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# NAVAL POSTGRADUATE SCHOOL
## Monterey, California




# THESIS

A REVIEW OF SAFETY NEEDS AND
SAFETY PERSONNEL REQUIREMENTS
IN THE NAVY

by

Irene Eleanor Hofer

September 1977

Thesis Advisor: J.W. Creighton



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# A REVIEW OF SAFETY NEEDS AND SAFETY PERSONNEL REQUIREMENTS IN THE NAVY

The need for increased safety programs, particularly for the Navy, is discussed on the basis that technological advances and the high cost of accidents and changes in public policy regarding the responsibility for safety have led to increased federal legislation to provide protection to the worker and general public. Increasing safety programs have led to problems caused by deficiencies in safety personnel, both in qualification and number, to perform safety functions now required. A partial solution is to initiate and accelerate educational programs for safety personnel to provide necessary training for the extensive technical safety activities in the Navy.

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by

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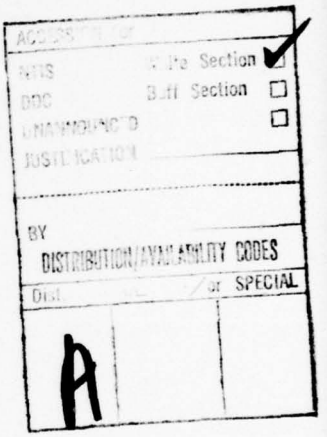


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## ABSTRACT

The need for increased safety programs, particularly for the Navy, is discussed on the basis that technological advances and the high cost of accidents and changes in public policy regarding the responsibility for safety have led to increased federal legislation to provide protection to the worker and general public. Increasing safety programs have led to problems caused by deficiencies in safety personnel, both in qualification and number, to perform safety functions now required. A partial solution is to initiate and accelerate educational programs for safety personnel to provide necessary training for the extensive technical safety activities in the Navy.

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# I. INTRODUCTION

## A. BACKGROUND

Since the beginning of history, man has been subjected to hazardous situations and accidental happenings which caused injury or death to him. Cave dwellers in their search for food or shelter stumbled over rocks or tumbled down ravines, to be sure, but these were isolated happenings not attributable to deficiencies in the actions of others. The protection of one's self from any sort of hazard was a responsibility left to the individual.

That is no longer the case. In the past sixty years, safety responsibility has shifted from employee to employer and from product user to product maker. Advances in the volumes produced and technologies used in manufacturing processes, weaponry, toxic materials, and the discovery of high energy sources including exotic fuels, high pressure systems, and atomic fission has increased the magnitude of the potential catastrophic effects of an accident, both in lives and money, so that an accident cannot be tolerated by the public.

As a result of the changing feeling about the importance of safety and the right of protection from hazards by an individual, new federal laws have been enacted which give a large role to safety organizations and to safety management. These laws are the Department of Defense Military Standard

for System Safety, MIL-STD-882 of 15 July 1969, the Occupational Safety and Health Act of 1970 for private concerns, and Executive Order 11807 of 28 September 1974, which strengthened job safety and health programs in the federal government.

There is much commonality in the essential elements of all these federal programs, but the main common element is personnel — the trained safety personnel required to administer and execute the functions required by these laws. Years ago, the "Safety Man" was a member of the personnel office who issued hard hats and steel-toed shoes. Today's safety professional and manager must be a technical, legal, and administrative expert. These new laws as well as technological break-throughs have drastically changed the role of safety personnel in the past few years.

The Navy has always had a strong inclination toward safe practices in their activities, engendered no doubt, by their somewhat hazardous pursuits in the line of duty, but many day to day details were left unattended. The recent issuance of the new Navy instructions establishing and delineating procedures for implementing the Navy's Occupational Safety and Health Program takes care of at least some of these details (Ref. 10 and 11 and Appendix C).

The question comes to mind as to the ability of present Navy safety organizations to take on these new duties in an expeditious manner in addition to handling the unchanged ongoing safety activities and their ability to adapt to the

changes when required. There is little logic in establishing a sweeping safety program if there is no possibility of handling the work involved in executing it.

B. THEORETICAL STATEMENT

There are several intuitive feelings connected with this study of safety personnel and safety program requirements for the Navy. They are the following:

1. There is a lack of acceptably trained safety personnel to administer and perform the new and the technologically complex functions required by operational Fleet activities, the new Occupational Safety and Health programs, and other safety regulations. This lack os both in number and capability.
2. No standards exist for selection and training of safety personnel. It is a "hit or miss" assignment, whereas the responsibilities of a safety office should make the selection and training of safety personnel a very critical activity.
3. There is a strong requirement to set up broad formal educational programs for training of safety personnel and managers to provide the numbers and type necessary to carry out mandated safety functions. Safety training in the past has not always been relevant nor specific. If some training programs do exist, not enough working level personnel are recipients of this training as yet.

## C. OBJECTIVE

The objective of this study is to survey the ability of safety personnel and safety management to handle the increased workload presented by the new federal law requirements and advances in technology, in addition to their previous duties. Specific targets of this study are to look at the need for increased safety activity and the ability to provide safety by studying the background and requirements of safety personnel and safety practices at various Navy establishments. It will also provide background for establishing requirements for future educational programs for Navy safety personnel.

## D. METHODOLOGY

The basic procedural method utilized to acommplish these objectives in this investigation consisted of the following:

1. A literature review in the areas of safety management, safety organization and function, safety personnel requirements, and safety education, including government directives, was made in order to provide a broad background in safety personnel and management practices and functions.
2. Personal interviews were conducted by the researcher with safety personnel and managers employed by the Navy to expand upon the meager amount of data about safety personnel factors and safety management practices, and to obtain their expert opinion on safety personnel and organization requirements.

3. The information was compiled, then analysed.

Chapter II delineates the need for increased safety programs, showing how advances in technology and the cost of accidents have led to a change in policy regarding the responsibility for safety. Increased federal regulation has followed to provide protection to workers and the general public. Sweeping occupational safety and h-alth programs and systems safety programs have been instituted in the Department of Defense and the Navy. Chapter III discusses safety personnel requirements and the problems that occur due to personnel shortages and background. Chapter IV proposes partial solutions to these problems by the adoption of safety personnel education requirements. Chapter V gives conclusions, and Chapter VI gives recommendations derived from the study.

Appendices A and B discuss the interview plan and results. Appendix C paraphrases the important portions of the Department of Defense and Department of the Navy instructions concerning occupational safety and health programs. Appendix D lists some general safety personnel functions and Appendix E gives a method for generating safety standards and regulations.

## II. NEED FOR INCREASED SAFETY PROGRAMS

### A. TECHNOLOGICAL ADVANCES

Technological change has gone on at an ever accelerating pace, especially since World War II. Moreover, technology has changed in ways that differ from the mechanistic, mass-production technology that until quite recently was considered to be all there was. Not only has the time required to translate a basic technical discovery to commercial production or process or usage decreased to a few years, but also the number of new products or processes is increasing exponentially. This rate increase is proportional to the population increase.

Technological progress has been all-encompassing and phenomenal. Today, peoples' minds must adapt to a constantly changing way of life brought on by such things as: instant communications, high speed transportation, massive computer systems, exotic toxic materials, ballistic missiles, space flight, atomic weapons, nuclear power plants, and laser beams. Some of these lead to situations in which ordinary persons are unable to know or cope with all the possible hazards or dangers from these new technologies. The increased technologies and increased volume has also increased the potential for catastrophic results if an accident should occur.

Efforts must be increased to avoid or eliminate conditions that could lead to an accident. If adverse conditions cannot

be eliminated, they must be controlled either by design or procedure. Safety must be viewed in dynamic terms to embrace innovations appropriate to changing and sometimes radically new technological requirements. It must not be restrained by policies, procedures and havits characteristic of older technologies. Safety practices and techniques must keep pace with the advances in technologies with which they are involved.

B. ACCIDENT COST REDUCTION

The greatest benefits to be derived from safety is the attendant savings in lives and property from prevention of accidents. Injuries and deaths are deplore, but frequently the economic factors produce the greatest motivation for corrective action. Prevention of injuries and deaths are an important moral consideration for safety, but monetary factors provide the greatest incentive. Another factor inviting corrective action is the loss of function, especially for military systems, where mission capabilities, attrition rates and availability of operating units can be seriously affected by accidents.

Total costs resulting from accident losses are unknown. The National Safety Council estimates the annual cost resulting from injuries and death, plus losses in motor vehicle mishaps and fires, at approximately thirty billion dollars. There is reason to believe that this is too low a figure for all accidents, for there have been

estimates that the number of industrial accidents and injuries are ten times the National Safety Council estimate (Ref. 15, p. 3).

Efforts have been made over the years to establish bases on which total losses can be estimated from measurable costs. A Department of Defense estimate for its cost from accidents is four to eight billion dollars annually, including one billion dollars in direct cost of loss of equipment, facilities, personnel and compensation. As can be seen from the very broad estimates for the cost of accidents, attempting to predict how much is lost by accidents and how much can be saved by safety programs is very difficult.

Safety programs in the past have been established on an after-the-face basis. That is, when an accident occurred, an investigation was conducted to determine what was meeded to prevent a similar accident from occurring again. Today, the advent of the atomic and space age industires, where the cost of even a single accident could not be tolerated, has set the pace for many other accident prevention programs in other areas. Their very low accident record is proof that strong safety programs do pay off, even though the hazards are very great.

## C. NEW LEGISLATION, STANDARDS, AND REGULATIONS

Most of our present laws regarding obligations of a person to prevent injury to others or damages to their property are based on common laws evolving first in England

and later in the United States. Over the years these common law principles have changed with the times and situation and new considerations of social responsibilities. In the past sixty years responsibility for safety has gone from the employee to the employer and from the user to provider or manufacturer of a product.

As a result of this changing feeling about the importance of safety, new federal laws have been enacted which give a major role to safety administration. The public demand for safety in the workplace has culminated in the Occupational Safety and Health Act (OSHA) of 1970 which had the fundamental aim of ensuring "so far as possible every working man and woman in the nation safe and healthful working conditions and to preserve our human resources." OSHA empowers the Secretary of Labor to set safety and health standards in the private sector.

It is now the responsibility of the employer to provide a safe working environment, necessary tools and equipment to maintain that environment, and to provide information on hazards. The employer must also provide rules to be observed by employees and employers, and indirectly, by equipment manufacturers and designers, and provide penalties for employers and employees for nonobservance of the standards.

Executive Order 11807, "Occupational Safety and Health Programs for Federal Employees," of 28 September 1974 and the Department of Labor (OSHA), "Safety and Health Provisions

for Federal Employees," CFR Part 1960, of 9 October 1974, strengthened job safety and health programs in the federal government by extending the provisions of OSHA to the employees of the federal government.

Department of Defense (DoD) Directive 1000.3 (Ref. 8) states the provisions of DoD accident prevention, safety, and occupational health policy to be carried out by all DoD activities to meet the requirements of the OSHA and Executive Order 11807.

The Navy has long had a major safety effort, as is evidenced by the enormity of their safety documentation (Ref. 9). However, it too established a stronger safety policy through implementation of OSHA and Executive Order 11807 by establishing and implementing the Navy Safety and Occupational Health Program through SECNAVINST 5100.10C (Ref. 11) and OPNAVINST 5100.8D (Ref. 10). The major provisions of DoD Directive 1000.3, SECNAVINST 5100.10C, and OPNAVINST 5100.8D are paraphrased and included in Appendix C to show the magnitude and quality of coverage expected.

Additionally there are the provisions of DoD Military Standard 882, "System Safety Program for Systems and Associated Subsystems and Equipment," (MIL-STD-882), of 15 July, 1969, which gives standards for use during concept formulation, contract definition, engineering development, production, and operational phases of items procured by the DoD. There must also be compliance with the product safety standards

set forth by the Consumer Product Safety Commission established in 1973.

## III. SAFETY PERSONNEL REQUIREMENTS

### A. PROBLEMS OF SAFETY PROGRAMS

The preceding chapter gave as reasons for increasing the extent of safety programs, the needs caused by advances in technology, high cost of accidents, and legislation which mandated safety in the workplace and in the use of products; the latter brought about by public concern with their safety. Analysis in the light of these greater demands on safety organizations show weaknesses in safety personnel experience, competence, and training.

This increase in the safety workload will lead to tremendous problems in implementing the safety requirements due to personnel deficiencies, both in number and qualification, since the increase in safety is ultimately the responsibility of safety personnel and management.

Already one reads frequently in the newspapers about the mistakes made by OSHA, both in devising the standards to be used and in enforcement of these standards. The standards are variously ascribed as being too harseh, too lenient, unreasonable, impractical, or unenforceable. OSHA is castigated for not being aware of every possible hazard for every material, chemical, or piece of equipment in every workplace. They are accused of worrying about little things while allowing major safety and health hazard discrepancies to go unnoticed.

Although the OSHA requirements were discussed in the foregoing situation, the same problems exist for the expansion

of safety programs in other areas, including DoD and the Navy. Reforming safety is like reforming anything else, sometimes it works, but oftentimes it remains weak and inefficient and ineffective.

The results of personal interviews by the researcher provided much insight into the areas of safety personnel factors, selection, training, experience, education, and future needs. The results of the survey are enumerated in Appendix B and are included in this Chapter to indicate the problems that may be expected in the future in implementing the vast safety programs that are expected.

## B. PERSONNEL SHORTAGE

Since the OSHA requirements are for both private industry and government facilities, there is generated a large demand for qualified safety personnel, way beyond their employment in the past. The new safety requirements are being implemented slowly, being hled up by the lack of qualified personnel to handle the work. Even though the OSHA included stipulations for funding training programs, there are a very few schools turning out safety personnel as graduates, and as a result there is great competition for the few qualified graduates that do emerge.

It was evident while interviewing the Navy safety personnel, that most of the safety offices had not yet begun to implement the OSHA requirements and did not know what further safety would be needed to comply with OSHA. They

believed their organizations were already understaffed and would not be able to handle an increased workload should it occur.

C. SELECTION PRACTICES

The most overwhelming piece of information gathered during the personal interview sessions was that NOT ONE of the respondents indicated that he or she entered the safety field deliberately or by personal choice and was prepared to fulfill the responsibilities of the job. Granted that somewhere in a safety organization, there may be at least one safety professional that did choose to work in the area and did study appropriate courses to prepare for such a career, it is obvious that very few children are dreaming of being a "safety man" the way they do a fireman or astronaut.

This feature was also substantiated by the literature reviewed on the subjects of system safety, safety management, product safety, or accident prevention or OSHA compliance. In fact all the literature always started with the presumption that the firm or organization was well staffed with thoroughlyy trained, educated and competent personnel ready to perform the safety work at hand. None of them mentioned that acquiring such personnel was the main stumbling block to providing safety in an organization.

In the past, in private industry as in military organizations, safety personnel were simple designated and assigned

to that position, without any real regard as to the qualifications of the individual to fill the position. Frequently, even in the past, there would be no applicants for the safety jobs available in the federal civil service, and the first person who could be found to take the job would be selected. Many of the interviewees, in fact, indicated that they took the safety job because it was the only one available, or that they were looking for a promotion. They were well-pleased with the work they were doing, however, finding it interesting and varied, even if the job was not their first choice.

The success of safety organizations in implementing safety directives and standards is heavily dependent on the functioning of the safety personnel designated to carry out the safety programs. For work with the responsibilities of protection of life and property that safety entails, greater effort should be made to recruit the best and the brightest individuals possible into its ranks, rather than filling the positions with whomever shows up first.

D. BROAD TECHNOLOGY

The technical complexity of safety work makes the problem of acquiring competent safety personnel very difficult. In no single work area does the technology cross so many scientific disciplines as necessitated by the requirements of providing safety. Nowhere is this more evident than in Navy activities, where the variability of operations make

the safety job all-encompassing. For example, there is safety to be provided ashore and afloat, each with its own peculiar type of hazards. There is aviation safety, missile safety, range safety, test operations safety, ordnance safety, ionizing radiation safety, electromagnetic radiation safety, nuclear safety, industrial safety, and industrial health and safety, to name a few. All of these and others are needed to provide a safe workplace and/or to protect the public from hazards created by the Navy operations.

The safety professionals interviewed all indicated that their work covered a very broad spectrum of technical areas. From five to ten applied sciences or technologies were listed by each of them as being used commonly by them in their day to day work. They felt they should be knowledgeable in more technical areas than they were. They deal with safety precautions ranging from "abrasives" to "zinc" with items such as "cyanide, fuses, missiles, punch preses, and scaffolds" in between.

## E. TRAINING INEFFICIENCIES

Most of the safety personnel interviewed indicated that while they had updated their technical training, they had not received any formal training in safety techniques and practices, even when they had none prior to beginning their safety jobs. They all indicated that the greatest source of safety expertise came from some form of on-the-job training, mostly from watching others or pursuing common practices.

There is danger in relying entirely on on-the-job training, because it leads to inbreeding of methods and a narrow outlook.

The deficiencies and inefficiencies in the education and training of safety personnel increases the possibility of purely bureaucratic functioning of the safety organization. Anxiety and doubts of their control over the hazards unknown to them lead to stringent regulations and strict conformance to rules due to their timidity, conservatism and technicism.

Inadequacies involving training incapacities force the safety personnel to rely on predetermined standards and regulations. These rules become transformed into absolutes, and are no longer perceived as relative to a situation for a specific set of purposes. Adaption to special conditions are not readily envisioned by those stipulating the regulations.

Many hazardous situations are overlooked because they do not fit into this normal schematic, while other less critical conditions are overly safety-controlled because of blind adherence to the existing controlling regulations. Conformance to standards and regulations becomes the be-all and end-all of the purpose of safety programs rather than the protection of life and property. This emphasis on conformity develops into rigidities which prevent an organization from adapting to today's rapidly changing technology. This punctiliousness adherence to formalized procedures can

be exaggerated to the point where primary concern for conformity to the rules interferes with the achievement of the purpose of safety.

Safety personnel who do not maintain knowledge of technological advances must rely on outside sources of information when new products or processes are added to their area to purview. Frequently these sources of information on possible hazards are the purveyors of the new items, and are reluctant to reveal more than they have to beyond what is obvious. In addition, safety testing and hazard analysis is expensive and extensive work in this area causes additional costs to them.

Still the word of the manufacturer is frequently relied upon as to the safety of equipment or material or process, as it is impossible for the safety personnel to do an independent evaluation. The interest of the manufacturer is not in knowing about the safety of his product, but in making a profit for selling it. It can be a dangerous practice for safety offices of the Navy to rely on the vendor for a safety evaluation, and not be able, because of lack of knowledge, to perform an independent safety evaluation. If safety personnel are forced to muddle through due to lack of training, their actions can have serious effects on the protection of life and property through their lack of essential knowledge and techniques of safety.

## IV. EDUCATION PROGRAMS FOR SAFETY PERSONNEL

The problems of the deficiencies in the number and qualifications of safety personnel cannot be solved readily, because the need and demand is far greater than the supply, and the time and effort involved in creating the supply does not lend itself to a "quick and dirty" solution.

To function properly, most technically professional safety personnel must have a well-rounded, broad education, and experience in many areas. Safety engineers must function to some extent in all areas of the physical facility and must cope with psychological and sociological problems, as was seen from the results of the interviews with the safety personnel. The type of problem encountered is so large, that a narrow education is totally insufficient for the safety professional.

A second educational requirement calls for emphasis upon quantitative and logical problem solving. A technical specialty in some branch of engineering, mathematics, or a physical science is a great asset. The safety professionals must be adaptable to the task at hand, with this characteristic developed to the point where they can acquire new specialties when required.

The interviewees, even though many had been safety engineers for ten years or more, recognized their need for more training in technical areas as well as in safety methods and management.

With this background in mind, coupled with the new safety requirements placed to on the Navy by the OSHA, to be implemented in all areas (Ref. 9 and Appendix C), an educational program to provide the necessary training peculiar to Navy requirements for their safety personnel is appropriate. The need for educational programs is great, as even the present safety personnel lack much of the proper background.

A course structure could contain both short courses for specific safety areas, as well as graduate programs to provide qualified safety managers. Course programs could include safety areas as Occupational Safety and Health, Systems Safety and Human Reliability, General Safety and Safety Management, Safety Career Development, and specialized areas such as Explosive Safety, Aviation Safety, and Missile Hazard Safety.

## V. CONCLUSIONS

The study provides the following conclusions:

1. The study shows that the number of qualified safety personnel available to carry out the increased workload due to technological advances and safety legislation is not adequate to cover all the safety required by the Navy. The present safety force is deficient in numbers and skills, and additional duties cannot be covered by them without increasing the safety workforce.
2. Most safety personnel did not have adequate safety skills when they entered the safety field and developed their expertise on the job watching others or following common practices.
3. There is a need for an educational program to specifically train Navy safety personnel in safety skills and safety management.

## VI. RECOMMENDATIONS

The following recommendations are offered as a result of the study:

1. Safety training programs to provide Navy safety personnel should be increased and accelerated to meet the increased need, and should include updating of the present safety personnel to equip them with modern safety skills.
2. A graduate training program in safety management should be initiated to provide managers the capability to plan more effective Navy safety programs and the capability to further train other safety personnel.
3. Wide dissemination of information on safety education programs should be made available to all safety personnel.

## APPENDIX A

### PLAN FOR INTERVIEWS

The interviews were conducted informally with no set pattern being followed. They were tailored to the interviewee and were intended to provide the researcher with an insight into the atmosphere, attitude and functions of the various safety activities being interviewed and to provide pertinent information concerning the safety personnel. The goal was to establish a rapport with the interviewee and to obtain candid information from the safety personnel.

The questions listed below formed the basis for the interview, but the discussion elicited from the respondnets were by no means limited to these questions. The following is a list of the most frequently used questions:

1. What is your type of organization and safety field?
2. How long have you worked in your safety job?
3. What is your educational background and work experience prior to your safety job?
4. How did you happen to get into the safety field?
5. What special training or education in your area of safety expertise did you have before you started your safety job?
6. What training or education in safety did you receive after you started your safety job?
7. How did you learn or develop your safety expertise?

8. What technical areas does your safety work cover?
9. Are you directly involved in determining safety regulations or policy for your organization or others? Explain.
10. Are you directly involved in enforcing or interpreting safety regulations or policy?
11. Is your safety organization and staffing complete? If not, what type of safety personnel should be added?
12. What do you think of the safety field in general as an occupation?
13. Do you feel your training and education match the safety job requirements?
14. What further education or training would be most beneficial to you and your safety organization?

## APPENDIX B

### RESULTS OF INTERVIEWS

Since the literature reviewed revealed little or no information on the requirements for safety personnel, the Delphi Method was employed in its original and classical form as a method for obtaining expert information, and not for obtaining group consensus or opinion convergence as it has come to be commonly used. In this study, there was no particular need for consensus on most of the matters.

Professional safety personnel were queried on a number of safety personnel areas to obtain relevant background knowledge which they possessed by virtue of their position and experience. In the context of an expert being an individual whose opinion is valued, these safety personnel were in a position to render expert opinions on the subject matter.

The following is an elaboration and discussion of the various responses received during the interviews, following the order of the questions appearing in Appendix A.

QUESTION 1

The safety personnel interviewed were mostly civilians presently active in a safety position for the United States Navy, including a few in management positions. Most of them were technical professionals in engineering positions. One civilian interviewee had a Health-Physicist title,

working with radiation safety in a Range Safety Office. The remainder of the interviewees were naval officers in a safety office billet. The types of safety offices interviewed were aviation safety, range (missile flight) safety, ordnance, safety, and industrial (ground) safety.

QUESTION 2

The personnel interviewed had been employed in safety positions for times ranging from two to twenty-two years. The majority of them had been in a job involving safety for more than ten years.

QUESTION 3

The civilian personnel possessed bachelors degrees in various engineering and scientific areas, including electrical engineering, electronic engineering, aeronautical engineering, mechanical engineering, general engineering, chemical engineering, physics, chemistry and biology. Nearly all of them had attended graduate classes in technical areas and several had masters degrees in systems management or other management areas. Several of the military officers had technical degrees, but a few had non-technical education backgrounds.

The work experience of the civilians prior to entering the safety area consisted of technical engineering or scientific work, as could be expected. Their experience included process engineering, flight test analysis, rocket design, range planning, meteorology, instrumentation engineering,

research in radiation effects, nuclear testing, insurance underwriting, manufacturing, and missile test operations. The military interviewees had been engaged in aviation or operations.

QUESTION 4

The reasons given for becoming safety professionals were: for promotional purposes, because it was the only job available, or because of assignment by military authority. In short, one could say that they entered the safety field accidentally. Although it was not their choice at the time, the interviewees feelings were mostly positive about the safety job when they were employed, feeling it would offer good experience and more interesting work.

QUESTION 5

Not a single person interviewed had had any training or education in safety prior to undertaking or being assigned to a safety position. Perhaps somewhere in the total safety field there are some safety personnel who had prepared themselves for a career in safety, but at present, they are the exception rather than the rule.

QUESTION 6

At least three-fourths of those interviewed indicated that they had received no specific safety training or educational courses after they became employed in the safety area. The reasons were that they were too busy to take

the time for training, they did not know of any applicable courses that were available, or that the funding was unavailable at the time. The exceptions to this lack of safety training occurred with those who were involved in nuclear safety, aviation safety or ordnance safety, and with those who started safety work in private industry. Thes interviewees did participate in safety related short courses. Those without safety training did enrill in advanced courses in their technical specialties, when these courses were available.

QUESTION 7

The interviewees stated that they developed their safety expertise or learned safety techniques primarily by on-the-job training by copying or watching others and following precedent or common practice where they worked. They learned through trial and error and through experience. Some said it was through self-education and literature or intuition and personal logic. A very few indicated that formal training formed part of the basis of their safety knowledge.

QUESTION 8

The technical areas included a myriad of technologies of which each interviewee listed at least six or seven. Some of the technical areas include the broad scientific areas of chemistry, physics, biology, engineering and mathematics. More specific areas of applied science and mathematics

include hazardous materials, toxic chemicals, waste disposal, sound, structural analysis, oceanography, aerodynamics, astrodunamics, explosive ordnance, electronics, meteorology, heat transfer, ionizing and electromagnetic radiation, lasers, manufacturing processes, instrumentation, computer programming, probability and statistics, operations research, and hazard analysis.

QUESTIONS 9 AND 10

The majority of the interviewees felt that they were involved in determining safety regulations or policy, and they all felt they were involved in enforcing or interpreting safety regulations or policy pertinent to their specific safety area. One person felt very strongly that it should be management who enforces safety, but that when this is not done, then the safety professional should see that the safety function is performed, especially in critical situations when life or health or severe property damage is at stake due to unsafe conditions.

QUESTION 11

A number of the personnel interviewed felt that there were deficiencies in their organizational set-up, primarily in the chain of command, lack of proper personnel in sufficient number, and inefficient use of available personnel. They felt hampered by lack of proper equipment and sufficient funds to carry out necessary safety activities. They felt

more support personnel such as mathematicians, computer analysts, technical specialists, technicians, and inspectors were needed as well as more personnel in their own categories to carry out the assigned safety function. Some of the managers believed the burden of implementing requirements of new directives if strictly carried out to the letter, could not be done with their present organization.

QUESTION 12

Their view of the safety field as an occupation based on their experience on the job was quite positive with the negative aspects offered as an area for improvement. The specific comments ranged from rewarding, satisfying, enjoyable and challenging to necessary, essential and useful. Many felt that the wide variety of tasks offered opportunity to be creatvie and kept their interest. They also felt they were performing an essential service, one that could not be dispensed with.

The negative comments were that the execution of safety was too bureaucratic, with narrow vision and conformity required which did not allow creativity. Regulations and standards were often determined unscientifically with too great a safety factor applied. Several felt that their work was unappreciated.

QUESTION 13

The safety personnel felt that their training and education matched the requirements of their job as far as their

technical specialty requirements were concerned. (A few felt that they were overqualified technically.) They felt that their specific knowledge of safety was too limited for comfort. They all felt qualified for their job, confident of their innate ability to do the job, but with some reservations about being able to handle all safety problems immediately if they went beyond familiar territory.

QUESTION 14

The respondents believed that further education or training that would be of special value to them would be formal safety training, specific additional technical training, and broad safety management education. They felt that they would also benefit from an exchange of ideas with other safety personnel in a seminar type educational meeting. The management training, specifically oriented to safety management, is needed to allow managers to set-up the most effective safety programs possible and to make the most efficient use of the safety personnel they work with.

GENERAL

The overall feeling during the interview was enthusiasm for the work they were doing. Much of the disgruntlement that was exhibited, and there was very little, was the result of frustration and inability to do more for safety because of lack of training and adequate safety programs.

## APPENDIX C

### PARAPHRASE OF PORTIONS OF DOD DIRECTION 100.3, SECNAV INSTRUCTION 5100.10C, AND OPNAV INSTRUCTION 5100.8D

I. Department of Defense Directive 1000.3, "Accident Prevention, Safety, and Occupational Health Policy for the Department of Defense," June 15, 1976

It is DoD policy to develop, budget for, and manage within DoD, accident prevention, safety, and occupational health programs designed to (a) prevent employee injury and occupational illness, and (b) protect Federal equipment, materiel, and facilities from damage or loss. These programs shall:

1. Afford an adequate degree of protection to the public from DoD operations;
2. Meet the requirements of section 19 of the Occupational Safety and Health ACT (OSHA) of 1970;
3. Include elements cited in section 2 of Executive Order 11807.

The responsibilities of the Assistant Secretary of Defense (Installations and Logistics) acting for the Secretary of Defense are:

1. Manage and administer DoD accident prevention, safety, and occupational health programs.
2. Provide policy guidance for all DoD accident prevention, safety, and occupational health programs.
3. ESTABLISH A SAFETY POLICY OFFICE THAT IS STAFFED WITH TECHNICALLY QUALIFIED SAFETY AND OCCUPATIONAL HEALTH PERSONNEL.

4. Establish policies for DoD component consultation with representatives of employees on safety and occupational health matters.
5. Establish a DoD safety and occupational health management information system to include accident reporting and records maintenance criteria.
6. Establish policies for reviewing DoD component safety and health standards to assure consistency with the standards of the Department of Labor.
7. Establish priorities and procedures to assure prompt abatement of unsafe and unhealthful working conditions.
8. Issue guidelines on general accident prevention, safety, and occupational health training requirements for DoD managers, supervisors, staffs, and workers.
9. Submit an annual report to the Department of Labor covering DoD safety and occupational health programs.
10. Coordinate with other Assistant Secretaries to establish safety policies for applicable materiel acquisition programs that involve research, development, testing and procurement and monitor life cycle of material acquired.

The responsibilities of Heads of DoD Components are:

1. Appoint a designated safety and occupational health official.
2. Ensure that accident prevention, safety and occupational health programs provide protection for military and civilian employees comparable to or exceeding OSHA.

3. Establish a properly staffed accident prevention, safety, and occupational health organization, which has the necessary authority and resources to assure:

   a. Workplace inspections and prompt abatement of unsafe or unhealthful working conditions.

   b. Development of implementing directives.

   c. Compliance with DoD MIL-STD-882 and other applicable Federal agency product safety standards.

   d. Orientation and training of employees in safety and occupational health.

II. Secretary of the Navy Instruction 5100.10C, "Accident Prevention, Safety, and Occupational Health Policy," 21 October 1976

The policy of the Secretary of the Navy to establish and maintain within the Department of the Navy comprehensive, aggressive, and effective accident prevention, safety, and occupational health programs, consistent with DoD policy, and designed to protect civilian and military personnel from injury and occupational illness; and Government property from damage or loss; to be staffed with technically qualified personnel.

The Assistant Secretary of the Navy (Installations and Logistics) is designated safety and occupational health official for the Department of the Navy to execute the following responsibilities:

1. Maintain, modify, and establish accident prevention, safety, and occupational health programs which provide civilian and military employees protection comparable to OSHA. These programs shall ensure inspection of workplaces and prompt abatement of unsafe and unhealthful working conditions as well as investigations of reports of unsafe and unhealthful working conditions, and development of implementing directives as required.
2. Ensure appropriate planning, programming, qualified staffing and budgeting to meet the requirements of the Navy accident prevention, safety, and occupational health programs.

3. Implement accident prevention programs to protect Government property from damage or loss and provide adequate protection to the general public when exposed to hazards associated with certain Navy operations.
4. Use the DoD safety and occupational health management information system for accident reporting and record maintenance.
5. Establish a Navy Occupational Safety and Health Committee.
6. Consult with labor organizations as appropriate on Navy safety and occupational health programs, as well as with employees.

The Chief of Naval Operations is responsible for:

1. Managing and administering, including establishment of planning, programming, qualified staffing and budgeting to meet the requirements to the Navy accident prevention, safety, and occupational health programs.
2. Promulgating implementing directives.
3. Providing for periodic inspections of workplaces and prompt abatement of unsafe or unhealthful working conditions.
4. Developing procedures to investigate reports of unsafe or unhealthful working conditions.
5. Promulgating criteria for records maintenance and reports for the management information system.

6. Ensuring compliance with MIL-STD-882 in the procurement of military systems, equipment, and related facilities.
7. Ensuring that civilian and military personnel receive appropriate orientation and training in safety and occupational health.
8. Ensuring cooperation of all echelons in support of coordination with local communities in occupational safety and health areas.
9. Ensuring the designation of officials to consult with employee representatives and appropriate labor officials on occupational safety and health programs.
10. Coordinating activities of the Navy Occupational Safety and Health Committee.

III. Chief of Naval Operations Instruction, OPNAVINST 5100.8D, "Implementation of the Navy Safety and Occupational Health Program," 29 June 1977

The objective of CNO's Navy safety and occupational health program is to enhance operational readiness and mission accomplishment by establising a program to reduce occupational injuries, illnesses or deaths and material losses or damage; and to create and maintain safe and healthful working conditions for Navy civilian and military personnel.

The program applies to all military and civilian personnel employed by the Navy. It is applicable to materiel as well as personnel and is in effect afloat and ashore, on and off Navy installations. It applies to Navy dependents and all other civilian personnel while embarked in ships or aircraft or while on shore installations. It shall be implemented through the chain of command.

The primary program areas are the responsibility of specific program sponsors who maintain the technical expertise to establish policy, direction, organization and procedures in each of the major Navy elements of submarine and diving, surface, shore, and aviation. The DCNO Submarine Warfare is responsible for submarine force safety and occupational health program. The DCNO Surface Warfare is responsible for the surface force safety and occupational health program. The DCNO Logistics is responsible for sponsorship and central point of contact for the implementation of OSHA and for formulation and supervision of the Navy Explosive Safety Program.

The DCNO Air Warfare is responsible for aviation safety and occupational health program. The CNO Safety Coordinator is responsible for providing interface between primary program areas.

In specified support areas, the Chief of Naval Material, Chief, Bureau of Medicine and Surgery, Chief of Naval Personnel, and the Commander, Naval Safety Center, shall develop procedures and provide instructions and shall:

1. Establish safety and occupational health standards in conformance with OSHA.
2. Promulgate and disseminate safety and occupational health information.
3. Investigate, analyze and recommend measures to eliminate hazardous conditions, practices and equipment.
4. Provide technical input relative to safety and occupational health education in applicable curricula or conduct specialized training.
5. Insure compliance with MIL-STD-882.
6. Promote research, development, and procurement of safety and occupational health protective devices.
7. Process proposed modifications to ships, changes to characteristics of ships and technical development of such projects for the purpose of improving occupational and health in accordance with the Fleet Modernization Program.

Commanders, commanding officers, and officers in charge shall:

1. Conduct accident prevention, safety and occupational health program.
2. Establish safety and occupational health councils and committees.
3. Insure that safety and occupational health responsibilities are assigned to qualified personnel at all echelons of command.
4. Insure compliance with current accident and injury reporting procedures.

The Chief of Naval Material shall ensure that safety and occupational health aspects are considered, designed and engineered into all ships and aircraft, weapons or weapon systems, equipment, materials, supplies, and facilities which are acquired, constructed, or provided through the Naval Material Command. Engineering control of known occupational health problems such as noise and hazardous materials should be emphasized in the overall objective of this effort.

The Chief, Bureau of Medicine and Surgery shall perform RDT&E in occupational health and safety to determine exposure limits in naval operational environment.

The Commander, Naval Safety Center will monitor safety and occupational health throughout the Navy. Responsibilities include:

1. Recommendations for program objectives, development of procedural guides, and preparation of directives.
2. Evaluation of overall program effectiveness.
3. Development of management reporting systems.
4. Collection of reports and analyses of data.
5. Conduct of surveys and investigations.
6. Promotion and evaluation of programs.
7. Maintenance of a repository of accident, injury, and serious illness data.
8. Coordinate with others safety and occupational health training.

The Chief of Naval Education and Training shall:

1. Incorporate safety, occupational health, and hazard awareness information into the curricula of all appropriate training courses.
2. Provide specialized safety, occupational health and hazard awareness training and education as required.
3. Serve as the central source for collection publication, and dissemination of information on safety and occupational health training courses.

## APPENDIX D

### FUNCTIONS OF SAFETY PERSONNEL

The functions of safety personnel depend to a great extent on the function performed by the organization and the level of activity of the organization and on the structure of the organization. There are generally specific safety functions to be carried out, whatever the purpose of the organization, however, and the following list can be adapted to meet any safety organization purpose:

1. Ensures that all required safety laws, regulations, codes, standards, and rules are observed.
2. Ensures record-keeping and reporting requirements relating to safety are met.
3. Determines safety policy and regulations.
4. Enforces or interprets safety regulations and policy.
5. Monitors activities where hazardous conditions exist.
6. Determines and delineates safety criteria for conduct of hazardous tests and operations.
7. Halts any operation or activity that constitutes an imminent hazard to personnel or could result in loss of equipment or facilities.
8. Establishes suitable liaison and working arrangements with other activities concerned with safety.
9. Coordinates safety sactivites as appropriate.
10. Assists in the formation of safety committees and assists them in carrying out their activities.

11. Establishes and monitors programs for detecting and correcting hazardous conditions.
12. Reviews and approves the safety aspects of facilities layouts and designs, and of equipment being procured and installed.
13. Makes certain that hazardous areas, entrances and exits, and dangerous equipment are posted in accordance with prescribed standards.
14. Controls selection, acquisition, and use of hazard monitoring, detection, and warning equipment; of personal protective equipment and materials; and of emergency equipment.
15. Conducts safety training of personnel at all levels.
16. Conducts investigations of accidents, near-misses, and hazardous conditions. Prepares reports and takes action to prevent orecurrences.
17. Measures and records any tests made of environmental hazards, such as presence of toxic gases, noise levels, or presence of radiation.
18. Disseminates information on safety to all activities to alert them to specific hazards, or to maintain general interest in safety.
19. Accompanies inspectors from governmental agencies on surveys and audits of the facilities. Reviews any report of discrepancies and initiates action for their correction.

20. Makes on-site reviews of activities and determines whether any procedures or methods could lead to accidents. Recommends changes as required.
21. Periodically inspects emergency supplies to ensure that they are ready for their intended purposes.
22. Keeps informed on latest developments in activities that relate to his job, such as new safety equipment; hazardous materials that might be used at his facility; changes in regulations, standards, codes and rules; new methods of accident prevention; new methods of safety analysis; or accidents that have occurred at similar facilities or in related industries (Adapted from ref. 15, p. 89-91).
23. Performs hazard analyses and safety studies to identify and isolate those safety problems that require more detailed analysis.

Basically, the principles essential for effective safety and the elimination of accidents, are knowing the nature of the hazard, reducing it to the minimum, developing safe and adequate procedures, developing safe practices, developing employee and operational safety-mindedness and knowledge, developing supervisory knowledge and ability, maintaining close supervision and continually checking results. The "Rules for Rodgers Rangers" used during the Revolutionary War in 1776 are still valid: "DON'T FORGET NOTHIN'" and "DON'T NEVER TAKE A CHANGE YOU DON'T HAVE TO."

## APPENDIX E

### GENERATION OF SAFETY REGULATIONS AND STANDARDS

Safety standards and regulations require conditions or the use of practices, emthods, operations, or processes appropriate or necessary to provide safety. They promote consistency, so that there is a basic level of safety in similar operations or equipment or material. They will generally indicate safety measures to be taken for major problems.

Safety standards and regulations to be worth the effort that is required to develop them, must not only be practical, but they must secure a good degree of acceptance. In addition to job safety standards, these include standards for safeguarding personnel, safety equipment, inspection standards, safe practices and safety rules.

This is an important area, justifying much greater development effort and attention, particularly safe practice standards and safety rules. In developing these rules it is eesential that:

1. Every rule be practical from the viewpoint of those to whom it applies.
2. Each hazard or condition dealt with must be definitely demonstrated as unsafe.
3. Rules be limited only to safety matters with matters extraneous to safety dealt with elsewhere.

An important point to remember for those who use standards and regulations is that they may not be applicable

to all situations and may not be stringent enough for all actual conditions. Each hazardous situation must be analyzed and examined on its own merits. Blind observance of standards and regulations is not justifiable.

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