineffectively. When these circumstances occur, they could result in Board actions whose effect is to compensate for DOE inaction or lack of competence. The interests of safety may well be served in that particular instance, but there are adverse effects such as: (1) the Board's action will conceal DOE weakness and thereby deprive DOE management of the opportunity to correct it; (2) the proper function of the Board as a second layer of safety oversight will have been compromised.

Two examples will illustrate the principles and problems involved -- one was encountered soon after the Board began operation and the other has lasted over a longer period. The Board's first Recommendation (90-1)[49] called attention to serious deficiencies in the training of operating personnel for the K-Reactor at the Savannah River Site. (It will be recalled that poorly trained operators contributed to the serious reactor accidents at Chernobyl and Three Mile Island.) It should have sufficed for the Board to make its Recommendation, which prescribed a clear course of corrective action in specific steps. However, DOE personnel were not competent enough to complete the tasks from there. Board Members, staff, and its outside experts had to devote extensive efforts to seeing that the contractor carried out the much needed operator training and qualification programs. With its small resources thus tied up at the Savannah River Site, the Board and its staff could not give as much attention to other sites as it otherwise might have.

Moreover, the Board soon discovered that DOE had not profited from the lesson it should have learned at K-Reactor. As other facilities at the Savannah River Site were being readied for operation, the Board repeatedly found it necessary to use its own personnel to make sure that operators were properly trained and qualified. The Board was spending too much time doing work that was DOE's responsibility, but which DOE was not doing due to a lack of qualified technical personnel.

The second example is the lack of technical expertise in radiological protection in the DOE Richland Operations Office at the Hanford Site (DOE-RL). In 1990 a DOE Tiger Team reported that "[d]ue to inadequate resources, DOE-RL health physics branch is not able to provide adequate oversight of contractor nuclear facilities."[50] [Emphasis added] This problem was among other major radiological protection problems identified by the team, "such as poor radiation protection practices and lack of disciplined operations, [which] have been identified in many ways and have been known for years."[51] These deficiencies have been repeatedly confirmed in assessments made on site by the Board's Staff. At least seven reports of the results were formally transmitted DOE by the Board between May 1992 to August 1995. In November 1995, a team from the Board's Staff again confirmed that the problems cited above continue.

It is clear from the above reports and from personal observations by both Board Members and the Board's staff that DOE-RL has not acquired sufficient numbers of well-qualified radiological protection personnel, nor have they properly motivated managers and supervisors to become actively involved with radiological work and safe work practices. Further, despite continuous acknowledgment that this problem exists, DOE's internal oversight organizations have been unable to force the line management organization to take effective corrective action. This has severely

hindered the establishment of a work environment at the Hanford Site that properly recognizes radiological safety. Unless upgrading of technical competence at DOE-RL is aggressively pursued, a safety-conscious work environment fully prepared to cope with problems of radiation exposures will not be achieved.

On October 25, 1995, the DOE-RL Operations Office Manager acknowledged in a memorandum that "[m]ost contractor radiological engineers and radiological control technicians, and [DOE-]RL and contractor personnel do not possess sufficient education, experience, and training in the areas of health physics and radiological controls principles to effectively carry out their assigned responsibilities, without professional health physics support."[52] However, as of the end of 1995, no effective action had been taken to provide it. As a consequence, serious deficiencies continue to exist at the Hanford Site.

Among the points to be emphasized here is that even a large investment of Board resources will be unavailing if DOE lacks the will and the expertise to bring about corrective action. In the case of inadequate radiological expertise at DOE-RL, neither the line organizations in EM Headquarters and DOE-RL, nor internal safety oversight in EH, have carried out their responsibilities effectively.

Efforts to Correct the Problem

1. Recommendations that specifically target the personnel problem. The principal means that the Board has for effecting safety improvements is through the formal recommendations that it makes to the Secretary. By the end of 1995 it had made thirty-three. Of these, twelve included recommendations directed toward strengthening the technical capabilities of DOE personnel.

For example, the most recent Board Recommendation, 95-2, *Safety Management*, describes a specific problem of technical expertise and recommended action as follows:

> *"We recognize that the various DOE organizational units which may be delegated review and approval authority for S/RIDs* [Standards/Requirements Identification Documents] *and associated Safety Management Programs may not have enough individuals with qualifications in the technical specialties required to carry out effectively the streamlined process being recommended. This means that technical assistance may need to be retained from elsewhere to compensate for such personnel deficiencies where they exist. It also means that DOE may need to augment its own technical expertise so as not to be obliged to continue indefinitely to rely on technical assistance from outside DOE."*
>
> *". . . Therefore, the Board recommends, that DOE:*

5. *Take such measures as are required to ensure that DOE itself has or acquires the technical expertise to effectively implement the streamlined process recommended."*[53] [Emphasis added]

Pertinent personnel-related extracts from other Board recommendations are included in Appendix G.

As noted elsewhere, it is the practice of the Board to send DOE reports of assessments made by the Board's Staff and outside experts at DOE sites. Many of these have cited specific deficiencies among DOE personnel. Having evidence that these and other measures were not bringing about the corrective measures needed, the Board sent the Secretary Recommendation 93-3, which called for comprehensive actions across the full range of DOE technical personnel problems. DOE has taken a number of measures called for by its Implementation Plan for Recommendation 93-3; however, they have not brought about the results intended by the Board in issuing the Recommendation.

2. Excepted Service Authority. In particular, DOE's efforts to attract and retain highly technically competent scientists and engineers in response to this Recommendation have been unsuccessful. In a market of limited numbers of highly competent nuclear technology personnel, it has long been evident that government agencies have difficulty hiring and retaining such personnel under the Civil Service System. Thus, the AEC, ERDA, and the Nuclear Regulatory Commission (NRC) all were granted excepted service personnel authority to hire outside the Civil Service System. When the Board was formed, one of its early, high-priority actions, based on the above and other precedents, was to seek and acquire its own excepted service personnel authority from Congress -- it has proved essential for hiring outstanding technical staff.

DOE retained such authority in limited form (i.e., for 200 positions) when it succeeded ERDA, but made no effort to use it. Recognizing that DOE not only needed to use its existing statutory authority, but also needed to expand such authority, the Board recommended (as part of Recommendation 93-3) that DOE seek the necessary legislation. DOE accepted the Recommendation, but showed little initiative and interest in using the available excepted service personnel authority or in acquiring the legislation to expand this authority until prodded and assisted by the Board. Moreover, having acquired the authority for a total of 400 excepted service hires, DOE has been ineffective in using it.

This lack of initiative and interest by DOE in acquiring excepted service personnel authority and the failure to use it aggressively and effectively, when acquired, is an important element of the Department's overall failure to address the larger technical personnel problem at defense nuclear facilities. DOE's use of excepted service personnel authority was treated in more detail in a statement by the Board's General Counsel at a public meeting held by the Board on the subject of the DOE technical personnel problem on January 23, 1996 (Appendix H).

Major Impediments to Resolving the Problem

There are several impediments to the kind of far-reaching measures that are needed to resolve DOE's technical personnel problems.

1. Lack of understanding, experience, and personal involvement by upper echelons of DOE management. The fact that the technical personnel problem exists, after six years during which the Board has called frequent attention to it, is prime evidence of lack of top management involvement, beginning with the Secretary and proceeding on down at other levels. It is evident, notwithstanding the actions of the Board, that these DOE officials have not treated the matter as one of sufficient importance to merit their continued, personal attention. Without such direct, personal involvement, there is little hope that the problem can be corrected.

2. Failure to define safety responsibilities. When the Board began operations in 1989, the safety responsibilities of DOE Headquarters technical line managers were in the process of being strengthened to exercise greater control over DOE field organizations and contractors and to hold them to a higher standard of accountability for performance than they had been previously held to.[54] However, In April 1993, a new Secretary of Energy announced a major change for the DOE organization.[55] It was intended, among other things, to assign more responsibility and authority to the field and, therefore, away from Headquarters. In several later discussions with the Assistant Secretaries for Environment, Safety and Health and for Environmental Management, and the Associate Deputy Secretary for Field Management (whose position had been newly created by the reorganization), Board Members tried to find out what specific changes in safety responsibilities had been made. A key purpose of these repeated inquiries was to make sure that such responsibilities were defined, promulgated, and understood by the individuals and organizations involved. Having failed for almost a year to obtain the information sought, the Board was obliged to impose a reporting requirement on DOE. The Board's letter of May 6, 1994, stated:

> *"The Board recognizes that under your leadership the Department has been undergoing a major reorganization with respect to its management of defense nuclear facilities. This reorganization has affected the roles and responsibilities of the various offices responsible for nuclear safety at DOE, and extends to the contracting process as well as to line management and independent oversight assignments. To carry out its statutory duty, the Board must understand in detail how certain aspects of this reorganization affect the Department's programs for assuring public and worker safety, for minimizing risk to life and property, and for protecting the environment."*[56]

On June 29, 1994, the Secretary sent a preliminary response and provided the Board with a newly-updated *Manual of Functions, Assignments, and Responsibilities for Nuclear Safety (FAR Manual)*.[57] Updating this manual represented a step forward in providing the information needed. However, it required that many complementary actions be taken by the organizational units affected, as well as

specific action to correct numerous discrepancies discovered in the FAR Manual by the Board's Staff. One of these actions was the issuance of DOE's response to the Board's May 6, 1994, reporting requirement. That response[58] provided a summary of DOE's approach to the management of safety, including the roles of line management, safety standards, technical competency, and independent internal oversight. However, implementation of the approach was inconsistent and often ineffective.

By September 1995, the FAR Manual was out-of-date, in part as a result of organizational changes. The Board brought this to the attention of the Secretary, who then directed the Assistant Secretary for Environment, Safety and Health to bring the manual up-to-date. Since this was not being accomplished, the Board again informed the Secretary of its continuing concern in December 1995. Again, the Secretary directed that corrective action be taken. As of now, there still has been little progress. Thus, over two and a half years after a major reorganization, which affected safety responsibilities at defense nuclear facilities, DOE still does not have in place clearly delineated safety responsibilities, especially as between Headquarters and field offices. This conflicts with well-established industry practice; for example, the applicable consensus standard states:

> *"Lines of authority, responsibility and communication for the operating and support organizations shall be established and defined. These relationships shall be documented and updated, as appropriate, in the form of organizational charts, functional descriptions of departmental responsibilities and relationships and job descriptions for key personnel positions or in equivalent forms of documentation."*[59]

This confused situation in DOE represents a clear lapse of sound safety management as indicated by DOE's own policy. Until safety responsibilities are defined in detail, deploying technical manpower resources effectively will be difficult, if not impossible.

DOE's attempts to resolve the problems of assigning, defining, and engendering understanding of safety responsibilities are complicated by differing views as to where such responsibilities should lie. This difference in views especially affects the relationship between Headquarters and field organizations due to the continuous state of flux of the Orders and standards that they work by. Field organizations have had a long history of relative independence from subordination to Headquarters; thus, these differences are likely to be difficult to resolve. A recent effort to do so was led by an action group of senior Headquarters and field managers under the aegis of the Strategic Alignment Implementation Group. The results of the deliberations by the action group were reported to the Associate Deputy Secretary for Field Management in a memorandum dated June 22, 1995, from the Manager, Richland Operations Office. The document states that "The Strategic Alignment Team identified the need for clarity in roles, responsibilities, authority, and accountability between Headquarters [and] the operations offices . . . to improve coordination and eliminate duplication of work."[60] It offered a plan for doing so. However, the plan was submitted in draft form and, as far as the Board has been made aware, no action has been taken on it.

A chronology of the efforts by the Board to Require DOE to adequately define nuclear safety responsibilities is attached as Appendix I.

3. Misplaced organizational assignment of internal nuclear safety oversight. Under the major DOE reorganization announced in April 1993, the unit responsible for internal nuclear safety oversight (Office of Nuclear Safety), which had previously reported directly to the Secretary, was placed under the Assistant Secretary for Environment, Safety and Health. From the perspective of nuclear safety, it is believed that this change was imprudent for several reasons.

Given the large dimensions of the technical personnel problem, it should have been brought continually, forcefully, and directly to the attention of the Secretary by the internal oversight organization. The Secretary was being apprised repeatedly by external safety oversight (i.e., the Board) that the technical personnel problem was the single most important safety problem at defense nuclear facilities. It is not evident that internal safety oversight, now located under the Assistant Secretary for Environment, Safety and Health, was confirming this forcefully and continually to the Secretary and providing detailed supporting information. Moreover, as noted elsewhere, DOE has a serious lack of radiological protection personnel, a portion of it under the Assistant Secretary for Environment, Safety and Health, the organization to which the internal safety oversight unit reports. If this unit had been assigned directly to the Secretary, instead of to the Assistant Secretary, it would have been obliged to report to the Secretary that the Assistant Secretary was not correcting technical personnel deficiencies within the EH organization. The fact is, the Assistant Secretary for Environment, Safety and Health has an apparent conflict of interest in this specific area.

Also, the Assistant Secretary for Environment, Safety and Health has a clear responsibility for identifying the need for corrective action on the widespread technical personnel deficiencies in line organizations, both at Headquarters and in the field. Had internal safety oversight reported directly to the Secretary, one cannot be certain that reports of these deficiencies would have been made to the Secretary, but the organizational arrangement would certainly have provided the responsibility and hopefully the opportunity.

4. Advice of External Advisory Groups. On February 1, 1995, a report, *Alternative Futures for the Department of Energy's National Laboratories,* was issued by Mr. Robert Galvin, Chairman, Secretary of Energy Advisory Board Task Force. Regarding DOE technical expertise, the report states:

> *"The root deficiency . . . is the absence of a sustained, high quality, scientific technical review capability at a high level within the DOE as well as a lack of leadership and poor management of the science/engineering-operational interface."*[61]

Emphasis by the Task Force on this "root deficiency" should have proved helpful in bringing about corrective action to strengthen DOE technical expertise.

However, the report is likely to have a contrary effect. It has been perceived by many as warrant for the DOE to relax its efforts to strengthen its standards-based safety program. This is due to several negative comments made by the Galvin Report concerning DOE's management of the national laboratories. It describes DOE's management style as "excessive oversight and micromanage[ment]."[62] An entire six-page appendix of the report was given over to anecdotal information regarding this perception of excessive oversight and micromanagement. The impression that is left with the reader of the report is that the DOE should leave management of these facilities to the contractors who operate them.

On balance, it appears that the Galvin Report will encourage those who seek a more *laissez faire* relationship between the DOE and its laboratories and, thus, hamper efforts to cause DOE to acquire the technical experience it needs.

Also, it is likely that the *Report of the External Members of the Department of Energy Laboratory Operations Board*, October 26, 1995 will have this same effect or will be used to hide from things that are too hard to do. In fact, the Deputy Secretary of Energy described the purpose of these external members to the House Science Committee as follows:

> *"They will help ensure that the Galvin Task Force report will not suffer the fate of many previous examinations of the DOE laboratories."*[63]

Paralleling the Galvin Report, the report by the External Members states that:

> "*The Department should continue to identify and tackle excessive administrative burdens which it imposes on the laboratories . . .*"[64]

and targets,

> *". . .four areas where dramatic reductions in the paperwork burden seem possible."*[65]

One of these areas is compliance with environmental, safety, and health regulations.

The objective of reducing the administrative burdens on the laboratories is a commendable one. But, the interpretation being placed on it could cause the DOE to back away from constructive technical interactions with the laboratories and contractors, and also to weaken technical requirements that apply to safety at defense nuclear facilities.

5. Uncertainty about Department of Defense (DoD) involvement within DOE's weapons program. Military officers of the Armed Services have had an important role in managing the nuclear weapons program of the DOE since the program's inception. However, changes of significant proportions and implications have taken place with regard to the role of military personnel within DOE's nuclear weapons program. By using "within" it is intended to exclude the complex

organizational and other matters in which both DOE and DoD are jointly involved in the nuclear weapons program and discuss only military officers assigned to DOE to perform DOE functions.

The Atomic Energy Act of 1946 established a Division of Military Application (DMA) and provided that it be headed by a general or flag officer (normally an O-8) who managed the AEC weapons program under the close, continuing direction of the General Manager and five AEC commissioners. Most of the General Managers had sound technical management credentials and many of the commissioners were either engineers or scientists of renown. The officers who headed DMA were highly-accomplished members of the Army's Corps of Engineers, all with outstanding academic credentials, graduate degrees in engineering and extensive engineering experience.

Most of the DMA technical staff were military officers from the Army, Navy, Marine Corps, and Air Force. Those with the best technical education tended to be Army Engineers and, in lesser numbers, naval officers with weapons-oriented postgraduate education. The assignments were considered attractive and career-enhancing. Special programs were established under which some officers received training in nuclear weapons technology at the DOE (then AEC) weapons laboratories.[66]

In recent years there appears to have been a progressive diminution in stature and responsibility of the senior-most officer assigned to weapons duties within DOE. For a number of years it was a "one-star" (O-7) position instead of a "two-star" (O-8), as it had long been. The attraction for military officers seems of late to have been closely associated with the fact that it offered the opportunity to meet the requirement of "joint-staff" duty. Also the length of the prescribed tour of duty appeared to have been shortened. The average tour length for the first five Directors of DMA was four years. For comparison purposes, during the six and a half years of the Board's existence, it has interacted with four different incumbents.

Concerned by the adverse effects on safety of these developments, the Chairman and another Board Member visited the Deputy Secretary of Defense in July 1994 and urged him to consider elevating the rank of the senior DMA military officer and extending the length of tour. The Deputy Secretary took action to return the rank to "two-star" (O-8) and made a tour extension to three years optional.[67] DOE itself did not take the initiative to enhance the importance of the assignment and was quite willing to accept a diminution of its importance.

In recent years there has also been an apparent dilution in the qualifications of other military officers assigned to DOE's nuclear weapons program; especially when compared to their counterparts in the early years of the program. One of the reasons has been that the nuclear weapons specialty has either ceased to exist or is regarded as "not career-enhancing." Also, the services are no longer encouraging graduate education aimed toward nuclear weapons as a specialty.[68] Another adverse factor might be the termination of the Military Research Associates (MRA) program under which young officers following a nuclear weapons career path could acquire experience at DOE's weapons laboratories working on weapons program assignments. During the years from 1953 to 1990, three hundred and

twenty-one (321) individuals completed this program.[69] The Board expressed its concern on this issue in a letter to the Deputy Secretary of Defense which stated, in part:

> *"The Department of Defense's continuing attention to the selection of highly qualified individuals of sufficient stature and commitment to critical DOE Defense Programs positions will be an essential element in ensuring the continuing safety of the defense nuclear complex."*[70]

The Board has no authority to ensure that there be DoD policies and programs which assure availability of officers of outstanding competence to the DOE weapons program. But it does have a responsibility to provide independent oversight of the DOE policies and practices by which officers assigned to safety responsibilities at defense nuclear facilities in DOE give assurance that they will be fully qualified.

It is not clear to the Board whether Congress has been kept informed of the conditions within the military services themselves which make it difficult for DOE to draw on the DoD for outstanding talent. To the extent that DOE cannot rely on the DoD to provide military officers of outstanding capability, it will need to make other provisions. But, DOE should ensure that the intent of Congress is not being altered with respect to the role of military officers in managing DOE's nuclear weapons program.

Summary

This paper has shown that **the most important and far reaching problem affecting the safety of DOE defense nuclear facilities is the lack of sufficient numbers of personnel who are technically qualified to provide the management, direction and guidance essential for their safe operation.**

This statement of the problem differs somewhat from that used by the Board in years past. The emphasis in previous statements was on DOE's " . . .difficulty in attracting and retaining personnel . . ."[71] with the requisite technical qualifications. While this difficulty remains, it can no longer be called " . . .the most important and far-reaching problem affecting the safety of DOE defense nuclear facilities . . . ."[72] The reasons should be readily apparent based on the data presented in this report. The more critical problem today is a lack of sufficient numbers of personnel who are technically qualified.

Despite repeated Board efforts to cause DOE to raise the level of technical expertise in the Department substantially, DOE progress to date has been inadequate. In order to invigorate its technical personnel, DOE must first establish a policy as regards the technical direction to be provided to its contractors. A DOE policy directive on this matter would clarify the situation; it should include direction with respect to: (a) the methods for providing technical direction (rules, orders, manuals, guides, etc.), (b) the appropriate level of detail, (c) the manner in which technical direction is provided (i.e., contractual nuances), (d) the mechanisms to assure that all important sources of input have been used (e.g., the field), and (e) the means by which contractor adherence to DOE technical direction and guidance will be monitored and assured.

The intent of the Board's Recommendation 93-3 was that the overall level of technical expertise in DOE be elevated. As shown above, this goal has, by and large, not been met. In order to invigorate the Recommendation 93-3 implementation process, DOE should perform several immediate "benchmarking" studies, that is, studies of other federal agencies that have consistently been able to attract and maintain highly competent technical and program management talent. The organizations used for this comparison should include, but not be limited to, the NR organization within DOE and the Navy's Strategic Programs (SP) organization, both of which have garnered consistent praise for their ability to accomplish complex technical assignments.[73] The report should include such recommendations, as deemed necessary, to achieve a comparably high level of "in-house" technical capability.

When these DOE studies are completed, the Board should review them and provide comments and/or recommendations deemed appropriate to the Secretary of Energy.

Given the lack of progress on the issue of improving the overall technical expertise of DOE, to-date, the Board should evaluate whether additional measures, either formal or informal, need to be taken. Such measures could range from providing informal assistance to DOE in identifying qualified candidates to making additional formal recommendations deemed necessary to remedy the situation and/or urging Congress to expand the Board's purview in areas associated with safety-related personnel in DOE.

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21. Board letter, Chairman John T. Conway to The Honorable Hazel O'Leary, re Staffing Deficiencies at DOE-AAO, July 20, 1994.

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23. DOE Annual Report to Congress, *Department of Energy Activities Relating to the Defense Nuclear Facilities Safety Board*, April 1995.

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62. Ibid.

63. *Report of the External Members of the Department of Energy Laboratory Operations Board*, October 26, 1995.

64. Ibid.

65. Ibid.

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67. Deputy Secretary of Defense letter, Honorable John Deutch, to the Defense Nuclear Facilities Safety Board, November 7, 1994.

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APPENDIX A

Appendix A

The Demanding Customer*

It is a paradox that despite the power of management systems there is so much difficulty in carrying out large-scale, technically-complex projects and programs. Such activities are normally conducted under contracts between the customer and one or more contractors engaged to carry out the associated functions. The customer will seldom have all the specialized technical capabilities in the depth and numbers required to accomplish these tasks, but it will certainly have large financial and technical interests in assuring effective management of the operations they entail.

Direction and guidance provided by the customer for contractor activities can take different forms. In many instances, the customer will arrange with contractor organizations to perform specific functions like research and development, design, procurement, construction, testing, and quality assurance, but will retain management of the total effort. In other instances, the customer will enter into arrangements where managing the total effort will be assigned to a selected lead contractor. The latter may still perform functions like those cited or have them provided by other organizations. Depending on the organizational arrangements involved, there will be one feature common to all -- the need for the customer to exercise management across a customer-contractor interface. It is a difficult terrain. For one thing, customer management cannot use the direct measures and techniques available when the organization does the job with its own personnel. Few, if any, members of the customer's organization will have authority to direct the specific actions of contractor personnel. Management must be accomplished by other methods. Experience has shown the methods that are effective and those that are not.

The key principle is that management and other capabilities of the customer's organization should be used basically for one function; namely, to require and otherwise bring about effective management by the contractor organization or organizations to assure performance in accordance with the contract. The decisive test for any action contemplated by the customer is whether it is conducive to this objective. The principal pitfall is that the customer will use its capabilities to compensate for continuing weaknesses of the contractor. Like other management principles, this one is logically compelling but difficult to apply. Departures from this principle are at the heart of countless management problems between customers and contractors. Many departures are deceptive in appearance; their very subtlety calls for managerial alertness to recognize them.

A second principle is that the customer should set forth technical requirements in sufficient breadth and depth to assure that the product will meet customer objectives, but not in such degree as will stifle contractor management, initiative, and innovative capabilities. A corollary is that the customer

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* The article reprinted here is a condensed version of a previously unpublished paper written by Board Member John W. Crawford, Jr.

needs to be able to adjust requirements, as practicable, to accommodate difficulties being encountered.

The prerequisite need in applying these principles is that the customer have "in-house" capability as measured by technical competence among its own employees to shape, guide, direct, and assess the activities and operations of its contractors. No one would deny that the customer must have financial, legal, and administrative capability and that these should be competent enough to negotiate from a position of strength with their contractor counterparts. However, one does not find a comparably strong consensus on the need for customer organizations to have corresponding strength in technical management.

In carrying out complex technological programs the customer must make decisions over a broad spectrum of technical issues. Help in addressing such issues can often be obtained from third parties. Even so, it still takes technical competence to know what questions to ask and who can best provide answers. In the end, the responsibility for making technical decisions (many with large implications for cost, schedule, and performance) is a responsibility from which the customer can never escape.

Once contractors have been chosen, the need for a demanding customer capability, both technical and non-technical, will increase. The objective of intelligently applying the technical capabilities of a customer will be that the contractor perform at the standards required. As a result, there will be a need for contractors to match strength with strength. The converse is also true. If the customer organization lacks technical strength, the contractor will not feel the same pressure to achieve excellence. In this world of limited numbers of strong performers, even the best and most dedicated contractors will have difficulty manning all jobs with cadres equal in capability. Thus contractors will tend to deploy their best talent consistent with incentives to perform which emanate from the customer. In this respect, a demanding customer capability is the best assurance that a project will be given priority by the contractor when it comes to the assignment of his most capable personnel.

Having cited the need for strong customer technical capability, it is important to caution against its misuse. The general caution is that it should not be used to do work or perform functions for which the contractor is being paid. This is a self-evident proposition, but it is regularly violated; for example, assume the customer has engaged a contractor to design a large technically advanced facility. As elements of the preliminary design are reviewed, system by system, customer personnel often find it necessary to urge redesign or reconsideration for what is poor, or marginally acceptable, work. The customer will often be able to reinforce these assessments by advancing better concepts and design features than those proposed by the contractor. Contractor personnel, anxious to please the customer and acknowledging the validity of his objections, will tend to adopt the revisions being urged. A situation can develop progressively in which customer technical personnel become, in effect, an adjunct of the contractor's design review organization.

Many customer personnel would not perceive this as happening; some would not find it objectionable if they did. Such individuals find professional satisfaction principally from making a contribution to the solution of problems and, not infrequently, from the appreciative remarks by the contractor about

such contributions. It takes a firm hand to keep them from subverting the larger interests of their own organization.

There are major objections to allowing this pattern of inordinate reliance on the customer to develop. One is that the contractor will see no need to improve his deficient performance. The contractor will not be giving the customer that level of performance for which he is being paid. The irony is that customer personnel will have been aiding him in the process. The second is that the customer, by his intimate involvement, is giving up his position of full objective review. The pattern of activity described is likely to be most pronounced at middle levels of management. Customer middle-management is often reluctant to see that the problem is brought to the attention of contractor top management. Thus, the latter are shielded from the problem while the customer shoulders the task of solving the problems that arise.

It is the job of customer top management to stop the misapplication of technical talent which has this effect. An indifferent management may not be aware that behind the rapport between customer and contractor is a design activity which reflects disproportionately more input by the customer than the contractor. The design also may be embodied more in the nature of compromise than customer top management would find acceptable if they knew the circumstances. The result is that the customer's capability has been used to bring about strengthened contractor management but rather to help preserve it in a state of weakness.

A demanding customer will insist on developing clear, mutually agreed-upon understandings about relationships with the contractor. True responsiveness by the latter always obliges the contractor to use his own good judgement in questioning suggestions made the customer staff if the contractor believes them to be ill-advised. Responsiveness is to be measured, not by the extent to which the customer responds automatically to guidance from customer representatives, but rather by the degree of responsibility exhibited in analyzing such guidance and then in acting on it or recommending reconsideration as appropriate. It is also to be emphasized that differences in important matters are not to be held unduly long at lower levels, where they foster animosity and weaken cooperation. Instead, they should be raised promptly to higher levels of management for resolution. The objective to be sought is open, constructive dialogue between the parties, giving the primacy to objective technical and other considerations and suppressing personal predilection and bias. The message to be conveyed is that the contractor has been engaged to use his best efforts and resources to provide a product or a service. He can be responsive only to the extent that he does this.

Circumstances may arise in which the customer, on the basis of its own experience and needs, will want to insist on courses of action that the contractor would not recommend as the preferred ones. Both parties should be clear about the matter when this is the case. They should also assure that the prerogative to make such decisions as are involved is not exercised on either side by individuals who are not authorized to make them.

The need for the demanding customer to have "in-house" capability emphatically should not be taken to imply that the numbers of personnel be large. A customer operating in a sound managerial

relationship vis-a-vis a contractor should be able to provide the needed managerial oversight with far fewer numbers than the contractor is obliged to use. As problems arise, however, pressures often develop to increase numbers within the customer organization, to better cope with problems. As such demands arise, continuing vigilance is needed to avoid falling into the trap cited earlier of trying to compensate for contractor weakness by doing the job for him. The job of customer management is to convey assessments of contractor performance to contractor management, taking problems as high and as rapidly up the managerial ladder as is necessary to bring about corrective action and results. The ability to do this depends more on competence than numbers. Thus, the objective should be to keep competence up and the numbers down. It is impossible to place too much emphasis on the role of customer top management in this process. They must have the competence to satisfy themselves that their key personnel are qualified to provide direction and guidance to the contractor, but never doing his work for him.

The difficulty which customer personnel often have in keeping the interests of their own organization in mind can be heightened when the site or sites at which the work is carried out are located at a distance from the place at which the customer's management, technical, and other capabilities are mainly located. Under these conditions, a field office will ordinarily be established at the work site. Here the customer's representatives interact with the more numerous contractor personnel. In proximity to the contractor's forces, field representatives easily lose the objectivity so essential to representing the customer and its interests effectively. Surrounded by contractor personnel, field representatives often acquire an outlook that more nearly represents the contractor's viewpoints than judgements consistent with the customer's own interests. When this happens, the representative needs to be replaced.

The matters cited thus far concern interactions between customer and contractor in line activities like design, construction, procurement, and testing. The avenues for assuring effective management during these activities are pretty much self-evident. It requires more managerial acumen to be aware of the full potential of the opportunities provided by the contractor's quality assurance program. A strong quality assurance program in the contractor's organization reinforces the efforts of the customer to assure strong line management. Such quality assurance is at its best when it anticipates the customer and operates to head off problems before the need arises for customer action. Operating inside the contractor's organization, the quality assurance organization is usually in a better position than the customer to discern developing problems and also to get a full understanding of the contributing causes. Yet managers in customer organizations often fail to appreciate these advantages and, thus, do not give sufficient attention to making sure that contractor quality assurance is strong.

Sometimes customer managers may resign themselves to the quality assurance function within the contractor being less than adequate. Again, they try to compensate for this contractor weakness by adding more quality assurance personnel in their own organization. The problem should be attacked where it is found -- by insisting that the contractor's program be upgraded as needed until it is performing effectively. The customer just cannot afford to lose the advantages such a program provides. The demanding customer will not do so.

In closing, it may be well to recall that in coping with intractable problems, the temptation is to look for ever more elegant managerial solutions. Yet the answer is more likely to be found in a return to basic principles. In coping with the massive problems of building large-scale, technically-oriented projects, there is the need to return to management fundamentals -- those of the demanding customer. The greatest need will be to establish an ordered, disciplined, well-documented relationship between customer and contractor. This means a relationship in which the customer, fully endowed with the capability to manage, uses that capability in all its technical and other dimensions to insist that the contractor meet the standards of excellence agreed upon between them. It also means not doing the contractor's job for him. Accomplishing these very modest objectives of good management may not bring popularity; however, it will most surely go a long way toward bringing in projects within costs, on schedule, and meeting technical requirements.

APPENDIX B

Appendix B

Excerpts from Selected Studies of Department of Energy Performance*

1. A Safety Assessment of Department of Energy Nuclear Reactors, DOE/US-0005, March 1981.

> "*An important contributing factor* [to the lack of adequate attention by DOE Headquarters' organizations to the nuclear safety aspects of its reactors] *is the lack of sufficient numbers of highly competent technical people in Headquarters' organizations with nuclear safety responsibilities. Field Office organizations also suffer from this lack.*"

2. National Research Council Reports:

   a. Safety Issues at the Defense Production Reactors, National Academy Press, 1987.

> "*The committee concludes that the Department, both at headquarters and in its field has relied almost entirely on its contractors to identify safety concerns and to recommend appropriate actions, in part because the imbalance in technical capabilities and experience between the contractors and DOE staff is of sufficient magnitude to preclude DOE from comprehensive DOE involvement in the operation of the production reactors. The committee recommends that the Department acquire and properly assign the resources and talent necessary to ensure that safe operation is being attained.*"

   b. Safety Issues at the DOE Test and Research Reactors, National Academy Press, 1988.

> "*The suitability of the existing* [DOE organizational] *arrangement is undermined by the absence of adequate staff in the DOE line management who are sophisticated on safety and operational matters .... In effect, the system relies almost exclusively on the skills and competence of the contractors.*"

   c. The Nuclear Weapons Complex: Management for Health, Safety, and the Environment, National Academy Press, 1989.

> "*Constant attention must be paid to the maintenance and improvement of technical capabilities. Concerted efforts are needed to recruit competent*

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* Most of the excerpts shown here were originally provided as an attachment to Board Recommendation 93-3.

technical personnel at all levels; and DOE must maintain an environment for the retention of employees by providing challenging assignments, meaningful participation in decision making, and professional advancement. Strong training programs are necessary to build a culture in which health, safety, and environmental considerations are seen as an integral component of operations."

3. Secretary of Energy letter to the President, December 20, 1991.

   "... the technical knowledge and skills of many DOE managers and employees are not sufficient to do their jobs."

4. Advisory Committee on Nuclear Facility Safety letter to the Secretary of Energy, March 24, 1989.

   "We recommend that you streamline management to make responsibilities clear, that you put knowledgeable people in line positions of responsibility, and that you give them authority. This is important for assurance of nuclear safety. Solving the DOE's problems will require upper management and operating personnel to work together closely and effectively. This will not be possible if the staff must work through buffers of people who are not technically competent."

5. Hazards Ahead: Managing Cleanup Worker Health and Safety at the Nuclear Weapons Complex, Office of Technology Assessment, 1993.

   "EM ... lacks adequate numbers of qualified staff to develop occupational health and safety programs suited to EM line operations and has little capacity to assess contractors' performance in health and safety matters."

   "The DOE Office of Environment, Safety and Health (EH) does not have enough qualified staff to monitor contractor operations."

6. Alternative Futures for the Department of Energy National Laboratories, Secretary of Energy Advisory Board, February 1995.

   Section G. Recommendations.

   1. "Sustained improvements in DOE management and leadership are needed both at senior levels in the Department and in positions below the Deputy Assistant Secretary level." It is clear from the above material that those portions of the problems that DOE can control stem from managerial deficiencies at the top levels in the Department."

APPENDIX C

Appendix C

Naval Reactors (NR): A Potential Model for Improved Personnel Management in the Department of Energy (DOE)*

Introduction

The Naval Reactors Program, more commonly known as "NR," was started by a small group of naval officers at Oak Ridge National Laboratory in 1946. Led by Hyman Rickover (a Captain apparently near retirement), this group was inspired by a concept: the possibility of using nuclear power to propel a submarine. Within seven years of its inception, the organization that developed out of this concept would put into operation the nations' first power reactor (the *Nautilus* prototype). The following four years would see three more nuclear submarines and two reactor plant prototypes operating and another seven ships and two prototypes being built. To date, more reactors have been built and safely operated by the NR program than any U. S. program; this record of achievement is remarkable by any standard. It is now a joint program of the Navy and the Department of Energy (DOE).

What are the attributes that made NR so successful? Much has been discussed and written about core NR management principles such as, attention to detail and adherence to standards and specifications. The purpose of this discussion is to examine the personnel practices used by NR, which are arguably even more central to the success of the program than the core principles mentioned above, and to reflect on their possible application to DOE.

There exists, however, a pervasive view that since there are some fundamental differences between the programs of NR and the remainder of DOE, nothing can be learned from studying the methods by which NR has achieved success -- least of all on the personnel front. As in many benchmarking efforts, it is true that there *are* fundamental differences between the organizations. However, experience in Total Quality Management (TQM) has shown the methods that lead to success in one organization can often be used in other organizations.

In the beginning, NR recruited the majority of its personnel from three sources: the Navy Engineering Duty Officer (EDO) community, other government technology programs and the submarine force. At that time, these selectees from other agencies and programs comprised the "cream" of the available crop. These personnel had been highly successful in their respective fields, whether in naval engineering and construction, in atomic energy laboratories or in submarines. NR attempted to "skim the cream" from those already competitive sources. The importance of this effort, to select only from the "cream of the crop," cannot be overestimated. In addition, it is believed that

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* The article reprinted here is a previously unpublished paper written by Steven L. Krahn, the Assistant Technical Director for Operational Safety on the Board Staff; formerly an engineer on the Naval Reactors staff.

insight can be gained from evaluating the education, training and qualification programs at NR; programs considered by many to have made a lasting contribution to the field of nuclear safety.

It is sometimes assumed that the comprehensive personnel management system developed by NR was, somehow, readily available at the outset. This was not the case, either as regards selection or the education, training and qualification areas. The system as it exists today was built through vision, will, and persistence. In addition, it drew upon a number of already competitive Navy education programs (e.g., the Naval Reserve Officer Training Corps, or NROTC scholarship program). A number of obstacles had to be overcome to reach the point where it is today; maintaining such a system requires unremitting top management attention to keep further obstacles from arising and old ones from resurfacing.

The NR organization has had to weather many storms. In the process it has developed an integrated personnel management system and a number of innovative programs to assure continued success in recruitment, selection, education, training and qualification. It is believed that benefit can be gained by studying and evaluating the personnel practices within NR for potential use within DOE.

The NR Program

Three basic elements comprise the overall NR program: (1) NR Headquarters, along with its representatives in the field; (2) the ships and fleet organizations that direct ship operations; and (3) the support organizations that include the engineering laboratories, prototypes, shipyards, and plant component fabrication facilities. Personnel in the headquarters organization and the officers who staff the ships are selected by NR and educated, trained, and qualified according to NR doctrine. The third group is operated almost entirely by industrial contractors, with the exception of government-owned naval shipyards. All have NR field representatives onsite and are subject to NR reviews of their personnel selection, training, and qualification.

An analogy can be drawn between the NR organization and the DOE. All NR activities, including research, development, design, construction, testing, training, operation, maintenance, and decommissioning involve close, technically oriented interaction and dialogue between NR and its laboratories, contractors, and/or the fleet. This dialogue is clear, open, and above all, two-way. In dealing with its laboratories and contractors, NR is essentially in the role as the customer or procurer of goods and services, just as the DOE is in relation to its contractors. NR sets the standards and approves the detailed specifications for the products it procures. The laboratories and contractors provide the products, as well as technical recommendations.

NR believes that this mode of operation requires the engineering and technical management capabilities of its personnel to be comparable to the best technical personnel in the contractor organizations. If this were not the case, NR believes it would be unduly dependent on laboratory and contractor proposals and recommendations. Vital NR programs would be deprived of NR's internal ability to discern weaknesses in laboratory and contractor capabilities and, just as important, the

ability to elicit or force actions to strengthen those weaknesses. There is a fundamental difference between this approach, which is characterized as "technical direction," and the approach used by DOE and its predecessor organizations often referred to as "management oversight."

Integral to the ability to provide adequate technical direction are the personnel involved in providing and receiving such direction. NR has developed a fully-integrated program to ensure that the best possible personnel are selected, educated to understand the technology that they use, and trained to operate their equipment in a safe manner. The program also ensures that the education and training are validated by a rigorous qualification program that is commensurate with the responsibilities of the position. The following discussion will provide an outline of this program and the rational behind it.

Selection

The selection process is probably the most important of the three categories mentioned above, i.e., of selection, education and training, and qualification. An ill-selected person probably cannot be educated, trained or qualified to a point where they would be suitable for the responsibilities for supervising the operation of a nuclear power plant or other nuclear facility. In the case of headquarters personnel, an ill-selected person will never be suitable for directing and guiding the technical aspects of nuclear programs. NR's selection process was -- and continues to be -- highly successful, as the results demonstrate.

When NR was formally established in early 1949, Captain Rickover initially recruited personnel to staff his program from Naval officers and civilians involved in previous nuclear power development and other technology programs. Initially due to an insufficient screening process (and, actually, inability to screen some "holdovers"), the results of this initial staffing effort were mixed and some personnel were let go. As the organization grew, Rickover (later promoted to Admiral) brought aboard personnel for additional nuclear power assignments by tapping the national laboratories and the Navy's EDOs who volunteered for the program. All of these new personnel were individually interviewed by senior NR staff and then by Rickover.

Rickover realized, early on, that his programs would expand and require more EDOs; therefore, he arranged for the establishment of a graduate program in nuclear engineering at the Massachusetts Institute of Technology (MIT) to educate future EDOs for his organization. The availability of this graduate education program not only improved the capabilities of the personnel enrolled, it acted as a positive recruiting attraction.

Also, very early on, Rickover demonstrated his appreciation of the importance of the human element in nuclear power operations by personally approving all of the original officers and enlisted personnel who would staff *USS Nautilus*, the first nuclear powered ship. As the nuclear-powered fleet grew, however, a more formal system for selection of personnel was required. Even so, the Admiral, as head of NR, continued to play a direct personal role in the selection of each officer to staff his ships

and in the selection of the officers and civilians who comprised the headquarters organization. This process continues today.

Concurrently, NR influences the selection of enlisted personnel by strengthening existing Navy instructions and standards. To be selected, enlisted personnel are required to be high school graduates, volunteers for the program, and have scored highly on both the mechanical aptitude and intelligence tests. However, insights from the officer and civilian selection process are more germane to a discussion of recruiting technical personnel for DOE. The point to be made is that the use and enhancement of existing Navy personnel selection tools for enlisted personnel indicated a willingness on NR's part to borrow methods that had been effective.

Selection for the Fleet

Initially, i.e., for *Nautilus*, the officers to be selected for the ships were chosen from a group of qualified, experienced submariners who were college graduates (with technical courses included in their backgrounds). Their records were generally prescreened by experienced officers in NR and then nominated by the Bureau of Naval Personnel. Their records were then sent to NR for final screening. The candidates had to have graduated in the upper half of their classes and to have demonstrated excellence in positions of increasing responsibilities.

As the number of nuclear powered ships increased, the pool of prospective candidates also had to increase. By 1960, the demand for officers had grown so large, especially with the advent of the Polaris missile program, that NR could no longer be so narrowly focused in its recruitment. The first steps in broadening the field of potential candidates were to permit the top-ranking graduates from the Naval Academy, then from NROTC, and finally the Navy's Officer Candidate School (OCS) to apply to enter the program directly upon commissioning. The success of these recruitment sources and others added later, such as the Nuclear Power Officer Candidate (NPOC) program, was so impressive that eventually recruitment of officers from other naval duties was no longer needed and was eliminated. From that point on, NR chose grow its own in-house capability. By the mid-1960s, those recruited came from colleges, universities, and the Academy. NR had developed the precept of "get 'em young and train 'em right!"

Selection for Headquarters

A similar progression can be seen in the personnel chosen to staff the NR Headquarters organization. As noted above, the first officers Rickover recruited were drawn largely from the EDO community, i.e., people who specialized in ship and ship system design, construction, and maintenance. However, this source of talent soon became inadequate and the focus shifted to top engineering and scientific graduates of the NROTC program. Officers aspiring for selection to the headquarters organization had to be in the top ten percent of their class in a school of recognized reputation. Some outstanding personnel from contractor organizations were also added to fill particular niches (e.g., reactor physics). As the program continued to grow, NR had to also look elsewhere for engineering talent

for its headquarters functions as well. Two factors required this: first, the growing size of the nuclear-powered fleet (already touched upon), and second, the Navy's promotion system for EDOs.

The career path for a Navy EDO was supposed to include a number of assignments across several fields that included design, maintenance and acquisition of ships. The system demanded relatively frequent rotation of personnel among the various departments within the then Bureau of Ships (now the Naval Sea Systems Command) and the naval shipyards. Admiral Rickover believed that it was impossible to master an assignment in the nuclear field during a standard three- to four-year Navy tour. He consistently sought, and won, tour extensions for officers assigned to NR. However, this practice doomed his EDOs from the standpoint of promotion. The result was that officers either resigned from the Navy to stay with the program as civilians or left NR.

As some initial program personnel left, and as the requirements became greater, the ranks were largely filled with home-grown talent (i.e., personnel who had been recruited and gone through the NR education pipeline). The result of this progression was that, as the program entered the sixties, NR Headquarters became dedicated to developing its own talent (as had the Fleet) and eschewed hiring experienced people from the outside. This aversion was across the board; even instructors for general subjects (such as mathematics) at Nuclear Power School were interviewed and approved by Rickover from a pool of recent college graduates. Thus, NR adopted the philosophy that when an organization reaches a certain level of technical strength and maturity, it is highly desirable to start "growing" the next generation of replacements internally, rather than hiring senior technical talent from the outside. Procedures had to be put in place to ensure that these technical personnel were the technical equivalent, or superior, to personnel in other organizational elements.

The Interview Process

One of the most important aspects of selection was, and continues to be, the personal interview process. From the outset, Rickover considered that personal interviews were crucial to success in his selection process. The importance Rickover attached to interviews was reflected in the attention he gave to picking interviewers. He chose them from among the most senior and experienced NR staff members (officer and civilian). Considerable attention was given to achieving a balance within the sets of interviewers in order to compile a variety of viewpoints. **No duties were accorded higher priority than interviewing.** Entire days were set aside at headquarters to these interviews, with Admiral Rickover himself setting the example. Only the most urgent duties (such as accompanying a ship on initial sea trials) took precedence, and then the interviews were rescheduled. No one entered the program without an "interview with the Admiral."

The interview process continues virtually unchanged today.

The interviewing process in NR normally consists of three preliminary interviews, largely technical in nature, with senior officers and civilians on the NR staff. The preliminary interviewers might be any combination of officers and civilians. Again, they come from differing divisions within NR Headquarters to achieve a variety of outlooks. In combination, however, their intimate knowledge

of the requirements of the work ensures that they can identify the capabilities the program needs. The final interview, and decision-making authority, remain with the program director, "the Admiral".

No formal criteria or set of questions are imposed on the interviewers. Rather, they are tasked to judge whether the candidate has those qualifications and attributes that indicate he or she can function successfully in either the rigorous technical demands imposed by duty at NR or in the fleet. To guide their questioning, the interviewers are provided with basic data about the candidates that includes: college attended, indicators of academic performance such as grade point average and class standing, and grades in courses regarded as indicative of analytical reasoning ability.

Common questions posed by the interviewers to the potential selectees might consist of the solving of calculus problems; explaining a principle of thermodynamics, physics, or chemistry; or describing technical matters pertinent to the candidate's course of study at college. NR does not look for "bookworms," however. Questions about world affairs, hobbies, or extra curricular activities are frequently pose to candidates to see if they are aware of their own surroundings. Interviewers concentrate on demonstrated reasoning ability and look for certain key attributes such as: intelligence, common sense, technical orientation, forcefulness, demonstrated leadership, industriousness, a sense of responsibility, and commitment. While all are important, intelligence and forcefulness, as well as common sense, are regarded as the most important attributes governing acceptance into the program.

Education and Training

Once the selection process is complete, the process of education and training personnel is the next area where the concepts that NR established stand out. The exact procedures and programs that comprise the NR education and training systems are not as important to this discussion as the dedication and systematic approach that NR applies to the process. However, the NR training system will be described briefly to gain a better appreciation of its thoroughness. The basic precept is that personnel must receive both adequate theoretical education and hands-on, practical training for their positions.

With the dedication to home-grown talent that became the *modus operandi* at NR came a recognition that, even given the excellent pool of personnel that the selection process was designed to ensure, something further was required. A comprehensive education and training program, as discussed above, was necessary to help develop the new recruits into technical professionals, whether for the fleet or for duty in NR itself (Headquarters or field offices). What is described below are the frameworks for the education and training programs used by NR. Continuing training is also provided, throughout an individual's career in the program that is appropriate to his or her position.

Education and Training at Headquarters

Education and training start early in a junior engineer's career at NR. During the first six months the engineers are required to complete an introductory course in naval nuclear systems. This course is taught by senior staff and covers all of the fundamental subjects required to understand the nuclear technology with which the engineer will be entrusted; homework is assigned and tests administered. The objective of this course is to familiarize the engineer with nuclear technology and lay a base for future work and education.

After successfully completing six to twelve months at NR, engineers are sent to the Bettis Reactor Engineering School (BRES) which is run by one of NR's nuclear engineering research and development laboratories. The course provides a complete graduate nuclear engineering curriculum, focused on the design and operation of nuclear power plants. The curriculum consists of mathematics, nuclear physics, fluid mechanics, materials science, core neutronics, statistics, radiological engineering and instrumentation and control. Although a small permanent staff is attached to BRES, the courses were taught largely by working professionals from the laboratory in order to keep the topics at the cutting edge of technical developments.

The capstone of this course was a naval reactor design project. This project involved everything from mechanical design and thermal-hydraulic calculations through safety analysis. The core had to meet performance specifications provided at the inception of the project. Safety calculations had to meet normal NR requirements, such as safe shutdown with one control rod stuck out of the core.

Upon completion of the BRES curriculum there was another five weeks of practical training. Three weeks were spent on shift work at a nuclear prototype plant to gain a "feel" for actual reactor operations. This was followed by two weeks at a shipyard to obtain familiarity with nuclear ship construction and maintenance.

Education and Training for Fleet Personnel

For *Nautilus* and *Seawolf*, the first two nuclear powered submarines, officers and crew were largely trained by laboratory personnel from the Bettis and Knolls Atomic Power Laboratories (more commonly known as Bettis and KAPL, respectively). Their training progress was personally monitored by Rickover and senior NR engineers. As nuclear power became an accepted part of the Navy's fleet, as opposed to a novelty, the need to integrate the needs of nuclear power into the Navy training pipeline became clear to NR.

NR has established a two-phase approach to training personnel to staff the Navy's nuclear powered ships. The first phase includes theoretical and technical education at Nuclear Power School (NPS) in the subjects necessary for reactor plant design and operation including: nuclear physics, heat transfer, metallurgy, instrumentation and control, corrosion, radiation shielding, etc. After successful completion, the candidates proceed to more education and hands-on training in reactor plant operations at one of the prototypes. Initially, these prototypes were fully-operational,

power-producing reactor plants, built to prove out reactor designs and operated very similar to ships at sea. In recent years, submarines have been decommissioned and used as training platforms. NR firmly believes that operational training on the "real thing" is the only way to ensure that the trainee is faced with the same operational characteristics and the same risks they will face when fully qualified and at sea. The curriculum of six months of academic study followed by six months of operating experience at a prototype was established early in the program and remains constant to the present.

Training at NPS and at the prototype is intense. The philosophy established for NPS from the outset, and as posted at the school even today, is that "At this school, even the smartest have to work as hard as those who struggle to pass." For most students at NPS, the course is far more difficult than anything they have ever encountered. The six months of practical training at a prototype are no easier; there the demands are even greater, both academically and operationally.

Enlisted students qualify on every watch station appropriate to their specialty. Officer students are trained on every watch station and duty, including enlisted duties, before becoming qualified as an Engineering Officer of the Watch. The officers are expected to have a comprehensive understanding of each duty assigned to each of their men -- both at prototype and at sea. In addition, the students are expected to study thoroughly and be examined on the design and operating principles of the nuclear plant and each component of the plant on which they are training.

Progress is marked by the ability to pass a series of written and oral examinations and by demonstrating competence through actual performance, including emergency drills. Roughly ten percent fail academically, in spite of the rigorous selection process. There are fewer officer failures, in numbers as well as percentages, than enlisted failures. This is primarily because of the intense selection and interview process. Moreover, no officer is dropped without the admiral in charge of NR personally approving it; in this manner he can know how and why the system, or the individual, has failed.

Qualification

Once a candidate has completed the NR Program's rigorous education and training sequence, their education is not over; in fact, in a number of respects, it has just begun. Lifelong learning is built into the hierarchy of qualifications present in the NR Program for Headquarters, operational and certain contractor positions. This commitment to a process of ongoing improvement of each person's capabilities is a hallmark of the program.

Qualification for Navy Operators

Training of fleet officer and enlisted personnel does not end with completion of prototype training; fleet personnel undergo extensive training and qualifications at sea, replete with examinations (both oral and written). In addition, there is an intense program of advancement in qualification requirements as personnel progress in rank and responsibility.

Qualification requirements for nuclear operators include written and oral examinations and demonstrated practical exercises. Thus, the training is performance-based, not unlike DOE's requirements at nuclear facilities or the Nuclear Regulatory Commission (NRC) requirements at commercial facilities. Qualification for all enlisted positions and for officers through Engineering Officer of the Watch is repeated within each individual's ship, even after complete qualification at a prototype. However, officers advancing to Engineering department head (or "Engineer Officer") are examined by written and oral examinations at NR Headquarters.

Subsequently, prospective commanding officers of nuclear-powered ships are required to attend a three-month course of instruction at NR Headquarters replete with extensive written and oral examinations, more comprehensive than the Engineer Officer examinations. This course is conducted at NR and is taught by NR senior staff engineers. It includes in-depth instruction, study, and examinations in: reactor design and physics, thermodynamics, metallurgy and welding, radiological control, shielding, chemistry, and operating principles. "The Admiral" makes the final decisions regarding success or failure at each step of the process during these advanced qualifications for Chief Engineers and new Commanding Officers.

There are time limits for an officer's advancement through these qualifications. Those not qualifying are separated from the program and will never return. Before this ultimate failure, intense efforts are undertaken to help the candidate succeed. However, continued lack of performance or a clearly demonstrated lack of ability to grasp the fundamentals of advanced qualifications, by either written or oral examinations, will result in this weeding out process. It does happen at both the officer and enlisted levels; personnel are consistently weeded out as they attempt to advance (in spite of the rigorous initial selection process) as they reach the limits of their capabilities.

Qualification for NR Headquarters Personnel

Personnel in the headquarters organization do not operate the reactors and, therefore, a qualification program as predominantly performance-based as that for fleet operators is not appropriate. Nevertheless, a program exists at NR Headquarters for performance observation and reviews that is as comprehensive as that employed at sea. However, its focus is different, its primary focus is on the ability to provide technical direction that is based on NR's standards and a sound technical understanding of a given problem or situation. Since the impact of such decisions on safety can be quite significant, they should be made by personnel every bit as qualified to perform their function as the fleet's personnel are to operate reactors.

Therefore, there are steps in advancement that require that the technical staff undergo evaluation and "qualification" within the job performance at headquarters. These processes include technical assignments to develop personnel and reviews by senior engineers of individual accomplishments. The junior engineers are examined on the principles of their assignments and the effect of their decisions on the fleet. A common sense approach is considered almost as important as the technical background. Throughout, consideration of safety is held paramount.

The penultimate qualification for NR engineers is to be granted signature authority. This authority permits the engineer to approve proposals on behalf of NR and has the effect of imposing direction and decisions by the NR engineer upon fleet operating procedures and nuclear propulsion plant systems. Various levels of signature authority exist; the importance of signature authority varies with level. In addition to signature authority, assignment to certain difficult, high-profile tasks is a well-understood signal that you have "made it." Such tasks included: participating in audits of contractor and shipyard performance, participating in operational reactor safeguard examinations of naval ships and prototypes, and other similar reviews. The ultimate sign of having "made it," however, was being assigned to a position that reports directly to "the Admiral."

The progress of technical personnel at headquarters is reported to the highest levels of management within the organization including the admiral in charge. Personnel who exhibit difficulty in advancing or who do not perform adequately, are given help at NR Headquarters, as are the operators at sea. If, however, they continue to demonstrate that they cannot succeed in a position, they will not be asked to stay on after their initial tour; in a sense this initial tour (two to five years) as a junior officer is viewed as a trial period. If they are past their initial tour and having problems, even after extensive efforts on their behalf, they are either transferred to a job where they can succeed or removed.

NR and its Contractors

As with DOE, much of the work performed in the NR program is actually performed by the contractors. The Bettis laboratory is run by Westinghouse; cores are manufactured by Babcock and Wilcox; primary components are made by a number of vendors, under the direct supervision of arms of the Bettis (or KAPL) organizations; and the reactor plant, as a whole, is assembled at private shipyards and overhauled and refitted at Naval Shipyards.

From the above, it can be seen that a number of similarities exist between the management scheme within NR and that which exists, in principle, in DOE. There are also, however, significant differences that are instructive to explore.

NR has had long-term relationships with its contractors: Westinghouse has run the Bettis laboratory since the inception of the program; Electric Boat built *Nautilus* and has been building submarines for NR and the Navy ever since; Newport News has built all of the nuclear carriers; and the list could go on. Most of these contracts are awarded on a sole-source basis after tough negotiation between NR and the contractor.

This stability, along with the technical competence of the NR Headquarters staff, has led to extraordinary and effective working relationships between NR and its contractors. The contractors, by and large, do not make major personnel changes without first discussing it with their respective NR customers. On the other hand, NR works closely with contractors and keeps them well informed if any cutbacks will be required due to budgetary constraints or completion of a ship class. This

excellent working relationship has permitted NR to be successful in maintaining the program's technical expertise, even in a downsizing environment.

For some contractor employees who play pivotal roles in nuclear safety, the NR program has established selection, training and qualification program criteria that it requires its contractors to adhere to. Examples of such positions include test engineers at private and naval shipyards; startup physicists, provided by Bettis and KAPL for refuelings and initial core criticalities; joint test group members from Bettis and KAPL, who monitor reactor plant test programs; and a number of others.

The basic requirements for these positions are explained in technical directives developed and issued by NR Headquarters. The implementation of these directives is monitored at the vendors site by a special category of NR Headquarters personnel: the NR Field Representative.

The Role of the "Field Representative"

NR has placed a Field Office to monitor the contractor's performance at each vendor site. The head of each of these numerous offices is an experienced headquarters engineer specially selected, trained, and qualified for the position.

In order to be selected as a Field Representative, an engineer had to have an outstanding track record within his or her specialty; have shown the desire and capability to contribute in the broader areas of the NR program; and, of course, have consistently exhibited the highly-valued attributes of intelligence and forcefulness. Being selected as a Field Representative is highly sought after and considered to be a clear mark of distinction. Most of the top level management at NR has been "in the field" at one time or another.

A specific training and qualification program was established for prospective Field Representatives. They were exposed to all the important divisions within NR Headquarters (to understand the entirety of the headquarters role) and then spent one to two years as an assistant at a Field Office. During their time as an assistant, they are required to complete a qualification program specific to the site. This program includes self-study, coursework, and on-the-job training, along with regular written and oral examinations. Only after garnering the respective Field Representative's endorsement would the individual be recommended back to headquarters for assignment as the head of their own field office.

However, the program does not end there. It was understood from the outset, that assignments to the field were of limited duration, and eventually the incumbent would be rotated back to headquarters; after a successful tour a senior management job could be expected.

Philosophy

It is clearly understood that there are differences in the overall mission between DOE and Naval Reactors. However, both have nuclear safety responsibilities. The exact personnel management

methods applicable to one, for instance, the NR "field" and Headquarters, may not be totally appropriate to the other; however, the philosophy behind these methods is basically the same. The discussion of interest is the philosophy and the methods behind ensuring technical excellence of personnel.

Philosophy behind Fleet Procedures

What were the reasons for the emphasis by NR on personnel selection, education and training, and qualification? NR had its hands full in designing nuclear propulsion plants suitable for shipboard operation and then guiding their construction and testing. However, these plants had to operate reliably and safely in intense tactical situations, as well as in the vicinity of large cities when entering or leaving port.

Foremost in NR's goals was technical qualification. The ships often operate at sea on independent operations with a requirement to maintain radio silence. In order to continue to operate the reactor plant safely under such circumstances, the onboard operators have to understand how the plant is physically designed, the physics behind power plant dynamics, and the reasons for each step in the operating procedures. If the plant ever exceeds normal operating limits, the operators have to know how to return it to normal conditions and what potential harm may have resulted. In extreme tactical situations, the operators have to know the full limits of the plant's safe operations in case these margins have to be called upon.

NR is of the philosophy that shipboard officers have to be as technically competent in all aspects of plant operation as the most senior chief petty officers. In addition, the senior officers (Captain, Executive Officer, and Chief Engineer) must achieve technical qualifications above anyone else on the ship. This is because in emergencies these officers have to make the correct decisions on the spot and immediately. These decisions have to be based not only on the experience of these officers, but on the theoretical knowledge of plant dynamics and the limits to which the plant is designed. Thus, the selection process continues to be oriented toward identifying those personnel who can demonstrate clear thinking under stress, perseverance, hard work, a quest for excellence, proven academic ability and intelligence, and the willingness to accept the responsibility for making decisions. Following selection, the education, training, qualification, and requalification processes have to be equally demanding and thorough.

Philosophy behind Headquarters Procedures

The same principles that govern fleet operations are true for the engineers who comprise the NR Headquarters organization. They have to design plants and develop maintenance programs for these plants that will be subjected to extreme operational demands and, no matter the age, must perform as designed. The Captain and Chief Engineer at sea, as well as the laboratories and contractor facilities that support the Naval Reactors organization, know that the center for technical expertise and backup exists at NR Headquarters.

Fleet operators know that they can call NR at any time from places such as Guam or Diego Garcia in the Indian Ocean and get full technical support. Whatever the nature of the question, usually an answer via the telephone is all that is needed because of the technical competency of the operators (however, all telephone approvals are followed up in writing within 24 hours). The organizations in the "field," such as the prototypes and laboratories, realize that NR Headquarters is the source of direction and the final approval for answers to engineering questions. In addition, NR provides technical direction to, and conducts reviews of: the laboratories that conduct naval reactors-related business and vendors who perform nuclear component work, as well as to the nuclear-powered ships. These evaluations could not be meaningful without the continuous technical direction and management review provided by headquarters based on consistent technical competence.

Conclusion

The NR methods of selecting, training, qualifying, and requalifying its personnel are, in principle, very similar to those outlined in DOE's Orders and directives. The philosophies of the programs, whether practiced within the Naval Reactors areas of interest or at DOE nuclear facilities, are not so dissimilar as to limit adapting some lessons learned at one operation to the other. There are parallels between the naval nuclear propulsion program and the DOE nuclear programs.

While the immediate responses by at sea operators and (at times) NR engineers generally may not be required in day-to-day DOE operations, there are times when the DOE organization is called upon for technical support and decisions. In addition, both organizations supervise and take a leading role in safety reviews of field operations. Thus, not only are the philosophies and methods similar, so are the requirements and procedures.

If existing personnel selection, education, training and qualification standards are not adequate to yield the level of technical personnel necessary, then they should be enhanced and followed by institutionalizing the changes for lasting value. In the end, the jobs at DOE Headquarters, just as the jobs at NR Headquarters, need to be considered both attractive and prestigious. This is required if personnel are to be retained in the organization after they are qualified and have gained meaningful experience.

APPENDIX D

Appendix D

Excerpts from Selected Trip Reports Sent by the Board to the Department of Energy (1993 and Later)

Letter, Chairman Conway to Assistant Secretary Reis, dated 11/15/93
[encl] Trip Report of Order Compliance Review at the Nevada Test Site (NTS)

> "*It appears that inadequate attention was given, in some instances, to the qualification of the personnel coordinating or conducting the* [order compliance self-]*assessment. In one example, an undergraduate intern was tasked to coordinate the DOE-NVOO* [Nevada Operations Office] *self-assessment and compliance with DOE Order 5820.2A, Radioactive Waste Management -- an Order with a significant degree of technical complexity.*"

Letter, Chairman Conway to Assistant Secretary Grumbly, dated 01/27/94
[encl] Review of K-Basins at Hanford

> "*In a recent review, the Office of Nuclear Safety (EH-10) indicated that neither DOE-RL* [Richland Operations Office] *nor WHC* [Westinghouse Hanford Company] *fully understood the potential problems associated with these* [K-Basins] *facilities.*"

Letter, Technical Director Cunningham to Mr. Whitaker, dated 10/21/94
[encl] Report on Development and Implementation of S/RIDs at Hanford High Level Waste Storage Tanks

> "*DOE-RL* [Richland Operations Office] *personnel stated that their review of WHC* [Westinghouse Hanford Company] *S/RIDs* [Standards/Requirements Identification Documents] *was not necessary to ensure adequacy.*"

> "*DOE-RL did not review any S/RIDs.... No plans or specific milestones are in place to ensure DOE-RL personnel review the S/RIDs for technical content and adequacy. DOE-RL personnel stated that their review is not necessary to ensure the S/RIDs are adequate, but could not explain how they will ensure S/RIDs are implemented at the site without benefit of a technical review of the content.*"

Letter, Technical Director Cunningham to Mr. Whitaker, dated 09/21/94
[encl] Rocky Flats Plant - Trip Report on the Review of Building 371 Seismic and Systems Design Bases, Special Nuclear Material Storage, and Systematic Evaluation Program Status

"*However, neither EG&G nor DOE-RFO* [Rocky Flats Operations Office] *had a sufficient understanding to discuss the details of the site conditions or the analyses performed by the original architect-engineer. It is particularly noted that the foundation design is not understood by DOE-RFO or EG&G. There was not enough information that had been reviewed and understood by EG&G or DOE-RFO to make an independent assessment of the adequacy of the structural analyses.*"

Letter, Chairman Conway to Assistant Secretary Grumbly, dated 09/05/95
[encl] Implementation of Recommendation 93-4 - Richland Operations Office Technical Management Plan, Report of Site Visit, August 1-3, 1995

"*Specifically, the* [Technical Management Plan] *TMP fails to identify the requirements necessary for DOE's technical management of the environmental restoration contractor, Bechtel Hanford, Inc. (BHI). DOE-RL* [Richland Operations Office] *Environmental Restoration (DOE-ER) personnel demonstrated a poor understanding of Recommendation 93-4 and have done little to effectively implement the TMP. The Board's staff also found that the technical capabilities and involvement of DOE-ER personnel are inadequate to allow for sound technical management of BHI.*"

"*Weaknesses in the DOE-RL Environmental Restoration organization were evident to the Board's staff in several areas relative to the TMP and the management of the environmental restoration contractor at Hanford. Prominent among these weaknesses were a noted lack of technical and managerial capabilities, a lack of understanding of Recommendation 93-4 and a lack of effective implementation of the assessment program set forth by the TMP.*"

"*The Board's staff noted evidence that the DOE-ER staff lacked the expertise and management involvement to effectively manage BHI.*"

"*DOE-ER field oversight of the contractor was also found to be erratic and infrequent.*"

"*Conversations with Washington State Department of Ecology personnel, DOE-EH Resident Inspectors, DOE-RL internal assessors, and a representative of the Environmental Protection Agency, Region 10 confirmed staff observation s regarding DOE-ER abilities. Based on their personal observations, all of these*

representatives echoed the concern that DOE-ER personnel lacked program management training and qualifications and technical background to effectively manage the activities of BHI."

"DOE-ER personnel acknowledged a lack of expertise in many of the technical areas to be assessed. Their proposed solution to this problem was to enlist the assistance of BHI to perform combined assessments of BHI activities."

"Examples of Poor DOE-ER Performance:

> *"... The cognizant DOE-ER Project Manager acknowledged that she did not understand the concern* [poor radiological work practices] *as she had no prior experience or training in radiological controls."*
>
> *"The DOE-ER Facility Representative... acknowledged he does not have the background or training to readily complete the DOE-RL Facility Representative program in the suggested twelve month period."*
>
> *"The DOE-RL Assistant Manger for Environmental Restoration... acknowledged that few of her staff understood their jobs adequately."*

Letter, Chairman Conway to Assistant Secretary Grumbly, dated 05/11/93
[encl] Fernald Environmental Management Project - UNH Neutralization Project Review Trip Report (April 21-22, 1993)

"The DNFSB staff believe that the Department of Energy Fernald Field Office (DOE-FN) and its new environmental restoration management contractor, Fernald Environmental Restoration Management Corporation (FERMCO), have a serious problem in communicating technical and programmatic information. FERMCO started up the UNH neutralization process without conducting a required readiness review and without informing DOE-FN. The UNH neutralization process operated, without DOE-RN knowing, for one week before the process was shut down. It was apparent that DOE-FN personnel did not understand the FERMCO organization...."

"The lack of DOE Facility Representatives has resulted in a lower level of technical vigilance by DOE and the removal of an important layer of defense."

Letter, Technical Director Cunningham to Mr. Whitaker, dated 05/13/94
[encl] Trip Report - Review of Implementation of DNFSB Recommendation 93-5 at the Hanford Site, March 28-31, 1994

> "*The Department of Energy (DOE) is not providing adequate technical management oversight of the program. As a result, critical decisions regarding characterization strategy, safety criteria, and required confidence levels for decisions are being made by WHC [Westinghouse Hanford Company] with little input from the Department of Energy Richland Operations Office (DOE-RL) or the responsible headquarters line organization (EM-36, EM-30, or EM-1).*"
>
> "*DOE-RL is not providing the technical direction required to successfully carry out the characterization program. Subsequent discussion with a representative from the responsible headquarters office (EM-36) confirmed that he was aware of this problem but had not intervened effectively to correct it.*"

Letter, Chairman Conway to Assistant Secretary Reis, dated 11/25/94
[encl] Los Alamos National Laboratory (LANL) - Review of Chemistry and Metallurgy Research (CMR) Facility Hot Cell Upgrades and the Fire Resistant Pit (FRP) Test Program

> "*Based on discussions with LANL* [Los Alamos National Laboratory] *regarding responsibilities and accountability, it is unclear who at LANL is responsible and accountable for assuring that the hot cell seismic upgrades will perform their stated functions. Other than budgetary responsibility, LANL management responsibility for these upgrades is diffuse.*"
>
> "*The design review process used by LANL to review the hot cell seismic upgrade design was weak and ineffective. Based on DNFSB staff review and discussions with LANL during the presentations concerning the technical substance of a design review, the DNFSB staff observed that the comments generated by LANL personnel were essentially non-technical in nature. They did not focus on whether or not the facility upgrade was adequate to prevent initiation of collapse mechanisms, as well as minimize and mitigate the FRP* [Fire Resistant Pit] *hazards and consequences. In particular, the comments of the LANL seismic reviewer merely requested that the comments previously prepared by the DOE reviewer be resolved. This suggest that LANL has not provided technical oversight of its contractors.*"

Letter, Chairman Conway to Acting Assistant Secretary Beckner, dated 05/03/93
[encl] Observations from a Trip to the Albuquerque Field Office, February 22-24, 1993

> *"For example, there have been only modest advances in the program to identify appropriate training in the areas of nuclear engineering and nuclear safety required for Field Office and Area Office personnel and there is no plan to acquire that training and education. This condition is particularly apparent at the Amarillo Area Office where there is a relative lack of personnel with nuclear engineering experience and training."*

Letter, Chairman Conway to Secretary O'Leary, dated 07/20/94

> *"The Board wishes to call your attention to staffing deficiencies at the Amarillo Area Office (AAO) that are adversely affecting the performance of safety-related functions assigned that office."*
>
> *"... the Board's letter of May 27, 1994, stated that the current overall DOE technical staffing situation is already 'below a level which the Board believes to be necessary for continued safety.'"*
>
> *"Even with these* [vacant senior manager and engineering positions] *filled, it is not evident that sufficient technical and management competence in middle management and staff at the AAO will be available to support the pace of activities at the site."*

Letter, Technical Director Cunningham to Mr. Whitaker, dated 09/27/95
[encl] Pantex Site - DNFSB Staff Report - Conduct of Operations and Training and Qualification Program Review

> *"Despite DOE-AAO's* [Amarillo Area Office's] *recruiting efforts, it has been difficult to attract quality candidates to fill the positions. Even with the issuance of the DOE-HR* [Office of Human Resources] *manual Manager's Guide to Administrative Flexibilities, DOE-AAO reported difficulty obtaining travel pay, hiring bonuses, "double-dipping" approvals, excepted service authority, and upper steps authorizations for GS pay grades. For example, DOE-AAO submitted a request for one excepted service position. The initial request was rejected (documentation inadequacies); the resubmittal required six weeks for approval. Due to the urgency of the need for an individual in the position, DOE-AAO was forced to fill the billet using the standard personnel system."*

Letter, Technical Director Cunningham to Mr. Whitaker, dated 07/05/95
[encl] Review of Implementation of Board Recommendation 92-4 and Hanford Tank Farms Activities

"*Improvements in the technical competence of DOE-RL* [Richland Operations Office] *personnel responsible for TWRS* [Tank Waste Remediation System] *are also behind schedule and to date have had no effect.*"

"*Upgrading the technical competence of DOE-RL TWRS personnel is required by the 92-4 Implementation Plan and is planned to be coordinated with similar actions taken in response to Recommendation 93-3. DOE-RL Director of the Office of Training stated his office does not have the funding to implement the site specific initiatives of 93-3 at the site level.... Consequently, progress to date at the TWRS level is poor....*"

Letter, Technical Director Cunningham to Mr. Whitaker, 07/28/95
[encl] Nuclear Explosives Safety Study: Arming & Firing and Timing & Control (A&F/T&C) System for Lawrence Livermore National Laboratory Devices at the Nevada Test Site

"*DOE personnel responded to the minority* [NESSG report] *position by stating that they did not believe that it was valid. This decision was based strictly on the experience of the DOE personnel. Technical justification for the decision was not documented.*"

Letter, Technical Director Cunningham to Mr. Whitaker, dated 12/15/94
[encl] Pantex Site - DNFSB Staff Trip Report - Emergency Preparedness Exercise Review

"*Weaknesses were noted in Pantex's and DOE's ability to evaluate the exercise.*"

"*During a participant's critique held immediately after the exercise, only minor deficiencies were identified and the Emergency Preparedness Manager stated that he felt performance was good. Objective application of the exercise evaluation criteria, prepared by Pantex, indicated that five significant objectives were not met.*"

"*The DNFSB staff reviewed the Pantex and Albuquerque Operations Office After-Action Reports. The reports were superficial, and did not present a critical evaluation of the exercise. Specifically, the reports did not identify the many technical issues raised by the DNFSB staff.*"

Letter, Technical Director Cunningham to Mr. Whitaker, dated 04/10/94
[encl] Report on the Radiation Protection Case Study of the Dismantlement and Decontamination Project at the Old HB-Line

> "*Although DOE and WSRC* [Westinghouse Savannah River Company] *admit the efforts in old HB-Line have significant worker risk, WSRC notes that no DOE-SR* [Savannah River Operations Office] *or DOE Headquarters personnel have actually been in the facility to observe operations. This lack of DOE line management and headquarters oversight attention indicates that DOE has not taken an active role in the resolution of the problems that have occurred.*"

> "*DOE and WSRC management have not taken an active role in the completion of the D&D* [Decontamination and Decommissioning] *of this facility. Although the workers performing this D&D are at a significantly higher risk than are most other workers on the site, DOE and WSRC management personnel have not adequately reviewed the work that is being performed to determine what actions could be taken to reduce the risk, or to ensure that future D&D work at the SRS does not result in the same risks to the workers. Despite the fact that work can not be adequately monitored from outside the facility, DOE personnel have reportedly not entered the highly contaminated areas of the facility since the work began 10 years ago.*"

Letter, Technical Director Cunningham to Mr. Whitaker, dated 07/28/94
[encl] Trip Report for Staff Visit to NTS, April 28-29, 1993

> "*Key Personnel: The DOE TC* [Test Controller] *and Lab/DNA TD* [Defense Nuclear Agency Test Director] *play pivotal roles in coordinating safe and effective test preparation and execution. However, no definite training and qualification requirements were presented for these personnel, or for the members of the Containment Evaluation Panel (CEP). Many of the highly-experienced people currently filling these positions may soon retire. It is unclear how the current level of competence will be maintained without an established program to transfer experience. It is also unclear how competency is being uniformly maintained with the current incumbents.*"

Letter, Technical Director Cunningham to Mr. Whitaker, dated 08/10/94
[encl] Training, Qualification, and Conduct of Operations Review at the Fernald Environmental Management Project, April 11-13, 1994

"*The DNFSB team reviewed DOE-FN's* [Fernald Field Office's] *actions associated with DNFSB Recommendation 93-3. It was found that the Field Office is waiting for Headquarters guidance with little action being taken to improve the technical capabilities of the staff.*"

"*In response to Recommendation 91-1, DOE-FN has defined key personnel positions and set forth tentative education and experience recommendations for technical support, oversight and assessment positions. No data were available comparing these recommendations against the background of incumbents. The briefer indicated that no system existed to ensure these recommended requirements were adhered to in current hirings and in fact were frequently not met.*"

"*... Concurrently, the Field Office had developed education, experience and required training for some DOE-FN management positions. As above, DOE-FN personnel expressed uncertainty in enforcing any new education and experience requirements in new hirings.*"

Letter, Technical Director Cunningham to Mr. Whitaker, dated 07/15/94
[encl] Report on Review of Hanford Facility Representatives Program

"*Two Site Representative candidates were observed in the performance of their duties. Neither candidate demonstrated an integrated knowledge of their facility; nor a strong understanding of the concept of nuclear safety inspections. Neither candidate could answer specific questions concerning technical safety requirements (TSRs) for their facilities. One candidate was not familiar with the physical layout of his facility.*"

"... *EM-25* [Office of Operations Assessment] *noted that qualification cards were being developed and signed by individual candidates for their own qualification; DOE-RL* [Richland Operations Office] *personnel stated that the written and oral examination banks currently being used to qualify Site Representatives are inadequate.... Never-the-less, these banks are still being used....*"

Letter, Chairman Conway to Secretary O'Leary, dated 05/11/94
[encl] Report on the Radiation Protection Program at the Hanford Site

> "... *the DOE [Richland Operations Office] contingent supporting Radiation Protection, previously noted by DOE-HQ to be inadequate in size to satisfactorily oversee contractor activities on a day-to-day basis, has not been augmented....*"

Letter, Technical Director Cunningham to Mr. Whitaker, dated 04/10/95
[encl] Savannah River Site (SRS) - Review of Preparations for the Decontamination and Decommissioning (D&D) of the Separations Equipment Development (SED) Facility

> "*The development of the authorization basis for the SED* [Separations Equipment Development] *D&D* [Decontamination and Decommissioning] *project, including DOE approval, is less than adequate. There is little evidence that DOE-SR* [Savannah River Operations Office] *conducted an adequate technical review of the SED D&D safety analysis, including an assessment of technical assumptions, such as Pu release fractions.*"

Letter, Technical Director Cunningham to Mr. Whitaker, dated 07/15/94
[encl] Defense Waste Processing Facility Trip Report July 6-8, 1993

> "... *DOE qualification requirements for the position of Fire Protection Engineer are less than those established by the NRC* [Nuclear Regulatory Commission]."

Letter, Technical Director Cunningham to Mr. Whitaker, dated 08/14/95
[encl] Trip Report - Review of the Department of Energy - Richland Operations Office (DOE-RL) Oversight of DOE Order 5480.21, *Unreviewed Safety Questions*, March 28, 1995

> "*The Board also noted a lack of monitoring and oversight of the USQ* [Unresolved Safety Question] *process by the Richland Operations Office* [DOE-RL]. *DOE-RL acknowledged these deficiencies and identified specific actions to correct them. Even so, during the eighteen months since these deficiencies were identified, little progress has been made in strengthening DOE-RL's monitoring and oversight of contractor USQ activities.*"

Letter, Chairman Conway to Assistant Secretary Grumbly, dated 09/08/95
[encl] Review of Procedures at the Hanford Site

> "*Richland Operations Office (DOE-RL) involvement in correcting the known Hanford Site procedure problem remains minimal, despite their own program indicating the problem persists.*"

Letter, Chairman Conway to Secretary O'Leary, dated 09/24/93

> "*Observations during these visits have led the Board to focus considerable attention on DOE's need to improve the selection, training, and qualification of personnel associated with the defense nuclear facilities, especially the weapons complex, on the premise that properly trained and qualified personnel are essential for the protection of public health and safety. The board has made eight sets of Recommendations since 1989 which address selection, training, and qualification problems....*"

APPENDIX E

Appendix E

Board Staff Report:
Review of DOE 1994 Technical Personnel Hiring Data

DEFENSE NUCLEAR FACILITIES SAFETY BOARD

August 8, 1995

MEMORANDUM FOR: G. W. Cunningham, Technical Director

COPIES: Board Members

FROM: Timothy J. Dwyer

SUBJECT: Review of DOE 1994 Technical Personnel Hiring Data

1. **Purpose:** This memorandum discusses a review of 1994 technical personnel hiring data from across the Department of Energy (DOE) defense nuclear facilities complex. This review was conducted by members of the Defense Nuclear Facilities Safety Board's (Board's) staff, Timothy J. Dwyer and Robert F. Warther, and outside experts John F. Drain and Ralph W. West, Jr. This review *did not* involve any evaluations of technical personnel performance in the field.

2. **Summary:** Throughout calendar 1994, DOE continued its efforts to improve the technical capabilities of the DOE staff, in response to Board Recommendation 93-3. In parallel with this effort, the Secretary of Energy authorized the hiring of nearly 1200 personnel. A few highly talented, well-qualified individuals were hired; however, many senior technical positions within DOE were filled by individuals drawn from a DOE technical population considered by several high level reviews to be deficient in personnel of exceptional technical qualities. Thus, DOE failed to take advantage of the unique opportunity this hiring authority provided to substantially raise the technical capabilities of the DOE staff.

   - Overall DOE hiring practices did *not* result in hiring a significant number of technical personnel who where highly qualified; no excepted service personnel were hired.

   - The technical applicant screening process used by DOE in 1994 tended toward selection of a *minimally qualified candidate; selection of highly qualified candidates occurred with no greater frequency than that expected through a random process.*

   - The selection process for those technical individuals hired by DOE in 1994 did not adequately emphasize the quality of candidate technical education.

In short, the data indicates that Board efforts to encourage DOE to ". . . raise the technical expertise of the Department [DOE] . . ." through allocation of technically qualified individuals to federal positions in the defense nuclear complex were not effective in 1994.

3. **Background:** The technical capabilities of DOE and contractor personnel have been an ongoing concern of the Congress, the Board, and numerous independent review groups for a number of years. The United States Senate Report accompanying the Board's enabling legislation states that the "Board is *expected to raise the technical expertise* of the Department [DOE] substantially. . . ." The Board has repeatedly stated, in its annual reports, that ". . . the most important and far-reaching problem affecting the safety of the DOE defense nuclear facilities is the difficulty in attracting and retaining personnel who are adequately qualified by technical education and experience to provide the kind of management, direction, and guidance essential to safe operation of DOE's defense nuclear facilities." Several other prominent organizations, including the National Research Council, the "Ahearne Committee," and the DOE itself have also weighed in on this matter with similar concerns. In this vein, Recommendation 93-3 was issued in June 1993 to recommend improvements in the recruitment, retention, education, and training of DOE's technical personnel. In fact, this Recommendation specifically called on DOE to ". . . establish the attraction and retention of scientific and technical personnel *of exceptional qualities* [emphasis added] as a primary agency-wide goal."

   DOE's Implementation Plan for Recommendation 93-3 was submitted and accepted in November 1993. Throughout calendar 1994, DOE labored to implement the various portions of this plan. In parallel with this effort, the Secretary of Energy authorized the various defense complex DOE Offices (most notably the Office of Environmental Management (EM), and to a lesser degree the Office of Environment, Safety and Health (EH)) to hire a total of nearly 1200 personnel. Therefore, in early 1995, the Board's staff requested that DOE provide data that would permit an evaluation of DOE's effectiveness at attracting highly qualified scientific and technical personnel. It is emphasized that the documentation provided by DOE was the only source material used in this review. No evaluations of personnel performance in the field were conducted, nor were any interviews, reference checks, or other information gathering techniques employed.

4. **Discussion.**

   a. **Overall 1994 DOE Technical Hiring Data.** The data provided by the DOE to conduct this review consisted of 467 Standard Form 171s (SF-171s) and their associated Position Descriptions (PDs), in some cases, augmented by their Vacancy Announcements, each set representing one individual who had filled a previously vacant technical DOE billet (either as a new hire, lateral transfer, or promotion) during calendar 1994. This data was *not* representative of all DOE hiring in 1994; rather, it concerned only technical personnel hired at the following DOE defense complex offices: the Office of Defense Programs (DOE-DP), DOE-EH, DOE-EM, the Albuquerque Operations Office (DOE-AL), the Idaho Operations Office (DOE-ID), the Nevada Operations Office (DOE-NV), the Oakland

Operations Office (DOE-OAK), the Oak Ridge Operations Office (DOE-OR), the Ohio Operations Office (DOE-OH), the Richland Operations Office (DOE-RL), the Rocky Flats Operations Office (DOE-RF), and the Savannah River Operations Office (DOE-SR). Data on 17 technical DOE defense complex senior executive service (SES) billets filled in 1994 were also included as part of the 467 SF-171s/PDs, but were treated separately. Of the 467 SF-171s/PDs submitted, 22 were discarded upon initial review as not related to technical billets (or containing insufficient data for classification or use in the review), yielding an overall sample size of 445.

The types of billets defined as "technical" included those identified as chemical engineers, civil engineers, electrical engineers, mechanical engineers, nuclear engineers, facility representatives, fire protection specialists, occupational safety specialists, radiological protection specialists, technical program/project managers, etc. The final data set included billets ranging from the GS-5 to the SES levels.

Figure 1 provides an overview of the number of technical billets filled (less SES's) in 1994 at each of the locations for which data was provided. Also depicted is the subset of that number already employed in DOE prior to accepting the new technical billet.

It is significant to note the DOE had difficulty collecting and providing this data. Initial DOE figures concerning 1994 hiring totaled 771 individuals, 291 technical and 480 *non-technical*. DOE later revised these figures to 470 technical, and 505 *non-technical* (975 total). Based on a review of the SF-171/PD data provided, the number of technical billets filled in the DOE defense complex in 1994 was 445; the fidelity of the DOE figure for non-technical billets (505) is questionable and is most likely valid only as a floor value.
Based on the data collection difficulty encountered, it is concluded that no mechanism existed for DOE senior managers to receive feedback on the efficacy of DOE technical personnel hiring efforts. This lack of feedback is indicative of a failure to adequately manage the process. Despite Board admonitions to DOE senior managers that they become personally involved in the process of hiring scientific and technical personnel of exceptional qualities, and that the intention to fill 1200 billets in the DOE defense complex provided a rare opportunity to raise the technical expertise of their Offices, it is obvious that DOE did not take full advantage of this chance to improve the technical capabilities of its staff.

Further, despite the fact that DOE had the authority to recruit 200 exceptionally qualified senior personnel through an excepted service program, and received authorization in October 1994 for 200 additional technical excepted service billets, *no excepted service positions were filled in 1994.*

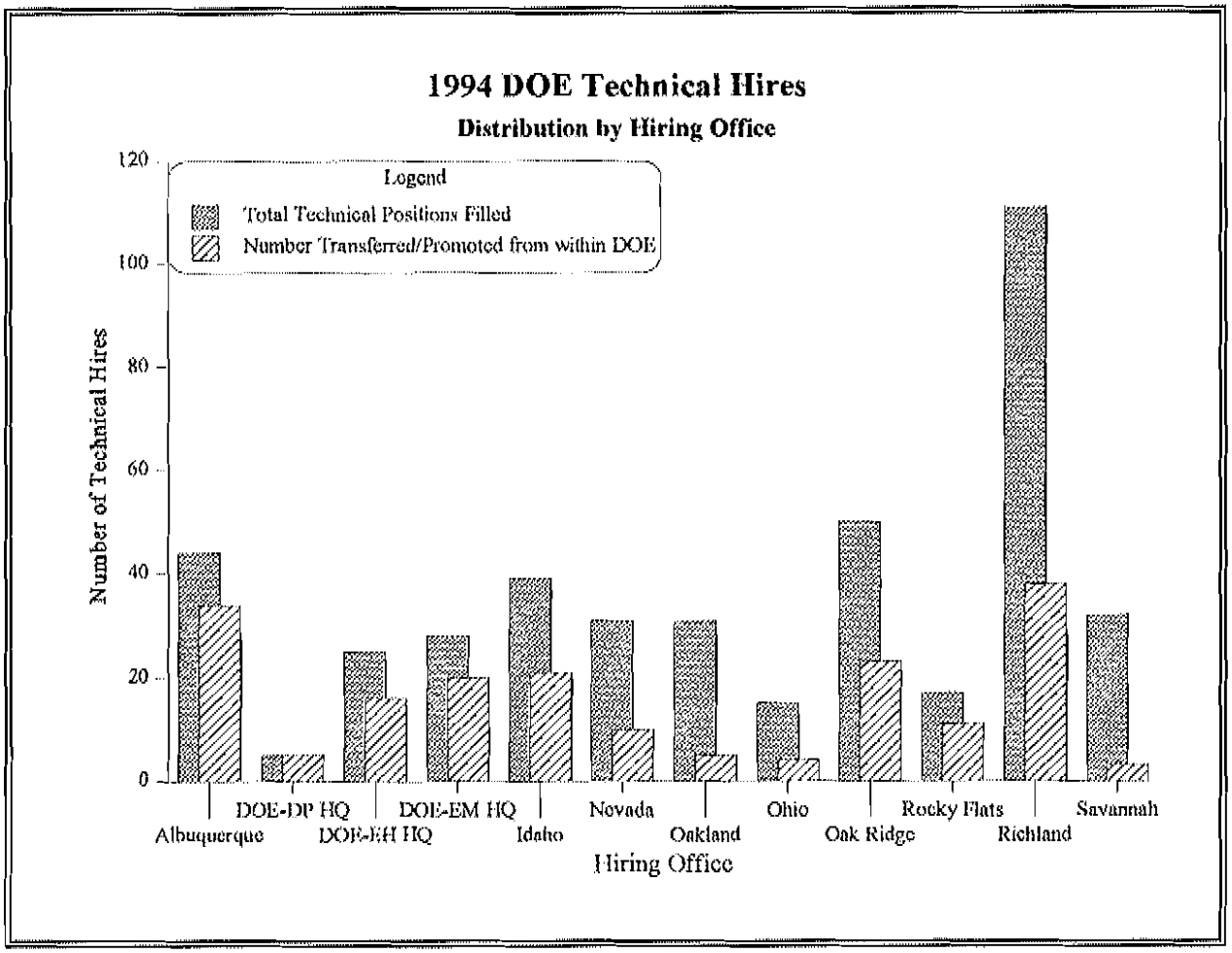

Figure 1

b. **Evaluation of the Technical Qualifications of 1994 DOE Technical Hires.** The 445 SF-171/PD sets were evaluated to determine the degree to which the SF-171 of each individual hired satisfied the specific Eligibility Requirements, Ranking Factors, and Duties and Responsibilities of the PD (and Vacancy Announcement, where available) under which the individual was hired. It is important to emphasize the fact that the standard used to evaluate each SF-171 was the same PD used by DOE to determine that the individual in question was the best-qualified candidate for the job.

For each SF-171/PD set, a grade was assigned, ranging from one to five. A grade of one signified that, based solely upon the SF-171 data, the individual did not meet the criteria of the associated PD, and accordingly, was not qualified for the assignment. A grade of three signified that the individual was probably qualified to the minimum criteria associated with the PD. A grade of five signified that, as described in the SF-171, the individual met or exceeded all criteria associated with the PD, and appeared to be an excellent match for

the billet described. (See Attachment A for further details on the method of evaluation used.) This data was collected for all 445 1994 DOE technical hires and is depicted in histogram form in Figure 2.

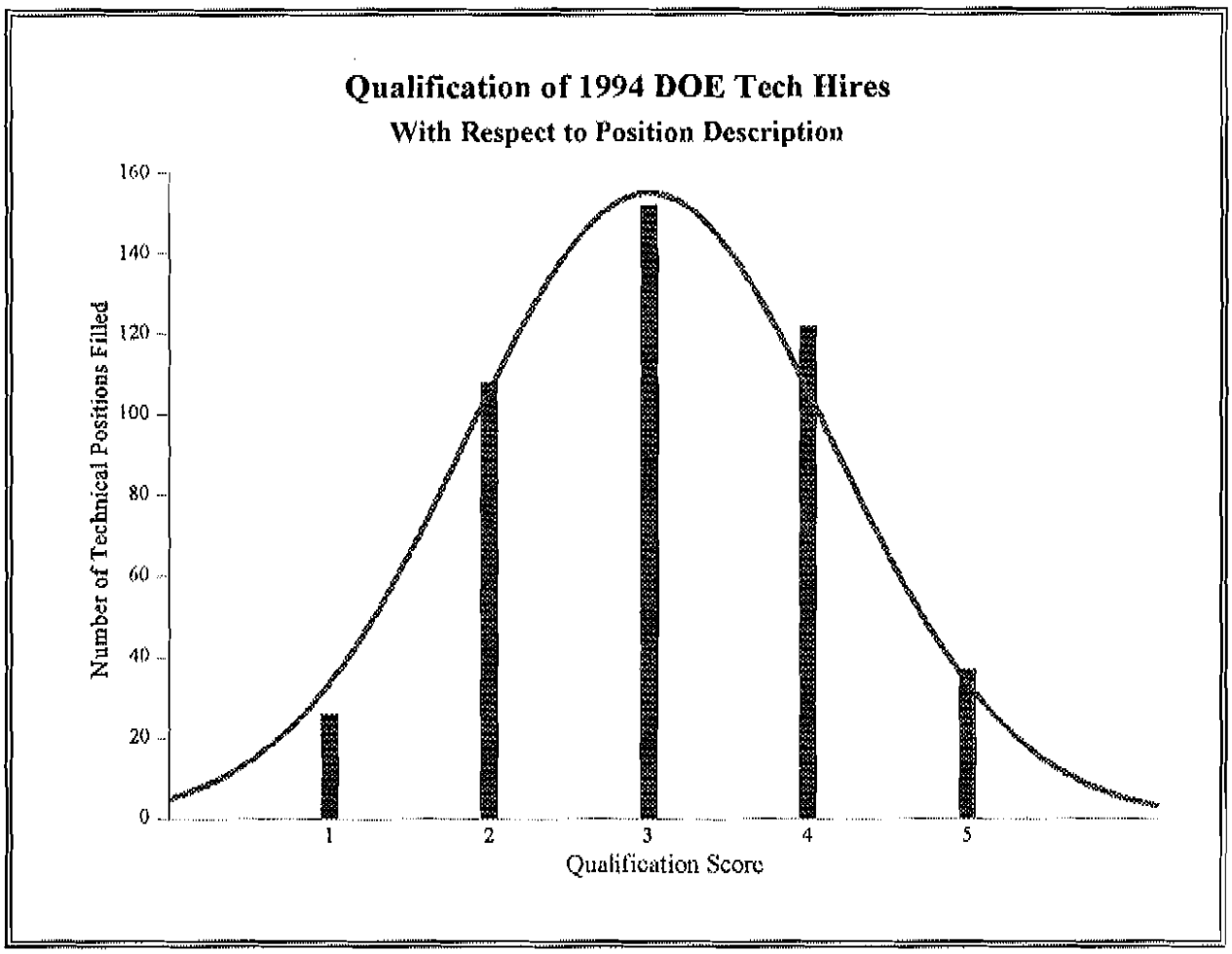

Figure 2

Note that the data approximates a normal (Gaussian) distribution: the data mean is 3.08, with a standard deviation of 1.04. In fact, it is strikingly similar to the smooth curve (Figure 2) that plots the normal distribution obtained for 445 data points with a mean score of 3.00 and standard deviation (1.14) fixed such that scores outside the range (of one to five) are limited to approximately one percent of the sample size. The significance of the similarities between the two plots rests on the fact that the smooth curve represents a hiring process in which the desired outcome is selection of an individual who *probably* meets all of the criteria of the PD (i.e., a score of 3), with selection of an individual who does not meet the criteria (e.g., a score of 1) or selection of an individual who is well-matched to the criteria (e.g., a score of 5) occurring with a frequency dictated by a *random process centered on 3.* Simply stated, analysis of the qualifications (relative to their PDs)

of 1994 DOE technical hires reveals that the hiring process tended towards selection of the minimally qualified candidate, and selection of a highly qualified technical candidate *occurred with no greater frequency than that which would be expected of a random selection process.*

A more telling comparison can be made by considering how much improvement is required of DOE to *begin* raising the technical expertise of the DOE staff substantially. This would require that DOE not hire any technical personnel who would score below *minimally qualified* (i.e., hire only for scores of *three* to five). To accomplish this, DOE would have to develop a hiring process that actively screens applicants to not select unqualified candidates (scores of one or two). Had this criteria been applied, fully 30 percent (134 of 445) of the 1994 DOE technical hires would not have been selected. Note that, from the 1994 DOE data, only 37 (less than 10 percent) of the 445 SF-171s/PDs were scored as highly qualified technical matches (score of 5) for the position in question.

The observed distribution of qualification scores for individual candidates did not improve even for the more senior positions filled in 1994. Figure 3 depicts the qualification scores obtained if SES data only is extracted from the data set. Once again, overlaid on the data is the normal curve that represents a hiring process in which the assignment of technical SES applicants to available technical SES billets selects the minimally qualified candidate. The comparison indicates that even at senior management levels, 1994 DOE performance did not result in hiring a significant number of technical candidates highly qualified with respect to their PDs. (This subject is discussed further in Section 4.d of this memorandum.)

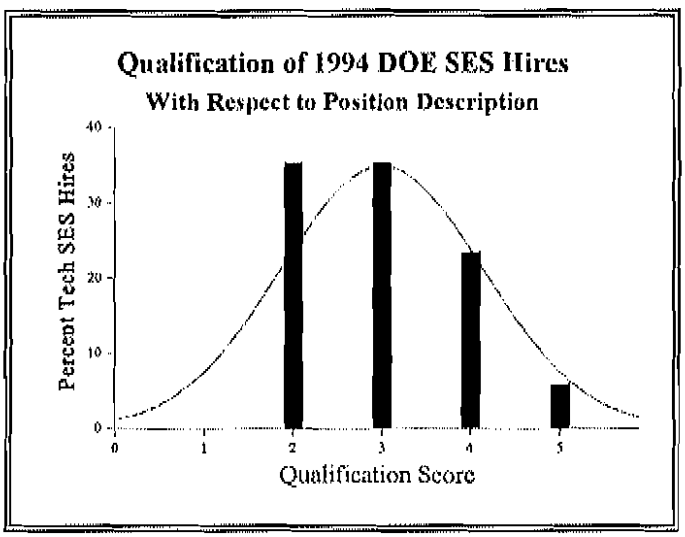

Figure 3

c. **Evaluation of the Educational Background of 1994 DOE Technical Hires.** The 445 SF-171s were further reviewed to evaluate the educational background of the 1994 DOE technical hires. In this review, the objective was to develop a snapshot of the technical educational background of the entire data set; in the aggregate, the quality of the educational background of a workforce is generally indicative of their technical capabilities. (Technical is defined to include the fields of Engineering, Science, or Mathematics.) An independent standard was chosen as the yardstick by which to score educational quality: *The Gourman Report*. *The Gourman Report* is an objective evaluation of degree program

curricula at individual colleges/universities, based on such factors as faculty, standards, admission requirements, and, most importantly, student performance following graduation.

Using both the undergraduate and graduate versions of this document, the educational background (including both curriculum and school) presented on each SF-171 was converted to a standardized quantitative score. These scores varied on a scale of zero (very poor at the undergraduate level, unacceptable at a graduate level) to five (very strong to excellent) for each level of degree (i.e., Baccalaureate, Masters, Doctoral). (See Attachment B for further details on the method used to evaluate educational quality.)

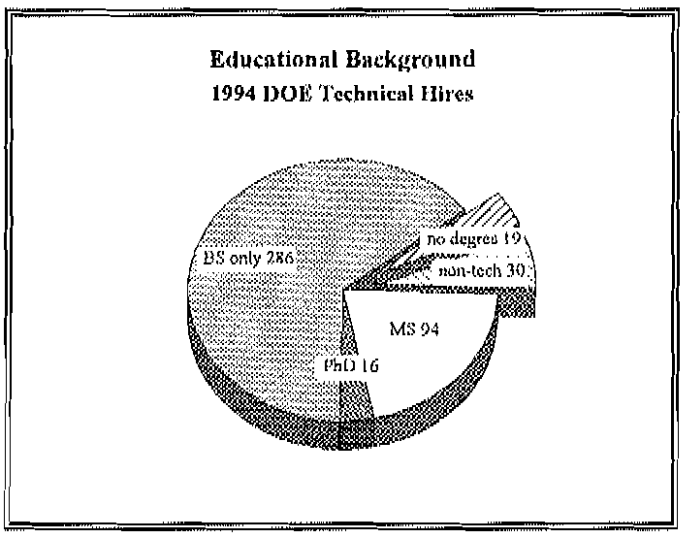

Figure 4

The first striking piece of data that falls out of this analysis is shown in Figure 4. Over 10 percent (49 of 445) 1994 DOE technical hires did not have at least a Baccalaureate technical degree. Nineteen had *no degree*. This is significant in that the Office of Personnel Management (OPM) minimum standard for hiring a GS-5 employee is four academic years beyond high school leading to a Bachelor's degree; a GS-7 should have a Bachelor's degree with at least two years of Superior Academic Achievement, or one year of graduate education.* Yet all 19 were hired at the GS-7 level or higher -- nearly two-thirds were hired at the GS-12/13/14 levels. It is clear that these personnel, plus the other 30 lacking a technical educational background, will be limited in their ability to provide technical expertise to DOE.

Further information developed through this review of educational backgrounds is depicted in Figure 5. To understand the data presented, it must first be pointed out that *The Gourman Report* does not rate schools in the range 0.0 to 2.0. Any school that would be scored below 2.0 is considered "not adequate" and is defaulted to a score of 0.0. Thus, there is a natural gap between 0.0 and 2.0. For purposes of this review, the following values have been placed in this gap: the range 0-0.5 has been used to count individuals lacking a four year technical degree; and the range 0.51-1.0 has been used to count individuals whose degree was obtained at a school not scored by *The Gourman Report* (in most cases, because the school was not in the U.S.). As can be seen, the distribution of

* *U.S. OPM Operating Manual: Qualification Standards for General Schedule Positions*, General Policies and Instructions.

education quality scores at the baccalaureate level is spread rather uniformly across the spectrum from 2.5 to 5.0. This is indicative of a hiring selection process that is *not* screening for highly qualified technical educational backgrounds. Using the scoring categories employed in *The Gourman Report* (see Translation of Grading Scales in Attachment B), educational programs must be scored 3.6 or higher to be merely "good." "Strong" technical educational programs are scored as 4.0 or higher. The absence of a bias toward the last two columns (4.01-4.5 and 4.51-5.0) in the 1994 DOE data indicates that DOE did not place adequate emphasis on scientific and technical educational backgrounds as criteria for personnel selection.

The data depicting the educational quality of 1994 DOE technical hires educated to the Masters level generally reveals the same absence of bias towards the higher end of the scale, although there is definitely an increase in the proportion of "very strong" educational backgrounds at this level. It is only at the Doctoral level that the educational quality data reveal a bias toward selection of highly technically qualified individuals; however, as was seen in Figure 4, this population represents less than four percent (16 of 445) of the 1994

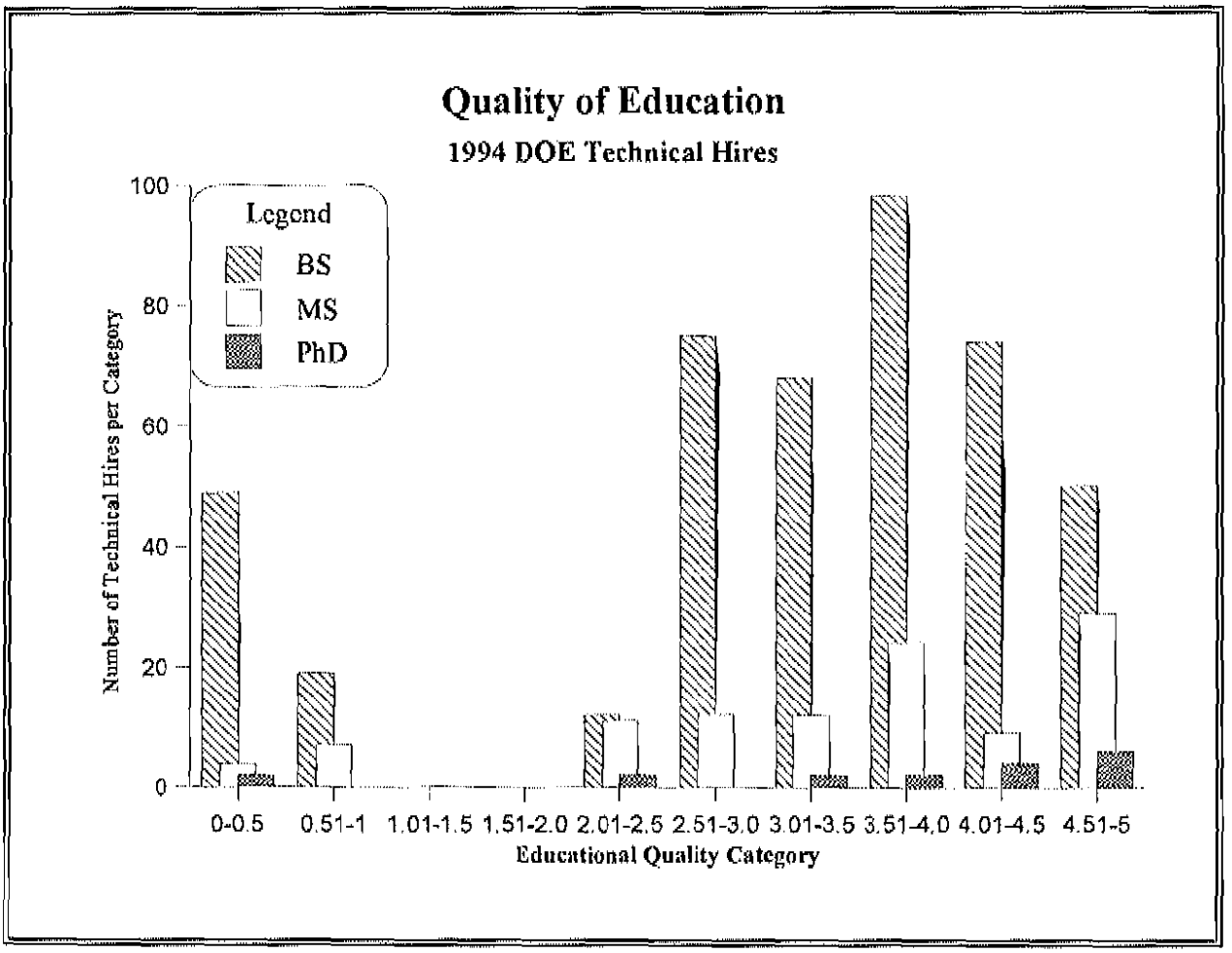

Figure 5

DOE technical hires. Furthermore, the universe of available doctoral programs is already naturally skewed toward higher rated schools.

d. Evaluation of the Source of 1994 DOE Technical Hires. The 445 SF-171s were examined to determine the source of the 1994 DOE technical hires. That is, for each individual, the job which he left to accept the DOE position in 1994 was categorized as either in DOE, in some other government agency, or outside of government (i.e., recruited from industry or school). For those SF-171s source categorized as in DOE, a further distinction was drawn as to whether the transfer to the new position was lateral or involved a promotion.

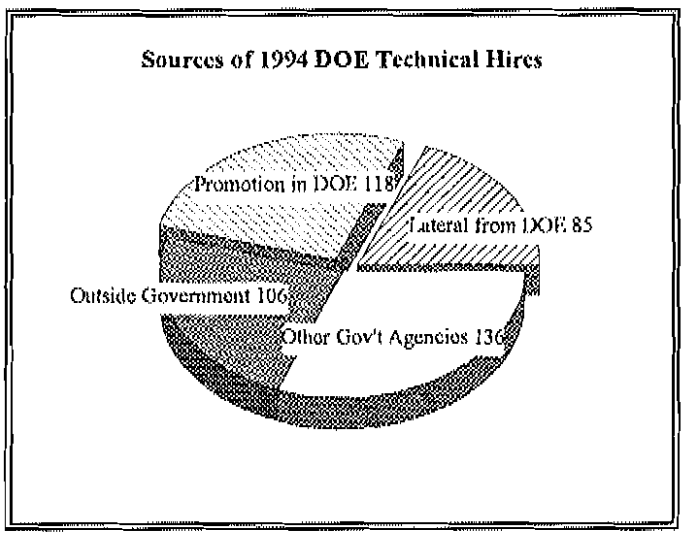

Figure 6

As depicted in Figure 6, overall, approximately 45 percent (203 of 445) of the 1994 DOE technical hires were already employees of DOE when they accepted their new position. Approximately 30 percent (136 of 445) transferred from other government agencies, and nearly 25 percent (106 of 445) were recruited from outside of government. Thus, nearly half of the 1994 DOE technical hires were drawn from a pool considered by several prominent review groups as lacking in scientific and technical excellence (see sources cited in the Background section of this memorandum, as well the letter from the Secretary of Energy to the President, December 20, 1991).

The longer-range aspects of this observation can be illustrated by examining the data relating to the senior levels of management in DOE. Figure 7 depicts the distribution of hiring sources for 1994 DOE technical hires at the GS-14, GS-15, and SES levels. As can be seen, more than 80 percent (127 of 158) of the 1994 senior level technical hires were drawn from this DOE population. Thus, even if (contrary to the findings presented in Sections 3.b and 3.c of this memorandum) the DOE technical personnel hiring process was successful at bringing in scientific and technical individuals of exceptional capabilities, they would be under the leadership of senior managers responsible for the culture that engendered Board Recommendation 93-3.

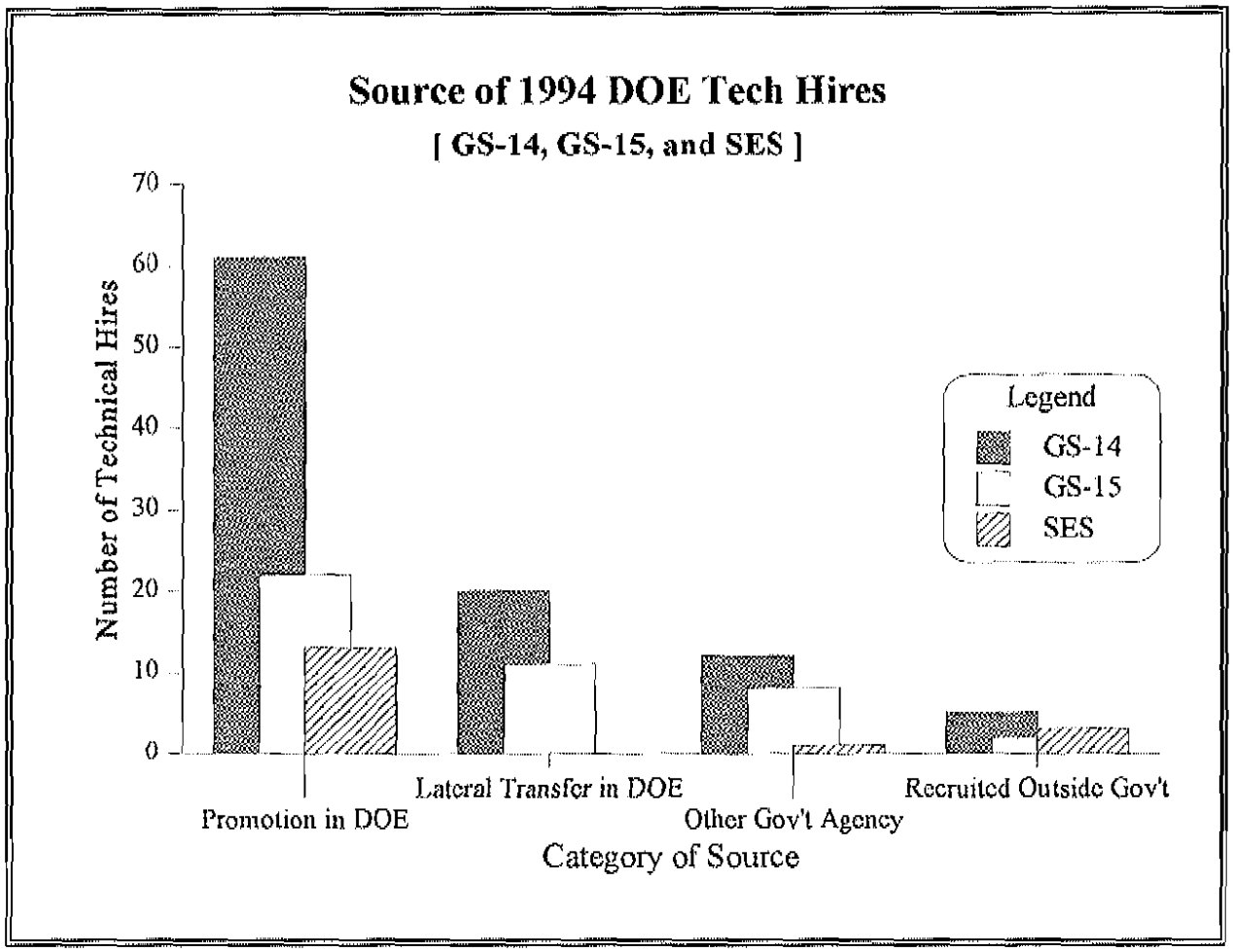

Figure 7

5. **Future Staff Actions:** The Board's staff will continue the evaluation of DOE technical personnel hiring through analysis of quarterly DOE data from calendar year 1995. The Board's staff is also considering evaluating DOE's staff (and contractors' staff) in their performance of safety functions at defense nuclear facilities.

Appendix E (cont)

Board Staff Report:
Review of DOE 1994 Technical Personnel Hiring Data

Attachment A

Method of Evaluation:
Technical Qualifications versus Positions Description

Individual DOE Position Descriptions were reviewed to ascertain the following:

- **Grade Level:** as-hired grade level or (if an intern/management ladder position) grade progression.

- **Eligibility Requirements:** e.g., specific degrees or licenses, time-in-previous-grade, etc.

- **Ranking Factors:** an operationally defined, measurable knowledge, skill, or ability that the hiring authority has determined is necessary for successful performance in this position. DOE is required to develop at least three ranking factors for each Position Description.

- **Duties and Responsibilities:** specific job requirements, which can be translated into necessary knowledge, skills, or abilities.

Individual SF-171s were then compared to the associated individual as-hired Position Descriptions, taking into account the criteria specified above. Grades were assigned to each Position Description/SF-171 pair based on the following criteria:

5 This individual is an excellent match for the Position Description, meeting or exceeding all criteria. As a hiring authority, this individual would be scheduled for an *immediate* interview, regardless of transportation requirements/schedule conflicts.

4 This individual is a good match for the Position Description, and appears to meet all criteria. As a hiring authority, this individual would be scheduled for an interview with the next group of candidates to be evaluated.

3 This individual probably meets all criteria in the Position Description. As a hiring authority, this individual *might* be scheduled for an interview if he was local (i.e., no transportation costs) and no schedule conflicts exist.

2 This individual requires additional training or experience in order to meet all criteria in the Position Description. As a hiring authority, this individual would more properly be considered for the position *two or three years from now*.

1 This individual *does not* currently meet all criteria and *will not* meet all criteria in the near future. As a hiring authority, this individual *would likely never* be considered for this position.

It is important to note that this review did not take into account any information other than that presented on the documentation available, and that both the Position Description and SF-171 were accepted at face value. No data verification, reference checks, or interviews were conducted in evaluating the candidates. Further, the Position Descriptions supplied were highly variable in quality, especially between sites. Some Position Descriptions clearly specified the duties of the position, and the level of education and experience required to fill the position. Others were so vague as to be only of marginal value.

To account for the fact that multiple reviewers were conducting the individual SF-171/Position Description evaluations, all reviewers **jointly** evaluated, discussed, and scored the first five SF-171/Position Description pairs to arrive at consensus grading criteria. The next 17 SF-171/Position Description pairs were **individually evaluated** and scored by each reviewer, with post-evaluation discussions to aid in achieving significant correlation. [As this accounted for approximately five percent of the data sample, and correlation factors of approximately +.90 between reviewer grades were realized, it was determined that multiple or joint grading would not be required for the remainder of the data.]

As the evaluation process proceeded, 12 additional randomly selected SF-171/Position Description pairs, as well as a mid-point group of 8 SF-171/Position Description pairs, received multiple scorings, using this individual evaluation system, to ensure that correlation between the reviewers remained high. [Because the SES data was treated separately, these 20 data sets amounted to approximately ten percent of the remaining data sample.] In all cases for which multiple, individually evaluated scores were developed, the final score assigned to an SF-171/Position Description pair was the mean of the individual evaluator scores, rounded to the nearest whole number (upward from .50 on).

All SES SF-171/Position Description/Vacancy Announcement data was evaluated jointly, to arrive at consensus grades.

Appendix E (cont)

Board Staff Report:
Review of DOE 1994 Technical Personnel Hiring Data

Attachment B

Method of Evaluation:
Quality of Technical Education

Evaluation of the quality of the technical education of 1994 Department of Energy (DOE) Technical Hires was based upon a recognized independent rating system published by National Education Standards. Undergraduate and Graduate Programs are rated separately in two books:

> ***The GOURMAN REPORT: A Rating of Undergraduate Programs in American & International Universities***, Seventh Edition [Revised], National Education Standards, Los Angeles, CA, 1989; and
>
> ***The GOURMAN REPORT: A Rating of Graduate and Professional Programs in American & International Universities***, Fifth Edition [Revised], National Education Standards, Los Angeles, CA, 1989.

As stated in the reports themselves, *The Gourman Report* is an objective evaluation designed to synthesize complex data into a "deceptively convenient" numerical rating, on a scale from zero (0, very poor) to five (5, excellent). Fourteen specific criteria are taken into consideration in the evaluation process, including:

- **Faculty** qualifications, experience, intellectual interests, attainments, and professional productivity (including research);
- **Standards** and quality of instruction;
- **Curriculum** and curricular content of the program or discipline and division;
- **Basis of and requirements for admission**, both overall and by individual discipline; and
- **Student performance** as measured by quality of scholastic work and records of graduates both in graduate study and in practice. [Note that this data is developed through proprietary methods used to make projections of the success of graduates from given institutions and disciplines in the "real world," subsequently validated against actual experience.]

For each 1994 DOE Technical Hire, information concerning schools granting degrees, and the fields in which the degrees were granted, were obtained from the SF-171's. Using this information, a quantitative score was developed according to the following criteria:

UNDERGRADUATE DEGREE SCORING, using *The GOURMAN REPORT: A Rating of Undergraduate Programs in American & International Universities*:

No Degree = 0.0

Non-Technical Degree (not Engineering, Science, or Mathematics) = 0.5
Technical Degree, but less than four years (e.g., A.S.) = 0.5

Technical Degree, but school not listed in *The Gourman Report* = 1.0

Four Year Technical (Engineering, Science, or Mathematics) Degree = see below

Enter the Gourman Report using the major field of study to find the appropriate *List of Leading Institutions*. SCORE the school value in the list, usually in the range 4.0 to 5.0, occasionally in the range 3.0 to 5.0.

- if not found -

Enter the Gourman Report using the school to find the appropriate section of the *Rating of Undergraduate Schools in Engineering on the Approved List of the Gourman Report*. SCORE the major field of study value in the list.

- if not found -

If the degree is in Engineering, enter the Gourman Report using the school to find the appropriate section of the *Rating of Schools in Engineering*. SCORE the overall engineering program value in the list, not to exceed the floor value for that major field of study previously found in the *List of Leading Institutions*.

- if not found, or if the degree is in Mathematics or Science -

Enter the Gourman Report using the school and SCORE the school value in the *Overall Academic Rating of American Undergraduate Institutions*, not to exceed the floor value for the appropriate major field of study previously found in the *List of Leading Institutions*.

- if not found -

This school is not rated in Gourman Report, use default scoring of 1.0 [see list above]

GRADUATE DEGREE SCORING, using *The GOURMAN REPORT: A Rating of Graduate and Professional Programs in American & International Universities*:

No Degree = not scored

Non-Technical Degree (not Engineering, Science, or Mathematics) = 0.5
[Note that Engineering Management/Business Administration/Law Degrees were treated separately; no score was developed for this examination of technical graduate degrees.]

Technical Degree, but school not listed in *The Gourman Report* = 1.0

Technical (Engineering, Science, or Mathematics) Degree = see below

Enter the Gourman Report using the Graduate or Professional field of study to find the appropriate *List of Leading Institutions*. SCORE the school value in the list, usually in the range 4.0 to 5.0, occasionally in the range 3.0 to 5.0.

- if not found -

If the graduate degree is in Engineering, enter the Gourman Report using the school to find the appropriate section of the *Rating of Graduate Schools in Engineering*. SCORE the overall engineering program value in the list, not to exceed the floor value for that field of study previously found in the *List of Leading Institutions*.

- if not found, or if a Mathematics or Science Graduate Degree -

Enter the Gourman Report using the school and SCORE the school value in the *Rating of United States American Graduate Schools: Academic and Selective*, not to exceed the floor value for the appropriate major field of study previously found in the *List of Leading Institutions*.

- if not found -

This school is not rated in Gourman Report, use default scoring of 1.0 [see list above]

Translation of Grading Scales Used in the Gourman Reports:

For UNDERGRADUATE ENGINEERING PROGRAMS:

very strong	4.51 to 4.99
strong	4.01 to 4.49
good	3.61 to 3.99
acceptable plus	3.01 to 3.59
adequate	2.00 to 2.99

For UNDERGRADUATE PROGRAMS OVERALL:

strong	4.41 to 4.99
good	4.01 to 4.40
acceptable plus	3.51 to 3.99
adequate	3.01 to 3.50
marginal	2.01 to 2.99

For GRADUATE ENGINEERING PROGRAMS:

very strong	4.51 to 4.99
strong	4.01 to 4.49
good	3.61 to 3.99
acceptable	3.01 to 3.59

For GRADUATE PROGRAMS OVERALL:

very strong	4.51 to 4.99
strong	4.01 to 4.49
good	3.61 to 3.99
acceptable plus	3.01 to 3.59
adequate	2.51 to 2.99
marginal	2.01 to 2.49

APPENDIX F

Appendix F

Excerpts from Board Recommendations to the Secretary of Energy Which Illustrate the Nature of Problems Addressed

Recommendation 90-4, *Operational Readiness Review at the Rocky Flats Plant*

Problem Statement:

> *"In several visits to Rocky Flats, the Board and its experts have reviewed aspects of operations and activities. These reviews have been directed toward ensuring adequate protection of public health and safety and concern matters that have an important bearing on resumption of plutonium processing operations. The Board's reviews have included such operations-related activities as reconstruction of drawings of systems important to safety ('red-lining'), development and validation of plant operating procedures, and training and requalification of plant operators in plutonium processing operations.*
>
> *"Several of these contractor activities, which would ordinarily be conducted in sequential manner, are being carried forward concurrently. Because of the interdependence of these activities, the Board has not yet been able to predict their adequacy at the time of proposed resumption of plutonium processing operations. For example, at the time of our most recent visit, no training lesson plans had been approved and less than one-third had been submitted for review. Training materials that were reviewed contained extensive on-the-job examination and performance requirements leading to requalification. This process will be time-consuming.*
>
> *"Usual practice in restarting a nuclear facility after an extended outage is the conduct of a comprehensive operational readiness review. Aware of the benefits of this practice in ensuring that public health and safety are adequately protected, and in view of the situation, the Board recommends that such a readiness review be carried out at Rocky Flats prior to resumption of operations."*

Comment:

Note that "usual practice in restarting a nuclear facility after an extended outage is the conduct of a comprehensive operational readiness review." [Emphasis added] DOE should not have had to be told this by the Board.

Recommendation 93-1, *Standards Utilization*

Problem Statement:

> *"The Board has noted significant progress by DOE in the issuance of new and revised nuclear safety orders that more explicitly delineate requirements in such areas as: unreviewed safety question determinations, technical safety requirements, nuclear safety analysis reports, design requirements and nuclear criticality safety. However, the Board's ongoing review of the use of standards in defense nuclear facilities has disclosed a number of potential inconsistencies in the manner in which DOE Orders related to nuclear safety are applied at facilities that produce and process fissile materials, relative to those facilities that assemble, disassemble, and test nuclear weapons. The Board notes that DOE orders differentiate between nuclear safety and 'nuclear explosive safety,' (the latter is defined by DOE Order 5610.11, Nuclear Explosive Safety); however, the Board considers that certain basic safety principles apply to the handling of fissile materials, regardless of the form that the material is in.*
>
> *"For example, a number of orders related to nuclear safety are explicitly excluded from applicability to facilities that assemble, disassemble and test nuclear weapons, while others are applicable only to 'nuclear facilities,' (as defined by DOE Order 5480.5, Safety of Nuclear Facilities). Those that apply to 'nuclear facilities do not necessarily apply to facilities that assemble, disassemble and test nuclear weapons. In other technical areas, such as quality assurance, essentially different programs have been put in place (i.e., DOE-AL directives QC-1 and QC-2, as opposed to DOE Order 5700.6C).*
>
> *"The Board is committed to ensuring the level of safety assurance at those facilities that assemble, disassemble and test nuclear weapons is at least as rigorous as that required at other defense nuclear facilities and that it can be measured to compare with the level of safety assurance provided to the public and site workers by commercial nuclear material processing facilities."*

Comment:

DOE should have been able to see on its own the need to assure the consistency of the DOE Orders applicable to nuclear safety at facilities that produce and process fissile materials and at facilities that assemble, disassemble, and test nuclear weapons.

Recommendation 91-6, *Radiation Protection for Workers and the General Public at DOE Defense Nuclear Facilities*

Problem Statement:

"The Board and its staff have conducted extensive reviews of radiation protection programs at DOE Headquarters and several DOE sites in the defense nuclear facilities complex. In particular, the SRS health and radiological protection programs have been reviewed on several occasions.

"After an inquiry into worker exposures to tritiated water from a moderator water spill at the site, the Board transmitted a report to the Secretary of Energy on May 31, 1991, that reviewed the management and radiation protection issues, as well as other factors that DOE and its contractor identified as root causes of the spill. Before completion of that report, the Board had directed its staff to continue the review of technical radiation protection issues that had been surfaced during the inquiry. In October, 1990, the Board's staff reviewed the SRS radiation protection program, that is included by SRS within what are commonly referred to as Health Protection (HP) program and Health Physics program. Board staff conducted follow-up reviews in February and April 1991. Staff reports based on the October 1990 and February 1991 trips were provided to DOE's Defense Programs personnel in letters from the Board dated November 1, 1990, and June 10, 1991, respectively. In its transmittal letter of June 10, 1991, the Board indicated it was giving consideration to the possibility of developing recommendations to the Secretary of Energy in the radiation protection area after further Board review.

"On June 20, 1991, representatives from DOE's Defense Programs, the DOE Savannah River Site Special Projects Office, and the operating contractor at SRS briefed the Board and its staff on radiation protection program issues. As a follow-up to that briefing, the Board conducted a site visit at SRS in July 1991. During that visit, Board Members interviewed SRS HP personnel and supervisors.

"The most recent Board staff assessment of DOE's radiation protection program and the operating contractor's HP program at SRS occurred during the period September 27 through October 10, 1991. The Board's staff reviewed relevant documents, attended briefings and discussions with DOE and operating contractor personnel at DOE Headquarters and at SRS, and observed selected evolutions at reactor and non-reactor facilities.

"Other independent organizations and committees have documented required improvements in DOE's radiation protection program, including the Institute for Nuclear Power Operations (INPO) in December 1990, the Advisory Committee on Nuclear Facility Safety in Section 5 of its final report dated November 13, 1991, and

the final DOE Operational Readiness Review (ORR) team in its report for Savannah River's K-reactor, dated November 1991.

"Primarily as a result of these assessments at Savannah River, but also because of other reviews at Rocky Flats Plant and elsewhere in the defense nuclear facilities complex, the Board has found a need for increased DOE attention in five major areas: (1) DOE management and leadership in radiation protection programs; (2) radiation protection standards and practices at defense nuclear facilities; (3) training and competence of Health Physics technicians and supervisors; (4) analysis of Reported Occurrences and correction of radiation protection program deficiencies; and (5) understanding and attention to radiation protection issues by individuals in DOE and its contractor organizations."

Comment:

DOE had sufficient evidence of its radiation protection problems to have instituted a comprehensive program of corrective action on its own initiative. Moreover, note that DOE was informed by letter in June 1991 that the Board was considering the possibility of developing recommendations. Recommendation 91-6 was not issued until December 1991; DOE therefore had six months in which to take the initiative, but failed to do so.

APPENDIX G

Appendix G

Excerpts from Board Recommendations to the Secretary of Energy Related to Personnel

Recommendation 91-1, Strengthening the Nuclear Safety Standards Program for DOE's Defense Nuclear Facilities:

> *"... Therefore, the Board recommends:*
>
> *4. that the Department critically reexamine its existing infrastructure for standards development and implementation at Head-quarters to determine if* ***organizational or managerial changes are needed*** *to (1) emphasize the priority and importance of standards to assuring public health and safety; (2) expand the program to facilitate the rapid development and implementation of standards; and (3) streamline the DOE approval process for standards; and*
>
> *5. that the Department reexamine the corresponding organizational units at DOE's principal Operations and Field Offices and DOE contractor organizations to determine if those organizations' standards infrastructure, responsibilities and* ***resources would also benefit from changes*** *to reflect improvements at Headquarters which strengthen and expedite standards development and implementation."* [Emphasis added]

Recommendation 91-6, Radiation Protection for Workers and the General Public at DOE Defense Nuclear Facilities:

> *"... the Board has found a need for increased DOE attention in five major areas: (1) DOE* ***management and leadership*** *in radiation protection programs; (2) radiation protection standards and practices at defense nuclear facilities; (3) training and* ***competence of Health Physics technicians and supervisors;*** *(4) analysis of Reported Occurrences and correction of radiation protection program deficiencies; and (5)* ***understanding and attention to radiation protection issues by individuals in DOE*** *and its contractor organizations."* [Emphasis added]
>
> *"Therefore, the Board recommends that:*
>
> *2. DOE review existing radiation protection training programs, and develop and implement a plan for an expanded training program that includes consideration of the following elements:...*
>
> *b. Delineation of the level of knowledge, skills, abilities, and other qualifications necessary for each generic radiation protection*

personnel position within the DOE complex, based on professional and industry standards and guidance. This should include association and/or interaction with professional health physics organizations such as the Health Physics Society and American Board of Health Physics certification for appropriate professionals.

c. *Determination of the current level of knowledge of radiation protection managers, professionals, supervisors, and technicians, by means of written, oral, and practical examinations.*

d. ***Delineation of the existing and supplemental training necessary to ensure that radiation protection personnel meet the qualifications of their respective positions.***

e. ***Evaluation of individuals after supplemental training to ensure that they meet the qualifications for their positions.***

3. *The Department critically examine its existing infrastructure for radiation protection program development and implementation at DOE Headquarters to determine if* ***resource, organizational, or managerial changes are needed****....*

4. *The Department examine the corresponding radiation protection organizational units at DOE's principal Operations and Field Offices and DOE contractor organizations to determine if those organizations' radiation protection programs'* ***infrastructure, responsibilities, and resources can be strengthened****....*" [Emphasis added]

Recommendation 92-2, DOE's Facility Representative Program at Defense Nuclear Facilities:

"*Therefore, the Board recommends that for defense nuclear facilities:*

1. *The Secretary of the Department of Energy expeditiously carry out a comprehensive analysis of the existing DOE Facility Representative programs....*

b. *...Consideration should be given to evaluating:*

(1) ***Qualification requirements and recruitment practices employed in selecting prospective DOE Facility Representatives;***

(6) ***DOE personnel practices and procedures that provide incentives and impediments*** *to making the position of DOE Facility Representative attractive and career-enhancing. At a minimum, restraints imposed by the practice of measuring responsibility predominantly in terms of numbers of individuals supervised should be addressed....*

d. *At the conclusion of the analysis, an* ***estimate should be prepared of the personnel and management resources that would be required***

***to establish and maintain an effective DOE Facility Representative Program**, and which reflects the results of the analysis.*

2. *Utilizing the results of the comprehensive analysis, the Secretary of the Department of Energy **establish a formal program to select, train, and assign DOE Facility Representatives** for the defense nuclear facilities.*
    a. *In establishing this program, DOE should be prepared to **modify personnel practices and programs as necessary to establish a beneficial and effective DOE Facility Representative Program.***
    b. *This program should give consideration to:*
        *(1) **Delineating DOE Facility Representative selection requirements, including specified standards of educational achievement, professional experience, technical aptitude, and forcefulness**...."* [Emphasis added]

Recommendation 92-4, Multi-Function Waste Tank Facility at the Hanford Site:

"*... The DOE organization responsible for the project **needs to have technically qualified personnel in numbers sufficient to provide direction and guidance to contractors** performing all phases of the effort and to assess the effectiveness of contractor efforts.*

*"The Board's view of the Hanford MWTF's conceptual design performed to date is that the design does not clearly present and delineate those aspects that ensure that the public health and safety can adequately be protected. In particular, the MWTF appears to be a project 1) without a well-defined mission or functional requirements (e.g., waste treatment or storage), 2) predetermined to consist of four one-million-gallon tanks regardless of their intended uses, and 3) **managed without sufficient regard for technical issues and engineering involvement.***

"... However, to ensure that appropriate nuclear safety characteristics are included in the design efforts, the Board recommends the following to the Secretary of Energy:

1. *Establish a plan and methodology that results in a project management organization for the MWTF project team that **assures that both DOE and the contractor organization have personnel of the technical and managerial competence to ensure effective project execution.**"* [Emphasis added]

Recommendation 92-5, Discipline of Operation in a Changing Defense Nuclear Facilities:

"*In furtherance of this view it is recommended that:...*

2. *Where a facility, after a long period of idleness for whatever reason, is being readied for new use or reuse,* ***special care should be taken to ensure that the line organization, both DOE and contractor, has the technical and managerial capability needed*** *to carry out its responsibilities.*" [Emphasis added]

Recommendation 92-6, Operational Readiness Reviews (ORRs):

"*The Board believes that among the features of an acceptable ORR are the following:...*

(d) ***The DOE review should include assessment of the technical and managerial qualifications of those in the DOE field organization who have been assigned responsibilities for direction and guidance to the contractor, including the Facility Representative****...*" [Emphasis added]

Recommendation 92-7, Training and Qualification:

"*Primarily as a result of assessments conducted by the Board's staff at the Hanford Site, the Pantex Plant, the Savannah River Site non-reactor facilities, the Oak Ridge Y-12 Plant, and the Rocky Flats Plant, but also because of reviews conducted elsewhere in the defense nuclear facilities complex, the Board believes there is a need for DOE to take action to* ***further strengthen training of technical personnel at defense nuclear facilities****.... Therefore, in keeping with the Board's statutory requirements and recognizing the priority DOE has placed on the facilities listed above, the Board recommends for these sites that:...*

2. *Where it is found to be necessary, the Department* ***strengthen organizational units responsible for training and qualification at the DOE Field Offices, DOE Area Offices****, and contractor organizations responsible for defense nuclear facilities at these sites, especially to* ***include the appropriate technical qualifications of the personnel assigned to defense nuclear activities****....*
3. *The Department* ***accelerate efforts internal to DOE to improve training and qualification programs of operations, maintenance, and technical support personnel*** *at defense nuclear facilities. An integral part of this effort should be an assessment of the roles and effectiveness of technical oversight groups to ensure that these groups' reviews, at all organizations and levels within the defense nuclear facilities complex, appropriately recognize the importance of training and qualification to public health and safety. The Department's program should also consider* ***restructuring on-site technical oversight groups to ensure*** *that training and qualification are afforded adequate attention and* ***team members possess the technical expertise necessary*** *to*

effectively evaluate training and qualification programs of operations, maintenance, and technical support personnel."

Recommendation 93-3, Improving DOE Technical Capability in Defense Nuclear Facilities Programs:

"... *Nevertheless, the level of scientific and* ***technical expertise in the DOE of defense nuclear facilities and operations has been declining****. The Defense Nuclear Facilities Safety Board in its last three annual reports has observed that:*

> *'...* ***the most important and far-reaching problem affecting the safety of DOE defense nuclear facilities is the difficulty in attracting and retaining personnel who are adequately qualified by technical education and experience to provide the kind of management, direction, and guidance essential to safe operation of DOE's defense nuclear facilities.*** *'*

"The Board has not been alone in calling attention to the problem. Congressional perception of ***the need to upgrade DOE technical expertise is evident*** *in the Board's enabling legislation. The need for such upgrading is further underscored by assessments made by a number of other groups over the past decade, as the attached excerpts from their reports indicate."*

> [NOTE: the "attached excerpts" referred to above were provided as an Attachment to Recommendation 93-3. They have been included in Appendix B to this report and are therefore not reprinted here.]

"*The Board believes that a* ***more aggressive, broad-based, and well-coordinated program directed at the enhancement of the technical capabilities of the DOE staff should be defined and implemented****. More specifically the Board recommends that DOE:*

1. ***Establish the attraction and retention of scientific and technical personnel of exceptional qualities as a primary agency-wide goal****....*
3. *Develop a broadly based program, giving consideration to the following:*
    - *a. DOE Internal Initiatives.*
        - *(1) Develop a set of mutually supportive actions which DOE could take, within existing personnel structures, to enhance capabilities. Measures that could be considered include:*
            - *(a) Plan and execute a system for using attrition to build technical capability....*
            - *(e) Establish initiatives designed to take advantage of skills of marginal technical performers and retrain them.*
            - *(f) Expand Headquarters/Field personnel exchange programs for highly qualified junior technical staff to*

promote understanding of all aspects of technical issues including their resolution....

c. DOE Internal Assessments.

(1) Perform an in-depth assessment of educational and experience requirements of key positions and develop both a short-term and long-term plan for key personnel development. Such assessment could include:

(a) Identification of qualifications (education and experience) required in key positions (above GS-14) in DOE Headquarters and field organizations with responsibilities for safely carrying out the defense nuclear program.

(b) Evaluation of incumbents for their ability to meet such qualification requirements.

(c) Evaluation of current availability within DOE of fully qualified personnel to fill these positions.

(2) Develop an action plan to meet needs thus identified." [Emphasis added]

Recommendation 93-4, Health and Safety Factors Associated with DOE's Management and Direction of Environmental Restoration Management Contracts:

"These reviews at Fernald have shown ***weaknesses in DOE's technical direction of contractor performance****, the contractor's conduct of operations, and the level of knowledge of personnel. With respect to the first weakness, a* ***lack of technical vigilance on the part of DOE-Fernald (DOE-FN)*** *allowed the ERMC contractor to start operations at the UNH project in April 1993 without (1) conducting a DOE-FN-required readiness review and without (2) informing and obtaining the approval of either the DOE-FN manager or the DOE headquarters project office to start the operation.*

"The incidents at Fernald and at other sites, taken together, also suggest that ***DOE's technical management and oversight structure for ERMC contracts are in need of upgrading****.... Based upon observations of the Fernald project, the Board has concern stemming from health and safety considerations that (1)* ***DOE may not have sufficient numbers of competent, trained headquarters and field personnel to technically manage such contracts****, and (2) contracts may be negotiated and signed before DOE has developed internal plans on how to carry out its technical management and oversight responsibilities.*

"The Board is aware that you have recently announced initiatives to reform DOE contract management.... The Board would encourage, in the interests of public and

worker health and safety, that the planned review of contracting mechanisms and practices also encompass the DOE technical direction and oversight structure. The Board believes that competence and effectiveness in technical aspects of management are essential to assure that contract services are provided in a manner which meets health and safety objectives.

"... The contractor [should] normally not be allowed to commence operations involving radioactive materials until DOE's plan for technical management of site activities has been put into effect. This means, among other things, that the relevant ***DOE site and headquarters offices have been adequately staffed with qualified persons to provide competent technical direction, guidance, and oversight of the contractor's operations.***

"Therefore, the Board recommends that:...

6. ***DOE immediately establish a group of technically qualified Facility Representatives at Fernald*** *to monitor the ongoing activities of daily operations at the site...."* [Emphasis added]

Recommendation 93-5, Hanford Waste Tanks Characterization Studies:

"Therefore, the Board recommends that DOE:

1. *Undertake a comprehensive reexamination and restructuring of the characterization effort with the objectives of accelerating sampling schedules,* ***strengthening technical management of the effort****, and completing safety-related sampling and analysis of watch list tanks within a target period of two years, and the remainder of the tanks by a year later...."* [Emphasis added]

Recommendation 94-4, Deficiencies in Criticality Safety at Oak Ridge Y-12 Plant:

"Accordingly, the Board recommends that:...

(3) ***DOE evaluate the experience, training, and performance of key DOE and contractor personnel involved in safety-related activities at defense nuclear facilities within the Y-12 Plant to determine if those personnel have the skills and knowledge required to execute their nuclear safety responsibilities*** *(in this regard, reference should be made to the critical safety elements developed as part of DOE's response to the Board's Recommendation 93-1)....*

(4) ***DOE take whatever actions are necessary to correct any deficiencies identified*** *in (3) above in the experience, training, and performance of DOE and contractor personnel."* [Emphasis added]

Recommendation 95-2, Safety Management:

> *"We recognize that the various* ***DOE organizational units*** *which may be delegated review and approval authority for S/RIDs and associated Safety Management Programs* ***may not have enough individuals with qualifications in the technical specialties required*** *to carry out effectively the streamlined process being recommended. This means that* ***technical assistance may need to be retained from elsewhere to compensate for such personnel deficiencies*** *where they exist. It also means that DOE may need to augment its own technical expertise so as not to be obliged to continue indefinitely to rely on technical assistance from outside DOE.*
>
> *"...Therefore, the Board recommends, that DOE:...*
>
> 5. *Take such measures as are required to* ***ensure that DOE itself has or acquires the technical expertise*** *to effectively implement the streamlined process recommended."* [Emphasis added]

APPENDIX H

Appendix H

Statement of Robert M. Andersen
General Counsel
Defense Nuclear Facilities Safety Board
Public Meeting, January 23, 1996

I. INTRODUCTION

A. Congressional and Technical Basis for Board Action on DOE Technical Competence

The lack of a sufficient number of technically-qualified program and oversight officials underlies all of the health and safety problems at defense nuclear facilities. Recognizing this, Congress, in its report of the Senate Armed Services Committee on S. 1085, stated that the Board is expected to raise the technical expertise of the Department substantially, to assist and monitor the continued development of DOE's internal Environmental Safety and Health organization, and to provide independent advice to the Secretary. Congress expected the Board to raise the level of critical expertise, technical vigor, and a sense of vigilance within the Department at all levels. S. Rep. No. 232, 100th Cong., 1st Sess. 10, 20-21 (1987).

Applicable requirements of the Board's enabling statute implicitly mandate that the Board address the technical competence of DOE's personnel. For example, the Board is required to (1) review the content and implementation of safety standards and (2) investigate events or practices which either adversely affect or have the potential of adversely affecting public health or safety. 42 U.S.C. § 2286a. To be effective, these Board reviews must consider the technical competencies of those who develop and implement safety standards and procedures and direct operations at DOE sites. The Board must then make recommendations it deems necessary to adequately protect public health and safety to the Secretary of Energy, or in appropriate cases to the President of the United States.

In each of its five annual reports, the Board recognized that the most important and far-reaching problem affecting the safety of DOE defense nuclear facilities is the difficulty in attracting and retaining personnel who are technically qualified to provide the management, direction, and guidance essential for safe operation of DOE defense nuclear facilities. In my opinion, it remains the most critical problem today.

B. Importance of Qualified DOE Technical Staff

The deficiency hinders DOE in providing fully effective technical direction and management of its contractors. The Board discussed this problem in each of its Annual Reports. A number of earlier independent assessments also noted the same deficiency, including the 1981

post-Three Mile Island DOE review of the safety of its reactors (the Crawford Report) and the 1987 Report of the National Academy of Sciences. Both the current and former Secretaries of Energy have acknowledged the problem and have committed to solving it.

The Board recognizes DOE's attempts to correct the problem. Unfortunately, they have not been effective enough, and the problem persists. The Board addressed the qualifications problem in several of its formal recommendations, and frequently communicated its concern on this matter to senior DOE officials over the past five years.

The problem is pervasive. Deficiencies exist to varying degrees not only in organizational units in Headquarters but also in the field organizations of DOE. The Board believes that a root cause of this shortcoming in DOE staff qualifications lies in a deep-seated conviction among many senior DOE career managers that program management capabilities, and perhaps only general technical familiarity, are adequate. Those who hold this belief elevate financial management, project scheduling, cost accounting, and other administrative management capabilities above technical competence in assigning people to positions of responsibility for managing technological programs of DOE. As a result, too many individuals without adequate technical qualifications are assigned jobs crucial to the safety of defense nuclear facilities.

Contributing causes include: limited capability of DOE to attract technically competent professionals to nuclear weapons activities and assignments as career choices; the failure to effectively use "excepted service" hiring authority by DOE, particularly for key technical management and direction positions; lack of an aggressive recruitment and retention policy for technical career personnel within DOE; insufficient attention by internal monitoring elements of DOE to this problem as a contributor to off-normal events; and the lack of an effective program for interchange of technical staff between Headquarters and field organizations within DOE.

The Board recognizes that it is much easier to identify this problem than to correct it. The Board also recognizes that some senior DOE technical managers are indeed very well qualified and that those managers usually share the Board's frustration in coping with the problem. Until that problem is solved, DOE will continue to have difficulty in developing and applying nuclear standards, in assessing the performance of contractors, and otherwise carrying out its responsibilities for assuring safe operation of facilities.

C. History of Board Involvement in Enhancing DOE Technical Capability

Since its inception, the Defense Nuclear Facilities Safety Board has emphasized that a well-constructed and documented program for training and qualifying personnel and supervisors for operations, maintenance, oversight, and technical support is an essential foundation of operations and maintenance and, hence, the safety and health of the public, including the facility workers. A substantial portion of the Board's efforts has been devoted to on-site

observation and review of personnel and supervisor selection, training, qualification, certification and facility operation.

Despite the long-standing requirements of DOE Orders, neither DOE nor the contractors have provided sufficient management attention and resources for training and qualification commensurate with the health and safety implications of their defense nuclear programs. Each of the sites evaluated by the Board has demonstrated weaknesses in contractor training programs that have potential negative safety consequences.

The Board's first Recommendation 90-1, issued in February, 1990, called for the development of an effective training program at Savannah River Site K-Reactor. Despite the successful application of Recommendation 90-1 to K-Reactor, and application of its principles to the Replacement Tritium Facility, DOE did not follow up with improved training of corresponding technical personnel at some other Savannah River Site defense nuclear facilities. Also, the Department has been slow to extend the underlying principles of Board Recommendation 90-1 to other defense nuclear sites.

On the basis of assessments conducted by the Board's staff at the Hanford Site, the Pantex Plant, the Savannah River Site non-reactor facilities, the Oak Ridge Y-12 Plant, and the Rocky Flats Environmental Technology Site, and, to a lesser extent, reviews conducted elsewhere in the defense nuclear facilities complex, the Board determined that DOE needed to take action to further strengthen training of technical personnel at defense nuclear facilities. Therefore, the Board, on September 22, 1992, recommended that several strong actions be taken to improve qualification and training at these specific sites. The Secretary responded and accepted the Recommendation on January 21, 1993. DOE's initial Implementation Plan, submitted in June 1993, was determined by the Board to be unacceptable as a means for achieving the needed improvements.

DOE did not correct the deficiencies in this Implementation Plan until the initiatives of Recommendation 92-7 were embraced by an even broader-based Board proposal (Recommendation 93-3) for improving recruitment, retention, education, and training of DOE's technical personnel. Previous annual reports have emphasized the importance of attracting and retaining technically- educated and experienced personnel to provide the management, direction, and guidance essential to safe operation of the defense nuclear facilities.

Unlike other federal agencies which rely upon technical competency, such as the Nuclear Regulatory Commission, the National Science Foundation, and the Board, DOE did not have excepted appointment authority. It was seriously encumbered by antiquated civil service restrictions that discourage bright, technically-qualified persons from being initially hired and subsequently promoted to positions of responsibility.

Recommendation 93-3 urged DOE to take dramatic action to attract and retain scientific and technical personnel of exceptional qualities. The Recommendation addressed concerns of the Board regarding the technical capabilities of personnel within the Department, both at Headquarters and in the field. Among the steps the Board urged were the following DOE initiatives:

1. Establish the attraction and retention of scientific and technical personnel of exceptional qualities as a primary agency-wide goal.

2. Take the following specific actions promptly in the interest of achieving this goal.

    a. Seek excepted appointment authority for a selected number of key positions for engineering and scientific personnel in DOE programmatic offices, in other line units, and in the oversight units responsible for the defense nuclear complex.

    b. Establish a technical personnel manager within the Office of the Secretary to coordinate recruitment, classification, training, and qualification programs for technical personnel in defense nuclear facilities programs.

3. Develop a broadly based program, giving consideration to the following:

    a. DOE Internal Initiatives

        (1) Develop a set of mutually supportive actions which DOE could take, within existing personnel structures, to enhance capabilities. Measures that could be considered include:

            (a) Plan and execute a system for using attrition to build technical capability.

            (b) Review the performance appraisal system for technical employees for its effectiveness in determining basic pay, training needs, promotions, reductions in grade, and reassignment/removal.

            (c) Review and improve programs for training and assignment of technical personnel. (This activity would be coordinated with actions taken, planned to be taken, in response to Board Recommendations 90-1, 91-6, 92-2, and 92-7).

            (d) Explore with the Secretary of Defense the possibility of assigning to DOE defense nuclear facilities activities a number

of outstanding officers with nuclear qualifications who may now be surplus to DOD needs.

(e) Establish initiatives designed to take advantage of skills of marginal technical performers and retrain them.

(f) Expand Headquarters/Field personnel exchange programs for highly-qualified junior technical staff to promote understanding of all aspects of technical issues including their resolution.

b. Independent External Assessments

(1) Use respected, independent, external organizations such as the National Research Council of the National Academy of Sciences, and the National Academy of Public Administration to assess DOE's ongoing and planned actions directed at attracting and retaining personnel with strong technical capabilities and to make recommendations for enhancements. Such assessment could include:

(a) Government-wide and/or DOE personnel recruitment and development policies and practices that may be effective inducements to government service.

(b) Comparison of DOE methods of building a qualified technical staff with qualifications comparable to those of other government agencies with predominant technical missions.

c. DOE Internal Assessments

(1) Perform an in-depth assessment of educational and experience requirements of key positions and develop both a short-term and long-term plan for key personnel development. Such assessment could include:

(a) Identification and qualifications (education and experience) required in key positions (above GS-14) in DOE Headquarters and field organizations with responsibilities for safely carrying out the defense nuclear program.

(b) Evaluation of incumbents for their ability to meet such qualification requirements.

(c) Evaluation of current availability within DOE of fully qualified personnel to fill these positions.

(2) Develop an action plan to meet needs thus identified.

The 93-3 approach conceptually contained several key elements: (1) engaging high level DOE involvement in correcting the problem; (2) hiring individuals from outside DOE to raise technical capability; (3) establishing technical qualification standards for key DOE technical personnel, assessing incumbent knowledge, skills, and abilities against those standards, and then raising incumbent capability by effective training and education; (4) using objective internal and external reviews of DOE programs to identify improvements in recruiting, retaining, and educating qualified technical personnel; and (5) implementing corrective action plans using every personnel management tool available.

To address several overlapping elements of Recommendations 92-7, which covered qualification and training of technical personnel, and Recommendation 93-3, the Secretary proposed, and the Board accepted, that a single Implementation Plan be developed for these two important inter-related Recommendations. After extensive joint effort by the DOE and Board task groups, DOE submitted a comprehensive combined Implementation Plan that was accepted by the Board on November 5, 1993.

Some of the actions recommended by the Board in Recommendation 93-3 were completed before the close of 1993. Both of the last two Secretaries of Energy have formally committed themselves, and the highest level of DOE management, to achieving a fully-qualified technical staff. A senior and broadly experienced DOE technical management expert was named to coordinate all of the technical personnel initiatives and to manage implementation of the plan. The Secretary issued a policy statement emphasizing the important link between technical competence and safety at defense nuclear facilities. Unfortunately, DOE did not move expeditiously enough to request Congressional authorization for excepted service appointment authority for key personnel during 1993. As will be discussed in detail later, DOE subsequently obtained excepted appointment authority. The Department has also recruited two classes of outstanding individuals for its technical intern program.

In the two most critical areas however, recruiting and hiring qualified individuals, and closing the gap between technical requirements and incumbents current abilities, progress has been slow and frustrating. For example, during the recent Board oversight of DOE's revision of nuclear safety Orders and rules, it was abundantly clear to myself, Dr. Ettlinger and other staff that DOE's standards effort suffered from an insufficient number of qualified technical experts in decision-making positions. Other members of the staff will provide the details of why we reach these conclusions.

II. FOCUS ON DOE EFFORTS PURSUANT TO EXCEPTED APPOINTMENT AUTHORITY

In Recommendation 93-3, the Board asked the Department of Energy to seek excepted appointment authority from Congress for a selected number of key positions for engineering and scientific personnel responsible for the defense nuclear complex. Congress subsequently provided such authority to DOE in Section 3161 of the National Defense Authorization Act for 1995. Section 3161, codified at 42 USC § 7231 Note, authorizes the Secretary of Energy to appoint up to 200 scientific, engineering and technical personnel to positions relating to safety at defense nuclear facilities. The rates of pay for the positions are not to exceed the rate of pay for Level IV of the Executive Service.

A. Definition of Excepted Service

To avoid confusion, I think it is important to begin with the definition of what excepted service is. Simply put, excepted service is appointment of professional staff to positions within the federal government without regard to civil service laws and restrictions regarding advertisement, appointment, hiring, and pay contained in Title 5 of the United States Code.

Long ago it was determined that the rigid pay, hiring, and classification requirements contained in the civil service laws were not well-suited to hiring and retaining certain professional employees. The federal government found it difficult to recruit individuals such as scientists, medical doctors, lawyers, engineers, and other professionals because of the rigidity contained in the civil service laws. Therefore, many of the agencies whose work is dependent upon highly-qualified professional and technical talent were given excepted appointment authority. Those agencies include the National Aeronautics and Space Administration (NASA), the National Science Foundation (NSF), and the National Institutes of Health (NIH), the Nuclear Regulatory Commission (NRC), among others, which Congress authorized to hire, pay, and manage such individuals without following the procedures contained in the civil service laws. This flexibility allowed those agencies to attract high-quality technical talent and is very evident in the quality of the technical staff the Board has been able to attract using its own excepted service authority.

B. Scope of DOE's Excepted Appointment Authority

Obtaining this legislative change for DOE took many months and the combined efforts of the Board and some within DOE. Even though DOE accepted the recommendation to seek excepted service for technical and managerial personnel, some DOE officials were reluctant and slow to initiate action. The Chairman of the Board met with the Secretary of Energy, officials in the Congressional Affairs Office, and the Assistant Secretary of Energy for Human Resources on numerous occasions to try to jump start the proposal. Mr. Conway used every opportunity to testify before Congress regarding the need for DOE excepted appointment

authority and the Board's successful use of its excepted authority in attracting fully capable people to staff positions.

The Board's General Counsel and General Manager slowly overcame opposition to the proposal within DOE, the Office of Management and Budget, and Office of Personnel Management. A draft legislative proposal was prepared and given to DOE.

Prior to enactment of the National Defense Authorization Act for 1995, the Secretary of Energy already had limited authority to appoint scientific, engineering, professional and administrative personnel without regard to the civil service laws. Section 621 of the Department of Energy Organization Act, 42 U.S.C. 7231, states in part:

> (d) In addition to the number of positions which may be placed at GS-16, GS-17, and GS-18 under section 5108 of title 5, United States Code, under existing law, or under this Act and to the extent the Secretary deems such action necessary to the discharge of his functions, he may appoint not more than two hundred of the scientific, engineering, professional, and administrative personnel without regard to the civil service laws and may fix the compensation of such personnel not in excess of the maximum rate payable for GS-18 of the General Schedule under section 5332 of title 5, United States Code [5 U.S.C. @ 5332 Note].

Section 3161 of the National Defense Authorization Act for 1995 provided additional authority for the Secretary of Energy to appoint scientific, engineering and technical personnel to positions relating to safety at defense nuclear facilities. Section 3161, codified at 42 U.S.C. 7231 Note, states:

> (a) Authority. (1) Notwithstanding any provision of title 5, United States Code, governing appointments in the competitive service and General Schedule classification and pay rates, the Secretary of Energy may --
>
> (A) establish and set the rates of pay for not more than 200 positions in the Department of Energy for scientific, engineering, and technical personnel whose duties will relate to safety at defense nuclear facilities of the Department; and
>
> (B) appoint persons to such positions.
>
> (2) The rate of pay for a position established under paragraph (1) may not exceed the rate of pay payable for level IV of the Executive Schedule under section 5315 of title 5, United States Code.

(3) To the maximum extent practicable, the Secretary shall appoint persons under paragraph (1)(B) to the positions established under paragraph (1)(A) in accordance with the merit systems principles set forth in section 2301 of such title.

* * *

(d) Termination. (1) The authority provided under subsection (a)(1) shall terminate on September 30, 1997.

(2) An employee may not be separated from employment with the Department of Energy or receive a reduction in pay by reason of the termination of authority under paragraph (1).

The plain language of DOE's statute places a single limitation on DOE excepted appointment authority: pay may not exceed level IV of the executive schedule, which is the same cap placed on compensation for members of the Senior Executive Service. The statute does not place any limitation on the use of excepted service for hiring technical managers with scientific and engineering education; in fact its reference to the high pay scale indicates that Congress expected such individuals to be hired. Congress and the Board expected DOE's excepted appointment authority to be used for key technical personnel, including decision-makers and managers.

A comparison of Section 3161 with comparable excepted appointment provisions for NSF, NASA, NRC, NIH, the Environmental Protection Agency (EPA), and the Defense Nuclear Facilities Safety Board also clearly shows that the excepted appointment authority contained in Section 3161 can be used to fill managerial, supervisory, or policy positions in technical areas similar to those in Senior Executive Service or Supergrade positions. See Appendix. Section 3161 limits the maximum rate of pay for excepted positions to that of Level IV of the Executive Service and requires that, to the maximum extent possible, persons shall be appointed in accordance with the merit systems principles of 5 USC § 2301. The merit systems principles of 5 USC § 2301 apply to all Federal agencies and include such general principles as recruiting from qualified individuals and not discriminating on the basis of political affiliation, race, religion, national origin, sex, or handicapping condition. The merit systems principles do not address the level of position to be filled. The only limit placed by Section 3161 on the level of the positions to be filled using excepted appointment authority is that the rate of pay for the positions shall not exceed Level IV of the Executive Service, the same as GS-18 of the General Schedule.

Excepted appointment provisions for the Environmental Protection Agency permit appointment without regard to the civil service laws to positions with rates of compensation limited to the maximum rate payable for GS-18 of the General Schedule. 42 USC § 300j-10. The legislative history for the EPA excepted appointment authority states that the provision

provides EPA with additional Supergrade and equivalent positions. 1977 U.S. Code Cong. & Admin. News 3663. Excepted appointment provisions for the Defense Nuclear Facilities Safety Board also limit the rate of pay to that of the maximum rate payable for GS-18. 42 USC § 2286b(b)(2). The Board has determined that its excepted appointment authority, like that of the EPA, permits personnel to be appointed to Supergrade or managerial positions similar to Senior Executive Service positions. Based on comparisons of DOE's excepted appointment authority under Section 3161 with the excepted appointment authorities of EPA and the Board clearly shows that the DOE authority can be used to fill Senior Executive Service positions and that the guidance contained in the November 1, 1994, DOE memorandum is unnecessarily restrictive.

Nevertheless, during a briefing to the Board on October 5, 1995, Mr. Archer Durham (Assistant Secretary for Human Resources and Administration) stated that the excepted appointment authority provided under Section 3161 would not be used to appoint individuals to positions with management responsibility within DOE. Direction provided to the heads of departmental elements concerning excepted service personnel authority in a memorandum dated November 1, 1994, from Mr. Durham states that the excepted appointment authority provided by Section 3161 "shall not be used to make appointments to Senior Executive Service positions."

The legislative history for Section 3161 is clear that it was the intent of DOE and the Congress that the excepted appointment authority provided by Section 3161 apply to scientific, engineering, and technical personnel in management positions as well as such personnel in purely technical positions. Such appointments need not be made directly to Senior Executive Service positions using SES procedures. A comparison of Section 3161 with excepted appointment authority provisions for other agencies also clearly shows that Section 3161 was intended to permit appointments to Supergrade or positions with duties similar to Senior Executive Service positions but with heavy technical or scientific responsibilities. Guidance issued within DOE which does not permit the use of excepted appointment authority under Section 3161 for high level management or positions which perform technical management similar to Senior Executive Service positions is unnecessarily restrictive, and not driven by legal requirements.

In Recommendation 93-3, the Board reiterated its observation of the previous three annual reports that:

> the most serious and far-reaching problem affecting the safety of DOE defense nuclear facilities is the difficulty in attracting and retaining personnel who are adequately qualified by technical education and experience to provide the kind of management, direction and guidance essential to safe operation of DOE's defense nuclear facilities. [Emphasis added]

The Board went on to specifically recommend that DOE seek excepted appointment authority for a selected number of key positions for engineering and scientific personnel in DOE programmatic offices, in other line units, and in the oversight units responsible for the defense nuclear complex. The Board did not recommend that the excepted service authority be limited to non-managerial positions. In fact, given the above statement by the Board, it is clear that the Board intended that excepted appointment authority be used to attract qualified personnel to provide management, direction and guidance for DOE's defense nuclear facilities and that the authority not be limited to non-managerial positions.

The Senate Committee on Armed Services subsequently reported out the National Defense Authorization Act for 1995 with the requested excepted appointment authority. In reporting on what would become Section 3161, the Committee stated the following:

> The committee recommends a provision that would amend the Department of Energy Organization Act to allow the Secretary of Energy to hire and employ, without regard to civil service laws, up to 350 [later reduced to 200] scientific, engineering, technical and professional personnel.
>
> The committee has long been concerned that many of the problems at the Department of Energy over the past years have been related to the inadequate number of highly skilled and trained professional engineers, scientists and other technical individuals who can perform oversight and management functions at the Department. [Emphasis added]
>
> * * *
>
> The provision recommended by the committee expands existing excepted hiring authority to include the addition of 350 [later reduced to 200] more positions. The committee believes that this will be adequate to comply with the recommendation of the Safety Board. S.Rpt. No. 282, 103d Cong., 2d Sess. 278-279 (1994).

It is clear from the legislative history for Section 3161 that DOE and the Congress understood that the excepted appointment authority would be used for scientific, engineering, and technical personnel who perform management functions as well as such personnel in technical and oversight positions. Furthermore, in prepared testimony for the Senate Committee on Armed Services, Subcommittee on Nuclear Deterrence, Arms Control and Defense Intelligence, Assistant Secretary Grumbly stated that:

> Based on the DNFSB's Recommendation 93-3, we are requesting excepted appointment service authority. This authority would allow the Department greater flexibility to recruit and keep technically trained individuals, and is pivotal to obtaining the technical and managerial expertise needed for this

program. [Emphasis added] S.Hrg. No. 765, Part 7, 103d Cong., 2d Sess. 16 (1994).

III. DOE PROGRESS IN IMPLEMENTING RECOMMENDATION 93-3

To provide a balanced view, DOE progress in implementing 93-3 must also be noted. DOE made notable progress by eventually obtaining additional excepted appointment authority as recommended by the Board. Section 3163 of the National Defense Authorization Act for Fiscal Year 1995, Pub. L. 103-337, authorized DOE to establish up to 200 additional excepted service positions for scientific, engineering, and technical personnel whose duties will relate to safety at defense nuclear facilities. Obtaining this legislative change took many months and combined efforts of the Board and DOE. Appropriate pay levels may be set, and individuals may be hired to fill such positions, without use of the procedural steps which encumber civil service. Excepted service anticipates all of the essential features of the National Performance Review (NPR), is fully consistent with the goals and specific recruitment programs called for in the NPR, and will easily dovetail into the Administration's program if NPR legislation is eventually passed.

DOE designated an excellent Technical Personnel Program Coordinator and recruited an excellent group of technical interns. DOE attempted to improve the Department's ability to recruit and retain technically-competent personnel by issuing an Administrative Flexibilities Handbook, developing new guidance related to career planning, and developing a qualification program for technical personnel. Contractor training and qualification have improved, as shown by more timely approval of the contractor's Training Implementation Matrices and improvements in the training of operators at facilities such as the Savannah River Site Replacement Tritium Facility and at the Pantex Plant. Additional effort is required to extend this success to facilities across the complex.

On the other hand, DOE has made much less progress in actually hiring qualified technical personnel for key Office of Defense Programs (DP) line and oversight positions. The hard-won authority to hire technical personnel under excepted appointments has been little used to date. Failure to immediately begin using its excepted appointment authority is one of the central obstacles to developing a technically qualified staff at DOE. The Offices of Environmental Management (EM) and Environment, Safety and Health (EH) have recruited and hired technical personnel, although without full consideration of the goals and standards called for by Recommendation 93-3. Additionally, it is unclear what percentage of the new hires will be devoted to technical positions involved with nuclear safety. At the public hearing on December 6, 1994, the Secretary of Energy and other high-level DOE officials told the Board that additional excepted service positions would be allocated to DP organizations. Few hires have been made to date. DP is challenged to increase the number of well-qualified technical personnel at a time when DP's organization staffing level is being decreased. Current staffing levels, as well as the skill mix of DOE, laboratory and contractor personnel, appear to be inadequate to meet the requirements of the existing defense nuclear safety program. These deficiencies have been highlighted by the Board on several occasions, but have not been corrected. Most notable is the lack of sufficient numbers of trained safety analysis personnel. This contributes to Safety Analysis Reports that are incomplete and unapproved, Nuclear Explosive

Safety Studies (NESS) that are out of date and unapproved, and Nuclear Explosive Risk Assessments, initially required in 1990 for every NESS, that are not yet fully implemented.

As part of a broad-based program for improving the qualification of its technical personnel, DOE is now developing and implementing technical qualification standards for DOE employees. However, technical personnel qualification standards that have been developed by DOE and reviewed by the Board and its staff lack the rigor necessary to cause a significant upgrade in the technical competence of DOE. A baseline external review of DOE's technical personnel initiatives has been completed by the National Academy of Public Administration (NAPA). Unfortunately, the review fell far short of the plenary review anticipated by the recommendation since it was restricted to DOE headquarters and did not include field operations.

While preparing the Implementation Plan for Recommendation 93-3, DOE officials stated a preference for curing technical deficiencies by education and training of the existing workforce as opposed to hiring new talent. This preference appears to be even stronger due to mandated personnel reductions, but progress on training and education lags. DOE's education and training efforts reviewed by the Board and its staff, however, are off-target. They are directed towards a superficial level of knowledge rather than a fundamental understanding of nuclear systems and processes. Full implementation of the Board's recommendations to upgrade DOE's level of technical competence is in jeopardy due to a lack of buy-in by DOE line management.

To maintain the capability to perform criticality experiments as recommended by Recommendation 93-2, DOE has performed a systems analysis to identify the necessary resources and personnel needs. In the limited area of criticality experiments, DOE has identified the resources and funding necessary to support current and anticipated requirements for conducting critical experiments and for training criticality experts and has established the Nuclear Criticality Experiments Steering Committee (NCESC) as a standing committee to oversee and coordinate the DOE criticality experiments program. The NCESC is addressing key issues regarding nuclear criticality experiment capabilities, identifying resource requirements, and justifying necessary funding.

Recommendation 93-6 addresses retention of weapons-related technical expertise, particularly at the national weapon laboratories, in a down-sized weapons complex. DOE prepared the Implementation Plan to complement the Stockpile Stewardship Strategy and the Stockpile Management Plan, which it also was developing. The Implementation Plan provides for a formal Integrated Safety Skills and Knowledge Platform (ISSKP) to identify the skills and knowledge needed to disassemble, modify, and test nuclear weapons. That platform will identify and record needed skills and knowledge. DOE intends to integrate the ISSKP with weapons testing and disassembly procedures, and plans to implement a program to document skills and knowledge by March 1995. DOE also has initiated a review of administrative controls and engineered safeguards which ensure nuclear explosive safety at the Nevada Test Site. DOE plans to validate and update weapons disassembly procedures by September 1995. DOE also committed to review the engineered safeguards and administrative controls for the Nevada Test Site and incorporate any necessary changes by February 1995.

By failing to satisfactorily complete many of the near-term initiatives identified in the Recommendation 93-6 Implementation Plan, DOE has placed the overall schedule in jeopardy. However, DOE's ability to capture and preserve expertise as identified in Recommendation 93-6 has been strengthened by the recently-enacted Section 3131 of the National Defense Authorization Act for Fiscal Year 1995. This section authorizes DOE to conduct a stockpile stewardship recruitment and training program at the national laboratories and to establish a "retiree corps" of retired scientists who have expertise in nuclear weapons research and development.

Other problems in the recruitment, retention, and training of personnel persist throughout the Department. DOE has hired few new managers either at the mid-level or at more senior levels of management, where the initiatives of Recommendation 93-3 can have the most effect. Further, no consideration has been given to using the Technical Qualification Standards being developed under this recommendation as an integral part of the hiring process.

EXCEPTED SERVICE PROVISIONS FOR SELECTED AGENCIES

1. Environmental Protection Agency. The Administrator of the Environmental Protection Agency has limited excepted appointment authority as provided in 42 U.S.C. @300j-10 which states:

> Appointment of scientific, etc. personnel by Administrator of Environmental Protection Agency for implementation of responsibilities; compensation
>
> > To the extent that the Administrator of the Environmental Protection Agency deems such action necessary to the discharge of his functions under title XIV of the Public Health Service Act [42 U.S.C. @ 300f et seq.] (relating to safe drinking water) and under other provisions of law, he may appoint personnel to fill not more than thirty scientific, engineering, professional, legal, and administrative positions within the Environmental Protection Agency without regard to the civil service laws and may fix compensation of such personnel not in excess of the maximum rate payable for GS-18 of the General Schedule under section 5332 of title 5, United States Code.

2. National Science Foundation. Excepted appointment authority for the National Science Foundation is provided in 42 U.S.C. @1873 which states:

> Employment of personnel
>
> > (a) Appointment; compensation; application of civil service laws; technical and professional personnel; members of special commissions.
> >
> > > (1) The Director shall, in accordance with such policies as the Board shall from time to time prescribe, appoint and fix the compensation of such personnel as may be necessary to carry out the provisions of this Act. Except as provided in section 4(h), such appointments shall be made and compensation shall be fixed in accordance with the provisions of title 5, United States Code, governing appointments in the competitive service, and the provisions of chapter 51 and subchapter III of chapter 53 of such title [5 U.S.C. @ 5101 et seq., 5331 et seq.] relating to classification and General Schedule pay rates: Provided, That the Director may, in accordance with such policies as the Board shall from time to time prescribe, employ such technical and professional personnel and fix their compensation, without regard to such provisions, as he may deem necessary for the discharge of the responsibilities of the Foundation under this Act. The members of the special commissions shall be appointed without regard to the provisions of title 5, United States Code, governing appointments in the competitive service.

3. Nuclear Regulatory Commission. Excepted appointment authority for the Nuclear Regulatory Commission is provided in 42 U.S.C. @ 2201 which states:

> General Duties of the Commission
> In the performance of its functions the Commission is authorized to --
>
> > (d) Employment of personnel
> >
> > Appoint and fix the compensation of such officers and employees as may be necessary to carry out the functions of the Commission. Such officers and employees shall be appointed in accordance with the civil service laws and their compensation fixed in accordance with chapter 51 and subchapter III of chapter 53 of Title 5, except that, to the extent the Commission deems such action necessary to the discharge of its responsibilities, personnel may be employed and their compensation fixed without regard to such laws: Provided, however, That no officer or employee (except such officers and employees whose compensation is fixed by law, and scientific and technical personnel up to a limit of the highest rate of Grade 18 of the General Schedule) whose position would be subject to chapter 51 and subchapter III of chapter 53 of Title 5, if such provisions were applicable to such position, shall be paid a salary at a rate in excess of the rate payable under such provisions for positions of equivalent difficulty or responsibility. Such rates of compensation may be adopted by the Commission as may be authorized by chapter 51 and subchapter III of chapter 53 of Title 5, as of the same date such rates are authorized for positions subject to such provisions. The Commission shall make adequate provision for administrative review of any determination to dismiss any employee;

4. National Aeronautics and Space Administration. Excepted appointment authority for NASA is provided at 42 U.S.C. @2473 which states:

> Functions of the Administration
>
> * * *
>
> (c) In the performance of its functions the Administration is authorized --
>
> * * *
>
> > (2) to appoint and fix the compensation of such officers and employees as may be necessary to carry out such functions. Such officers and employees shall be appointed in accordance with the Classification Act of 1949, except that (A) to the extent the Administrator deems such action necessary to the

discharge of his responsibilities, he may appoint not more than four hundred and twenty-five of the scientific, engineering, and administrative personnel of the Administration without regard to such laws, and may fix the compensation of such personnel not in excess of the highest rate of grade 18 of the General Schedule of the Classification Act of 1949, as amended, and (B) to the extent the Administrator deems such action necessary to recruit specially qualified scientific and engineering talent, he may establish the entrance grade fro scientific and engineering personnel without previous service in the Federal Government at a level up to two grades higher than the grade provided for such personnel under the General Schedule established by the Classification Act of 1949, and fix their compensation accordingly;

APPENDIX I

Appendix I

Efforts by the Board to Require DOE to Define Responsibilities for Nuclear Safety: A Chronology

03/13/90	Secretary of Energy issued memo directing action be taken to identify nuclear safety functions, assignments, and responsibilities.
12/22/92	DOE issued revision 0 of the *Manual of Functions, Assignments, and Responsibilities for Nuclear Safety* (FAR Manual).
04/02/93	Secretary of Energy announced a major reorganization for the Department.
05/06/94	Board issued reporting requirement to the Secretary requesting DOE provide information regarding the establishment of a Nuclear Health and Safety Management Program and the definition of Nuclear Safety Responsibilities and Organizational Arrangements.
06/29/94	Secretary of Energy issued preliminary response to the 05/06/94 Board reporting requirement and provided revision 1 of the FAR Manual, dated May 25, 1994.
10/15/94	DOE issued revision 2 of the FAR Manual.
10/21/94	Secretary of Energy signed the final response to the 05/06/94 Board reporting requirement including a commitment to tie senior management performance appraisals to their environment, safety, and health (ES&H) responsibilities.
12/02/94	DOE requested by the Board's staff to provide clarification of statements made in FAR Manual regarding the assignment of responsibilities at DOE headquarters (HQ) and in the field.
12/02/94	Secretary of Energy issued memo to the Department requesting field and HQ elements to acknowledge their responsibilities as stated in the FAR Manual and committing to use of the FAR Manual.
12/09/94	Board staff meeting with Principle Deputy Assistant Secretary for Defense Programs (DP-2) on the FAR Manual to discuss information request of 12/02/94.
05/26/95	Department issued memo from Assistant Secretary for Environment, Safety and Health (EH-1), Assistant Secretary for Environmental Management (EM-1), and Associate Deputy Secretary for Field Management (FM-1) to field elements assigning several safety and health responsibilities to the field and area office managers.

06/15/95 Meeting between a Member of the Board, the Board's staff, and representatives from EM, DP, and EH to discuss progress on updating the FAR Manual.

06/16/95 DOE issued Implementation Plan for assigning ES&H roles and responsibilities throughout the Department (SAI-30 - one of the DOE Strategic Alignment Initiatives).

06/22/95 DOE tasked the Manager of the Richland Operations Office to lead a team to address the division of roles and responsibilities between HQ and the field (SAI-13 - one of the DOE Strategic Alignment Initiatives).

07/21/95 DOE submits the Implementation Plan for Recommendation 94-5, *DOE Plan for Management of Standards-Related Activities*. Included is a commitment to deliver an approved, revised FAR Manual by February 1, 1996, *or 60 days after issuance of 10 CFR 830*.

08/10/95 Quarterly meeting between the Secretary and the Board. Included discussion about the need to define roles and responsibilities within the DOE.

09/07/95 Meeting between Board Members and the Deputy Assistant Secretary for the Office of Nuclear and Facility Safety (EH-3) to discuss progress on the FAR Manual update.

10/03/95 Meeting between Member of the Board and EH-3 to discuss progress on the FAR Manual update.

10/04/95 Board issued letter to the Secretary imposing a reporting requirement on DOE relative to Recommendation 93-4 that included a requirement to reconcile several efforts purported to define responsibilities within the Department.

12/05/95 Board issued letter to the Secretary imposing a reporting requirement on DOE to provide the status, schedule, and milestones that will culminate in the update to the FAR Manual being completed and delivered by February 1, 1996.

12/14/95 Quarterly meeting between the Secretary and the Board. Included discussion about the need to define roles and responsibilities within the DOE.

12/19/95 Meeting between Member of the Board and EH-3 to discuss progress on the FAR Manual update.

12/28/95 DOE issued response to the 12/05/95 Board reporting requirement stating that every effort will be made to complete the update by February 1, 1996 or 60 days after the issuance of nuclear safety rules.

01/17/96 DOE issued response to the 10/04/95 Board reporting requirement stating that every effort will be made to define roles and responsibilities by February 1, 1996 or 60 days after the issuance of nuclear safety rules.

01/30/96 By a letter to the Secretary, the Board reemphasized the need for an update to the FAR Manual on a definite schedule.