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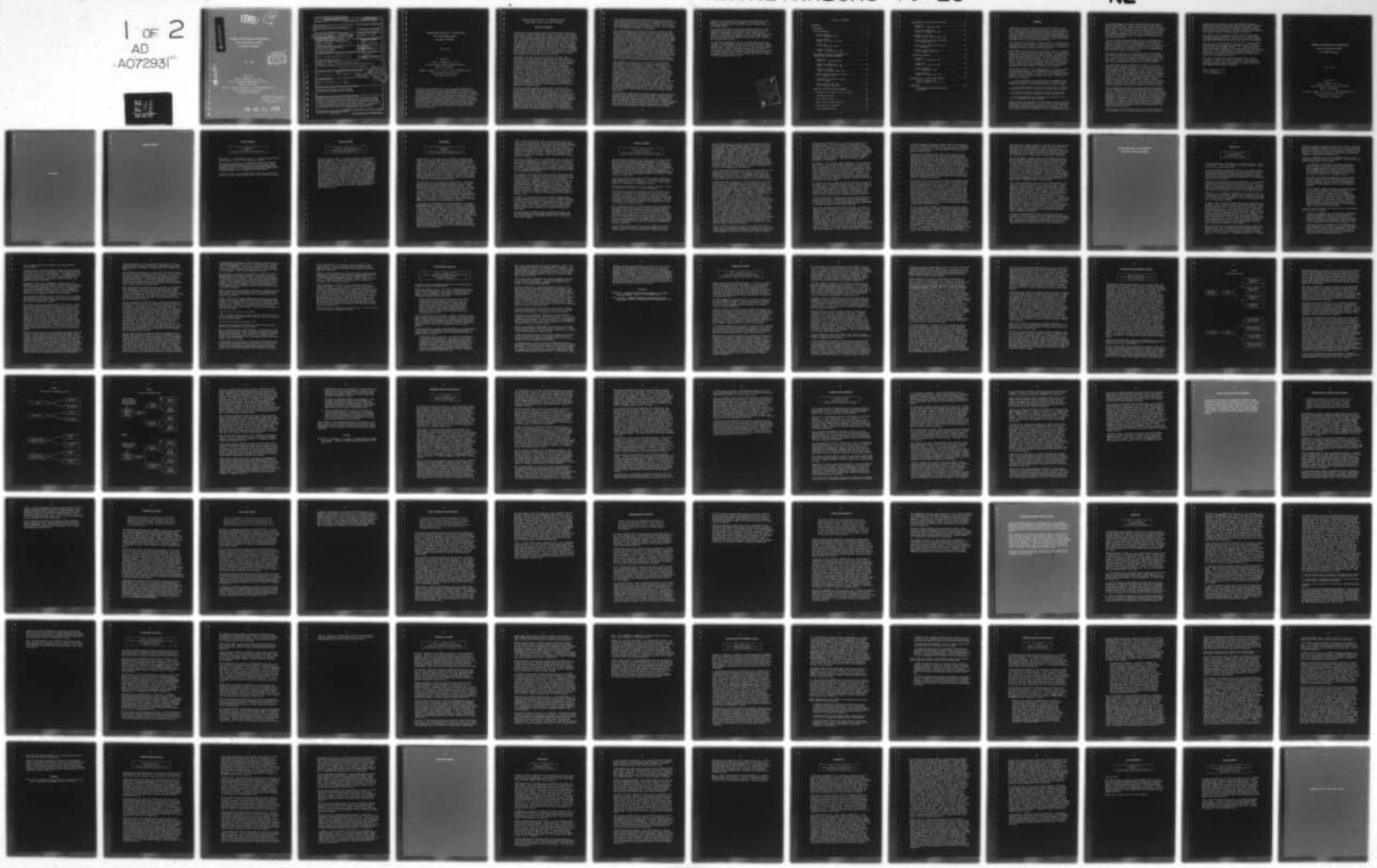

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Problems and Strategies of Implementing Navy Occupational Health and Safety Programs

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Presented are the proceedings of a conference that was designed to address issues of implementing occupational health and safety programs in the Navy. Persons from operations as well as from a number of other professional and disciplinary groups were involved to add diverse viewpoints. A final section of the report relates many of the issues addressed at the conference to knowledge about the organization and management of such programs.
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PROBLEMS AND STRATEGIES OF IMPLEMENTING NAVY OCCUPATIONAL HEALTH AND SAFETY PROGRAMS

JUNE, 1979

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PROBLEMS AND STRATEGIES OF IMPLEMENTING NAVY OCCUPATIONAL HEALTH AND SAFETY PROGRAMS

EXECUTIVE SUMMARY

A conference on Navy occupational health was held at Battelle Human Affairs Research Centers, Seattle, Washington on January 29-30, 1979. The conference was designed to provide a forum in which issues of implementing Navy occupational health and safety programs could be addressed from a number of perspectives. The conference objectives were to consider organizational factors in the implementation of Navy occupational health programs, to address issues of cost effectiveness in Navy occupational health programs, and to facilitate the development of a meaningful research program in this area. Participants included operations and line managers, safety experts, industrial hygienists, epidemiologists, behavioral researchers, and physicians. Individual perspectives, viewpoints and goals were diverse and often contradictory. The threads that bound the participants together were a deep commitment to improved occupational health care in the Navy and a clear conviction that the current occupational health program faces serious difficulties.

The problems that surfaced during the conference are indeed serious. Participants noted that: operational and occupational health needs are often pitted as direct adversaries; stated goals, priorities and directives are usually not accompanied by the resources necessary to carry them out; existing reward structures seldom encourage, may even discourage, the use of effective occupational health procedures; there are few training programs and those that exist fail to get the message to the worker; information and monitoring systems are haphazard and often inaccurate or unusable; and long term planning and occupational health priorities either do not exist or are drowned out by fragmented, crisis-oriented efforts that channel resources to specific issues but ignore general and long-term needs. In the course of discussion, these problems became viewed as stemming more or less directly from two sources: (a) the lack of a clearly stated set of occupational health goals and priorities to which upper level Navy management is firmly committed and will support through policy decisions and resource allocation, and (b) the lack of an appropriate organizational structure to accomplish the occupational health goals and objectives that have been stated.

The conference produced numerous suggestions about the nature of an optimal occupational health program in the Navy. First, it must combine varying degrees of a number of structural dimensions that are often presented as either-or propositions. One such dimension is centralization-decentralization where some parts of the occupational health program are best served by centralized authority while others require decentralization. The problem-solving and program implementation efforts called for throughout the conference require the highest levels of the Navy to develop clearly stated goals and priorities to guide both present and future programs. These goals and priority decisions are needed to allocate resources and manpower, to ensure that all Navy commands adhere to the occupational health requirements developed in these programs, and to reduce conflict between operational and occupational health goals. Such statements argue

for a strong centralized decision making and authority structure at the highest levels of the Navy hierarchy that will be responsible for developing occupational health policies and goals and will delegate sufficient resources and authority to ensure that these goals are met. Current instructions (OPNAVINST 5100.8E) appear to provide a vehicle for such a structure but are not presently being used for that purpose.

While the development and enforcement of broad goals and policies appear best served by a centralized, hierarchical structure, this does not seem to apply to the implementation of these policies. Because implementation of any policy requires considerable flexibility and problem solving, local occupational health programs appear to require a different type of structure. These programs require the autonomy to develop specific occupational health directives, policies, or guidelines that are adaptive to local needs and the authority (or access to the authority) to enforce compliance with those guidelines. They require flexibility to obtain technical expertise from a variety of sources without major constraint by formal organizational boundaries. Such concerns argue for decentralization so that local occupational health teams which include professionals from management, industrial safety and engineering, industrial hygiene, and occupational medicine can decide how procedures are implemented. In these latter teams would reside the responsibility for the development of specific practices and guidelines to carry out the policies and priorities established at higher levels. Through such a process, the guidelines would be more enforceable because they are viewed as legitimate and responsive to the needs of each facility.

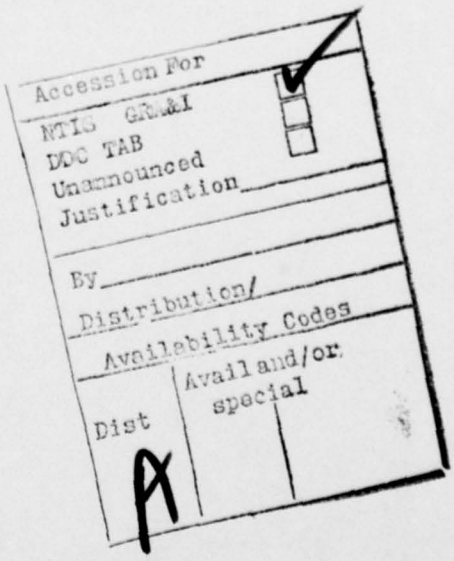
Such statements do not mean that one structural plan for occupational health care will meet changing needs. The above statements apply to conditions as they exist now and in the short-term. The long-term structural picture is likely to appear quite different. As occupational health concerns and programs become broader in scope, new professional roles will emerge to oversee occupational health programs and to provide coordination with other programs. Models for such roles already exist in personnel administration and hospital administration. It is also likely that increased emphasis on occupational health needs in the design and implementation of operational technology and work procedures may alter or reduce the role of some professions which are currently key to occupational health care any may elevate the roles of others such as the design engineer, the industrial hygienist, and safety engineer. Further, as policies are transformed into in-place programs, applied technical roles will undoubtedly emerge to supplant much of the expertise that is currently the purview of highly trained professionals. Thus, structural decisions made now to address immediate needs must continually be reviewed as these needs change.

The second major suggestion was that structural decisions about occupational health care must be accompanied by effective information systems that are designed to meet both short-term and long-term needs. Foremost among the short-term needs were information about type and duration of exposure to hazards and potential hazards, evidence of compliance with standards and guidelines, indications of program effectiveness, and so forth. Long-term needs were geared to the discovery of currently unrecognized risks, protrayal of career profiles, and information oriented toward the design of future

programs. In designing information systems to meet these needs, careful attention must be paid both to the adequacy of the content and the form in which data are stored so that the systems are indeed useable for the intended purposes.

Third, training and reward systems must be designed so that the proper information and practices are disseminated to the workers that are most affected by occupational health hazards. Several suggestions were offered for such programs, including the use of intact groups, the involvement of all levels including management, and the use of reward systems that encourage behaviors that comply with occupational health guidelines and discourage other behaviors.

The conference demonstrated the wealth of available expertise that can be brought to bear immediately on the Navy's current occupational health problems. It also pinpointed several areas that require extensive research and development. Among the major areas in the latter group were epidemiological studies to identify additional hazardous agents in the work environment, development of environmental monitoring techniques, the design of training and reward systems that will increase compliance with sound occupational health practices, and the design of future work environments to minimize occupational health risks.



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FOREWORD

A conference on Navy occupational health was held at Battelle's Human Affairs Research Centers in Seattle, Washington, on January 29 and 30, 1979. The purpose of the conference was to provide a forum where persons from diverse professional and disciplinary perspectives could address issues of implementing Navy occupational health and safety programs. The conference itself was sponsored by the Navy Medical Research and Development Command and by the Office of Naval Research. It was jointly hosted by Battelle and by the Naval Health Research Center.

The introduction to this document provides an overview of the objectives and structure of the conference. This opening section is followed by the conference proceedings. The final section of this report explores ways of responding to the issues addressed at the conference.

Several events have given rise to this conference. One is the increasing public concern about the potentially adverse effects of work environment conditions on individual health and safety. Another is the passage of the Occupational Safety and Health Act of 1970 that details employer's obligations regarding workplace conditions. This was followed by executive order calling for the federal government to take on an exemplary role for the rest of the nation by itself providing safe and healthy working conditions. Other events include increasing claims against the government for work related hearing loss and asbestosis as well as the threat by organized labor of work stoppages if conditions do not improve.

The principal objectives of the conference were (1) to assess the effects of organizational factors on the implementation of Navy occupational health and safety programs, (2) to consider the cost effectiveness of Navy occupational health and safety programs, and (3) to facilitate the development of a meaningful research program in this area. The following questions were addressed:

- What is presently known about the impacts of management factors, especially organizational and cost effectiveness issues, on the implementation and conduct of Navy occupational health and safety programs?

- What specific conditions in the Navy either support or hinder the implementation and conduct of occupational health and safety programs?

- Are there alternative organizational designs that might make occupational health and safety programs in the Navy more effective?

- What research needs to be conducted to more effectively understand the implementation of these programs?

Several points of view were built into the conference design to facilitate meeting the conference objectives. It was felt that the conference must incorporate the experiences and perspectives of the consumer, the health care provider, the fiscal administrator and the line manager alike. The latter groups especially are responsible for Navy units and must deal with

the competing demands of occupational health programs and traditional mission related objectives. Equally important are the views of the industrial hygienists, safety experts, and occupational health physicians whose technical expertise is critical both in the provision of preventive health care and in the treatment of those who become injured or ill from their exposure to industrial conditions. A third important perspective was provided by representatives of the research community who provided expertise in exploring new avenues for dealing with existing Navy occupational health problems.

Too often, problem-oriented conferences such as this unintentionally exclude one or another key group. Sometimes those who have expertise in other related research areas, who are responsible for program implementation, or whose units are directly affected are left out and are not provided the opportunity to express their ideas, beliefs, and feelings about the problem areas. The result is often a set of recommendations that are not well received by other groups.

One problem in gathering such a heterogeneous group of professionals is that there may be an insufficient common background for each communication. The researcher may lack information about the day to day problems of the operating unit or the problems in providing health services to these units. The operating officer may lack the focused background to understand the problems and issues faced by the other two groups.

This communication problem was addressed in two ways. First, pre-conference reading materials were sent to all conference participants to provide a common vocabulary and common basis for discussing the issues. These readings are listed in Appendix A. Second, the first morning of the conference consisted of formal presentations by well-known experts in each major field. These presentations defined problems in occupational health and safety program implementation from each profession's unique perspective. This segment of the conference had presentations from representatives of Navy operations, occupational medicine, industrial hygiene, epidemiology and environmental health, decision analysis and economics, and organizational behavior. Such presentations provided conference participants with an overview of issues and problems as viewed from each professional perspective and added to the common background.

The first afternoon was devoted to a grouping of persons mixed by discipline and profession to encourage interaction and discussion among participants. It was hoped that this session and other informal discussions would assist participants in viewing problem areas from a number of diverse perspectives. The topic areas discussed were equally diverse and included: information systems; audit, control and compliance; cost effectiveness; communication, education and training; organizational structure; and field experiments. The specific instructions for this part of the agenda are presented in the section entitled "Topical Discussion Group Summaries." The discussion summaries are edited versions that reflect highlights of these discussions but often omit the diverse and animated perspectives expressed during each session.

Written summaries from each topical discussion group were presented to all participants the first evening and provided a basis for the second

morning's discussion sessions. These latter groups were designed to include persons from more homogeneous professional and disciplinary backgrounds and to identify issues each profession could address or tackle. Plans of action were reported back in a general session that afternoon. The instructions for this discussion period are presented at the beginning of the section entitled "Professional Group Plans of Action."

Any conference requires considerable hard work by many persons whose names never appear as presenters or editors. While it is impossible to list everyone who helped, we wish to give special recognition to several individuals whose efforts were critical to the success of the conference.

First, we wish to thank CDR Ronald E. James and Mr. J. Randolph Simpson of the Office of Naval Research and LCDR Leigh E. Doptis of the Naval Medical Research and Development Command. Their efforts greatly facilitated the conference. Secondly, Ms. Shelley A. Haverstock of Battelle played a key role in making conference arrangements and assisting conference participants. During the conference she spent many additional hours ensuring that the conference progressed smoothly and arranging clerical support for the conference participants.

Others who contributed to the conference were Mr. Milo J. Clancy, Dr. Michael K. Lindell, Ms. Cindy G. Perry and Ms. Kathie A. Vezzani of Battelle; LT Mark C. Butler, MSC, USNR and Ms. Linda Dutton of the Naval Health Research Center; and LCDR Sally R. Cowles, MC, USN of the Naval Regional Medical Center in Bremerton.

John A. Drexler, Jr., Ph.D.
Allan P. Jones, Ph.D.
E. K. Eric Gunderson, Ph.D.

Problems and Strategies of Implementing Navy Occupational Health and Safety Programs

June, 1979

Edited by:

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Seattle, Washington

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PROCEEDINGS

OPENING REMARKS

OPENING REMARKS

J. E. Rasmussen, Ph. D.
Director
Battelle Human Affairs Research Centers

Good morning. I'm John Rasmussen, Director of the Battelle Human Affairs Research Centers, and I'd like to welcome you to Seattle.

This morning we're gathered at a conference on Problems and Strategies of Implementing Navy Occupational Health and Safety Programs, jointly sponsored by the Office of Naval Research and the Medical Research and Development Command. It is co-hosted by the Naval Health Research Center in San Diego and our Battelle Human Affairs Research Centers.

With that I'd like to ask our co-host, Capt. Eugene Lang, the Executive Officer of the Naval Health Research Center to say a few words of welcome.

OPENING REMARKS

CAPT J. E. Lang, MC, USN
Executive Officer and Program Coordinator
Naval Health Research Center

Thank you very much, John. It is indeed a pleasure for me to welcome you here on behalf of the Naval Health Research Center, Bureau of Medicine and Surgery. I for one feel that we have a golden opportunity here. The Navy is faced with a lot of occupational health problems and has been for some time. These problems are coming to the forefront because of social pressure, economic pressure, and environmental pressure. We are gathered here, gentlemen, for that very reason--to take a look at the Navy's role in addressing these problems. To my knowledge this is the first time that we have asked the groups you represent to sit down and discuss a single topic area. Your invitation was based on your expertise, your occupational performance, and your motivation. You represent, in the terms that one sees frequently in the newspaper today, the consumer, the deliverer of health care, and the researcher. We felt this represented a unique mix. We felt it also represented taking the Navy's expertise in all areas and putting it together and shaking the bag quite vigorously, so to speak. Gentlemen, before this conference is over, I expect you'll be tired. Welcome once again. We're glad to have you.

BACKGROUND

J. E. Rasmussen, Ph. D.
Director
Battelle Human Affairs Research Centers

A few words are in order about how the conference originated and how Battelle got involved. About nine years ago--after twenty-one years in the Navy--I joined Battelle to develop a broad-based contract research organization in Seattle. The Human Affairs Research Centers is an interdisciplinary social science research group focused on societal problems. We have all of the traditional social science disciplines represented on our staff as well as individuals trained in a number of related disciplines. Thus, the staff includes a cadre of individuals trained in law, policy analysis, statistics, regional and urban planning, various aspects of health care delivery, and economics. We also have a strong organizational behavior group. Our research is focused in seven broad problem areas--one of which is the delivery of health care and another is in the area of organizational effectiveness.

About two years ago, at a professional society meeting, I was talking with some of my old colleagues about contemporary issues in the Navy Medical Department and how research might impact upon them. There appeared to be a particular challenge related to the areas of organizational effectiveness and the economics of occupational medicine. That is in trying to cope with some of the problems, which, as Dr. Lang indicated, are not only rapidly emerging but are going to be with us. The trend of our society is toward more government regulation and more participation of citizens in technological decisions. Over a period of about two years we had a series of discussions with the NHRC staff members, Dr. Bloom's staff in the Navy Medical Research and Development Command, and individuals in the Office of Naval Research.

These discussions culminated in the bringing together of an extremely heterogeneous group of operational and research people. Our purpose in meeting for a period of two days is to make (if possible) an assessment of the effects of organizational factors on the implementation of occupational health programs in the Navy, to look at the cost effectiveness of these programs, and to facilitate the conceptualization of a meaningful research program in this area. I am quite sure we will not come up with a new occupational medicine program for the Navy in a period of two days and this is not our goal. Neither will we develop the "ideal research program" to solve all of the problems related to the Navy's Occupational Health and Safety Program. However, I hope that through the process of this workshop we will all gain. Maybe all of us will broaden our perspectives and we will possibly understand better where some of the researchable issues lie, as well as identifying some issues which may not be researchable.

I have a rather deep conviction that any research that's done in the Navy, if it's to be meaningful, must involve operational groups from the very beginning--especially those operational groups that would be impacted by the outcome of the research. These "users" must help design the studies so as to insure the right problem is being studied and that the researchers understand the problem. Further, involvement of the operational or user community facilitates implementation of research results. Research can't be done in a vacuum. I think this conference is the very type of setting, the very type of group, that facilitates research progress in the Navy.

This morning, because we have such a heterogeneous group of participants, we will have presentations in six specific areas. This will provide a common frame of reference for our subsequent interaction. Our speakers will sketch occupational health problems in the Navy as they see it from the viewpoint of their specialty. The six professional specialty areas are listed in your program--Operations, Occupational Medicine, Industrial Hygiene, Epidemiology/Environmental Health, Decision Analysis and Statistics, and Organizational Behavior.

This afternoon we will break into several interdisciplinary groups which will identify a list of key issues that can be later addressed by disciplinary groups. This afternoon's groups will consist of people who come from quite different backgrounds. The groups were intentionally structured that way. Tomorrow morning we will go back to groups having a greater degree of professional commonality and interest in order to work through some of the issues that surface this afternoon. Tomorrow afternoon we will hear recommendations which the disciplinary groups have pulled together. Finally, on Wednesday morning we'll have a small group from the research community, who will stay behind and attempt to draw conclusions as to what the products of this conference mean for research. There will be a report of this workshop and all of you will receive a copy.

In summary, it strikes me that we are dealing with a mammoth problem. We're not going to solve it in two days. I think the process of working it through is about as important as the conclusions we reach. Above all, if we are able to do anything that's meaningful, we're going to have to keep on a pretty tight schedule. Right now, we are a little ahead of schedule, which is fine. This way we will be able to meet our agenda and then possibly open the meeting up for discussion if we get far enough ahead.

Our first speaker is Captain Joe Bloom, the Commanding Officer of the Naval Medical Research and Development Command, who will address the issue of what research and development sponsors look for from occupational health research.

A MODEST PROPOSAL

CAPT J. D. Bloom, MC, USN
Commanding Officer
Naval Medical Research and Development Command

The challenges and responsibilities confronting the Naval Medical Department in our times are sobering, almost overwhelming. In particular, I believe the Navy has serious problems in providing to Navy people proper protection from our peculiar environmental hazards. I further believe that the Navy--including the Naval Medical Department--has a fundamental responsibility in meeting and resolving a broad spectrum of these problems. I intend to provide you with a frame of reference for developing new directions not only for the Naval Medical Research and Development Command but also for Naval Medical Department performance for meeting our responsibilities in these areas.

This is by no means the only frame of reference, the only approach, or gospel according to a new New Testament. It is simply a single person's opinion offered to get us off dead center of what, up to now, has been ineffective, unenlightened, and pedestrian activity.

Your reciprocal obligation is to listen, to debate, to accept or revise, and then to fill in the details of an improved approach.

A starting point might be some reflection on the discontinuities that often result from the impact of new technologies and new social values on existing institutions. We increasingly find that the conceptual platforms on which many of our traditional institutions are based cannot accept the strain and distortion of present-day requirements. When such is recognized, rethinking the conceptual underpinning must occur if the institution is to continue to be valuable to the organization of which it is a part and to society at large.

Such is the case, I believe, for the institution known as Navy medicine. For over two hundred years that proud profession has been fundamentally concerned with the direct, immediate, visible, and pragmatic care of individuals injured in battle or sick from conditions surrounding the battlefield. It is true that from time to time distractions, sometimes of large proportion, seem to get in the way. Perhaps the care of dependents and retired beneficiaries are modern-day examples of such "distractions." That issue aside, until very recent times, the central rationale of a Naval Medical Department was the immediate care of the symptomatic diseased or disabled sailor and marine in the context of amphibious and open ocean operations.

I do not need to convince you that the past two decades have seen fundamental, irreversible changes in naval warfare together with a continuing explosion of science and technology that feeds those changes

at an accelerating pace. Think but for a moment on weapons platforms encased in closed environments, nuclear energy, "smart" missiles, advances in polymer chemistry, intercontinental weaponry, electronic and solid-state wizardry, a redistribution of defense effort between civilian and uniformed members, and the new and expanding role for women in seagoing and shore-based assignments. I also submit that a common denominator of these advances is a new and valid concern for asymptomatic hazards of environments; its corollary is the resulting disease, often with long asymptomatic latent periods, inflicted on some of those exposed. To complicate matters further, there are changes in social values familiar to you all. Our national concern over large institutions growing larger, our collective and individual suspicion of the "Establishment," and our struggle to reestablish individual values in a world increasingly complex and interrelated are but a few examples of imperatives that impact insistently on the status quo of naval medicine.

I have concluded and now propose to you that for Navy medicine to survive we must effectively analyze and respond to these issues--scientific, technological, social, and moral. In my judgment, such analysis and adaptation must include concern for environmental hazards and diseases of long latent periods as a central co-partner with the immediate care of acute illness and injury in our revised mission and reason for being.

The immediate rhetorical question is: Why Navy medicine? In our modern society, concern for environmental quality and occupational health is articulated by many institutions--public, private, state, federal, technical, political, and academic. The only answer that makes sense in an age of cost-effectiveness hysteria, budget analysis, redundancy, dragon killers, and unempathetic engineering mind sets is the uniqueness of Navy environmental problems. I believe that uniqueness is expressed in at least four directions. First, there is uniqueness in the application of material and energy to the accomplishment of the Navy mission. Second, the exposure of our personnel to hazards is frequently on the basis of twenty-four hours a day, seven days a week, for many weeks on end. Accordingly, the relationship of cellular and tissue injury and the opportunities for, and the completeness of, repair is quantitatively and qualitatively different from the civilian worker exposed to the same hazard for a more limited eight-hour day, forty-hour week. Third, the Navy work environment is characteristically one of multiple, not single, but I repeat, multiple hazards interacting in unpredictable and unappreciated combinations of synergy and antagonism in cellular injury-repair scenarios. Finally, the Navy work environment is characterized by mobility of people and fluctuations in hazard levels for any given work site. Our operations are not those of the monotonous production line. On the contrary, our workers, civilian and uniformed alike, must frequently move from place to place, perform different tasks and always do so in a tempo of operations where equipment and processes, energy fluxes, and airborne contaminants are turned on and off in a sequence that, if not entirely random, is difficult to predict.

The more important question must then be not, Why Navy medicine? but rather, how is such complexity manageable? My answer is that first, the complex problems and challenges of Navy-unique environmental hazards are indeed manageable. The solution of these complex problems (with many

variables over an extended time axis) requires no less than a triply integrated approach. First, there must be a system developed to (1) identify the worker at risk, (2) measure physiological and behavioral functions in that worker before the onset of symptoms, (3) relate deviations in those functions to symptomatic illness that may or may not be job-associated, (4) signal the health-care provider that more detailed study is required, and (5) inform the worker periodically on the meaning of the entire process to the individual and the individual's health. We frequently use the expression "biomedical monitoring" to describe the process and realize that it is derived from the more general methodologies of epidemiology.

The second arm of the required integrated approach is the assessment of the workplace. That assessment must be comprehensive, flexible, responsive to fluctuating levels of multiple hazards with variable time constants, and relevant to sites of intake or target organ damage. To not couple workplace monitoring with the process of biomedical monitoring is to risk incomplete and invalid information from both approaches. I am firmly convinced that this issue is not negotiable. I know of no instance in which occupational medicine and industrial hygiene, the performing professions of biomedical monitoring and workplace monitoring respectively, have gone in separate, uncoupled, uncoordinated directions and resulted in a useful product.

The third arm of a triply integrated approach recognizes the vastness of our ignorance of basic mechanisms of body burden, injury, and repair in biological systems. As in most biological sciences, laboratory modeling is a complementary methodology for unraveling these secrets. In the area of occupational health, such modeling is contained within the discipline of toxicology--a discipline that, in my judgment, cannot effectively stand alone but must be configured and scrutinized in the light of workplace assessment and biomedical monitoring information.

A triply faceted system to address Navy-unique environmental hazards at present does not exist. Its development, testing, and evaluation is properly the responsibility of the research and development community. Its transition to general utilization throughout the naval establishment is the responsibility of the Naval Medical Department.

We must next consider some organizational principles. The first of these involves a rethinking of line and staff responsibility for environmental health. The problem is one of conflict of interest. A line commander at sea, in a shipyard, or a bureau office has a primary responsibility for expedient, cost-effective accomplishment of assigned missions. An untidy fact of life is that environmental health issues frequently interfere. They are costly, time-consuming, sometimes disruptive, often complex, and frequently misunderstood. In the rapid-paced, pressured, multifaceted world of executive decision making, environmental health has been, and will continue to be, shortchanged unless it has an advocate. At a level inferior to ultimate executive decision making, that advocate must be someone other than the operations or production manager. In our Navy, I believe that advocate should be the Naval Medical Department. In the parlance of the behavioral scientist,

I believe the Medical Department of the Navy must be the superego for the Navy in matters of environmental health. This role is incompatible with that of an apologist for errors in management decision or practice: rather it requires access to, and respect from, the highest levels of executive decision making.

The second organizational principle that I wish to discuss is the essentiality of coupling research, training, and career development with facilities and services. The science and technology base that supports environmental hazard evaluation and control is relatively new and untested, as are the trade-offs between skilled professionals and automated instrumentation. Along with development, evaluation of new approaches and new equipment is required to sort out the worthless from the innovative. New approaches must be phased smoothly into established operating routines to realize their full advantage. Not only must practitioners of environmental health be trained to new procedures as they are developed, but in addition, the Navy's deficit of skilled personnel must be corrected and these skilled personnel retained. Our experience to date has demonstrated that these highly desirable goals cannot be accomplished without the close coordination of the research, education, and application functions.

The third principle or issue is the irrationality of approaching single-hazard control with ad hoc task forces. I would in particular attack the current asbestos program as a case in point. An almost hysterical effort and resource base is being thrown at this single problem. Yet there is something like 7×10^4 chemicals out of a possible 10^9 that are potential toxic hazards. This is to say nothing of energy forms such as ionizing and nonionizing radiation, mechanical energy, noise energy and heat energy that can cause deleterious effects. As each of these becomes exposed as a fashionable hazard, are we to mount a task force to confront it? How many task forces will be required before we realize the inefficiency of their redundancy? How will we ever begin to understand the interaction, both synergistic and antagonistic, of several hazards imposed concurrently or sequentially on an individual if single agent preoccupation is to be our only organizational approach? I believe we can and must do better.

The last issue, under the heading of organizational principles, deals with our responsibility to inform and counsel the individual exposed to work-related environmental hazards. If we are to measure and monitor the person and the jobsite; if we are to collect, record, and analyze all these data; if we are to attempt to use them to better working conditions; if we are to do all these things, we shall surely fail if we neglect the systematic, empathetic, and unbiased interpretation of the information for the individual directly involved. If we listen carefully to consumer advocates, labor leaders and their constituencies, they are telling us that they are confused by our rhetoric and uninformed not only about our intentions but also about the data on which we base our decisions. I firmly believe these data and their meaning must be shared, in a systematic, understanding way, with each individual involved. To use a worn out cliche--if we can do something as complicated as putting a man on the moon, surely we can do something as simple as this.

How are all these changes, observations, principles, and deviations from the orthodox to be brought together? I believe that the Naval Medical Department role in environmental health needs a new master plan. I believe that this master plan must include a broader-based research and development effort with resources to support it. Some of my ideas about the direction of that expanded research and development program have been sketched for you. I hope you will help me fill in the details.

In order to support a broadened research and development program and meet our obligations toward graduate education in environmental health, the Naval Medical Department must have a facility devoted to the study of problems and to the dissemination of information related to Navy-unique environmental health. Such a facility might be in the form of an expansion of an existing department in one of our laboratories. As an alternative, it might be a new construction project in an area where it will have a high degree of fleet visibility and appropriate proximity to like academic institutions. Perhaps an even more exciting possibility is a Naval Medical Department facility with strong academic affiliation built into its cornerstone. I hope during your deliberations these next two days you will weigh and analyze these propositions and, indeed, make recommendations supporting one of them or rejecting all of them in favor of something better of your own design.

Last, I believe the master plan must include a systems approach to providing environmental health services to the Navy at large. A systems approach can best be embodied in a Naval Medical Department Systems Command to orchestrate medical department responsibility for research, development, direct operational medical support, and health matters related to environmental hazards. Such a command would have complete medical department responsibility for health and safety monitoring and standard setting including workplace assessment and monitoring. It would effect a single, unbreachable chain of command from the headquarters level to Navy work sites throughout the world. It would ensure complete separation of resources and responsibilities from existing Naval Regional Medical Centers. It would coordinate the command control of both medical research and occupational health service resources. It would provide a single-manager accountability for the entire occupational health effort. Finally, it would provide a vehicle for phased development of centralized data collection, storage, analysis and interpretation capability for both policy decision making and individual worker assessment and counseling.

I perhaps have overextended what should have been a bland welcome. I am, however, excited about the possibilities, impatient with the lack of progress, and in need of the talent in this audience to make improvements work. I hope you will challenge and dissect what I have said to you and then help me--and more importantly our Navy--get on with the job of providing better environmental health care to those who depend on us.

PROFESSIONAL ROLES IN IMPLEMENTING OCCUPATIONAL HEALTH PROGRAMS

OPERATIONS

CAPT J. C. McArthur, USN
Commanding Officer
Pearl Harbor Naval Shipyard

As the old saying goes, "A few months ago I couldn't even spell 'occupational health.'" The last few months I have been up to here in it and it has been a real eye-opener for me.

It is a real pleasure to be here this morning. I was asked to describe the role that operations personnel play in occupational health care and planning--more specifically to answer the questions, "What is the role of operations in occupational health programs in general?" and "What is the role of operations in developing and implementing future occupational health programs and methods?"

The answer to both questions is pretty straightforward. To me, operations represents the community of people, facilities, work places and work practices to which occupational health programs are applied. Operations' role is to do something productive which may involve hazardous or toxic materials, forces and conditions, and still have the people involved remain productive and healthy and not come down with occupational disease.

Operations' role is pragmatic and concerned primarily with the results of occupational health programs. Because of this pragmatic role, I would like to speak to you in simple, pragmatic terms. My principal experience is in the Naval Shipyard environment, so it is from that background that most of my conclusions are drawn.

In today's legal 'fish-bowl' environment with executive orders directing the federal sector to provide national leadership in occupational safety and health, we need to do a lot better than we have been doing. The obvious question is, "How?" I think the answer is fairly straightforward and simple--maybe hard to do, but simple to talk about. Part of the answer is not to leave so much to the prerogative and struggle and fight of the occupational health professional in the field. Instead, we need to decide at the Navy corporate level what kind of toxic materials, hazards, stressors, and so on we are most concerned about and how we are going to deal with them. We need to interpret the laws and regulations and promulgate them to the field in clear, understandable and decisive terms. Then we must follow up to obtain compliance and at the same time must provide the resources for that purpose.

Now, this plan may not be as satisfying to the occupational health professionals, but it will free them from struggling with yesterday's and today's problems and will allow them to focus on tomorrow's problems. Let me say this again in a little different way, because from my perspective it is very important. I recommend that whenever it is possible,

certainly in matters of compliance with law, Navy corporate level management should promulgate standard requirements that are clear, understandable and enforceable in the field. This practice will tremendously ease the burden on the occupational health professionals and properly put the burden on less sophisticated administrative, technical and supervisory personnel to administer the promulgated rules.

I have been assigned to lead a joint NAVSEA/BUMED project to improve occupational safety and health at Naval shipyards. I would like to read from the tasking letter on this project.

> ...to review the current status of occupational safety and health programs, less radiation control and radiation health programs at Naval shipyards and at NAVSEA SYSCOM fixtures, and to recommend policies, procedures, programs and staffing to provide these organizations with occupational safety and health programs that meet the requirements of the law, executive order, and instructions from higher authority.
>
> The scope of your study and recommendations should not be restricted by preconceived resources, organizational or other material boundaries. The policies and programs recommended for Naval shipyards should be suitable for implementation at other NAVSEA SYSCOM industrial activities with minimum modification.
>
> The Naval Material Command, the Bureau of Medicine and Surgery, and the subordinate commands all have responsibilities in carrying out occupational safety and health programs. In making your review and in developing your recommendations, do not be constrained by current divisions of responsibility. Recommend assignment of the various elements of responsibility where they can best be accomplished. Include in your recommendations specifics on appropriate interfaces between Navy Regional Medical Clinics and the Naval shipyards, as well as between the Bureau of Medicine and Surgery, the Naval Material Command and the Naval Sea Systems Command.

It goes on to say that direct liaison between yourself and everybody else in the world is approved.

> I expect your recommendations to be sufficiently comprehensive to provide the Commander, Naval Sea Systems Command, an instrument for agreement on occupational safety and health program responsibilities with the Chief of Bureau of Medicine and Surgery. Further, your recommendation [should be] capable of rapid implementation after your formal presentation to me.
>
> After approval of the recommendations by the Commander, Naval Sea Systems Command, I will expect the practical implementation within a matter of months of your recommendations to provide the Naval shipyards with occupational safety and health programs which comply with the requirements of law, executive order and instructions from higher authority.

This is signed by Rear Admiral Manganaro, Vice Chief, Naval Sea Systems Command.

So that's the task I have been assigned. Clearly, we're not going to revolutionize the world. We're focusing in on the shipyard environment for now and as far as we can see downstream. As I understand it, this tasking was born out of a lot of frustration at the NAVSEA Command and the Surgeon General levels. They tried to sign an agreement last November on the subject but decided not to because they didn't have enough to work with at the time.

We started to form a team in mid-December consisting of Dr. Tom McManomon; Dr. John Osborn; Alex Munton, a retired Industrial Hygienist; Mr. Dick Patterson, the NAVSEA Industrial Activity Director and Occupational Safety and Health Manager; Mr. Dave Plimier, the Management, Engineering and Information Office Director at the Pearl Harbor Naval Shipyard; Mr. John Prebula, the Nuclear Quality Assurance Director at Pearl Harbor Naval Shipyard; and myself as the team leader.

Just last week, we completed a series of one-day visits at all of the naval shipyards and associated medical clinics in the first information gathering phase of the project. Commander Joe Bellanca travelled with us to some of the east coast shipyards.

We've been to all of the yards now and to all of the clinics. In each case, except Portsmouth Naval Shipyard where we got an early jump in December with just a partial team, Dr. McManomon and Dr. Osborn and I met with the commanding officer of the shipyard and the head of the clinic at the beginning of the day. We explained our mission and dispelled any ideas that we were performing some sort of audit or investigation. We tried to make it clear that we were there to learn about occupational safety and health problems as seen by those particular shipyard and clinic personnel, to obtain their ideas on how to make improvements, and to see the initiatives that they had ongoing at the particular activity. We spent the remainder of the morning in a group session with 18 to 25 persons from the shipyard and the clinic who are most heavily involved in providing, administering, or receiving occupational safety and health services. In the afternoon, we broke into smaller groups and went around the yards and clinics to look and talk further.

During the morning session, we used a discussion topic sheet sent out in advance to trigger thoughts and guide discussions into general areas of interest. We stayed away from any formal question and answer session. The topics covered included management of hazardous or toxic material and stressors, and subcategories like systems for identifying them in the shipyard, introduction of new items, labeling instructions to the workmen for safe use, storage, data interchange with other yards, personnel exposure to toxic or hazardous material and stressors, what needs to be controlled, what needs to be monitored, the determination of exposure limits, record keeping, emission of toxic or hazardous materials, and industrial hygiene services. We asked whether services are adequate now, whether industrial hygiene people are available, and whether industrial hygiene should be split up between subprofessional and professional

industrial hygienists. We discussed medical examinations for workmen, asbestos control, administration of claims, conventional safety, acute medical attention of accidents, interpretations of law, executive orders and so on.

These discussions were very good as it only took a few mintues to break the ice before really productive discussion got going. At the end of the day prior to departing, Tom and John and I again met with the CO's of the shipyard and the clinic to summarize what we believed characterized that particular location. In other words, we weren't there to sell anything. We were simply there to try to understand and characterize that particular location: how they were doing things, where they thought they were going, and what the problems were.

Again, the reception and the open and frank discussions at all locations were overwhelming. It was quite clear to me that there is tremendous spirit and knowledge among the occupational health personnel in the field. They really want to do the right thing. We did find, however, as the old saying goes, that even though that spirit was extremely willing, the body was a little weak. To be more direct, there was an almost universally perceived serious shortage of personnel and funds to carry out their mission as they see it.

Each of the shipyard clinics was different in many regards and had, over the years, adapted to the forces of personalities and the conditions at each location. There were also many similarities among each of the sites. An important one that comes to mind is that the shipyard and NRMC cooperation at most places was absolutely outstanding. Also, there was a significant shortage of doctors and industrial hygienists to accomplish even the bare minimum of an occupational health program as they believe it should be done. The requirements of occupational health programs at the shipyards are not well defined, and most are operating in a brush-fire mode without a coordinated program. Most agree that the corporate level Navy needs to promulgate some program to prescribe the 'what' of the occupational and industrial hygiene business and, in some cases, even the 'how.' Most of the occupational health and industrial hygiene direction at the yards and the clinic originates with the professional views of the resident doctors and industrial hygienists. There seems to be little communication or standardization among the shipyards, even though the shipyards--all eight of them--are in the same business, and use the same kind of materials.

Several shipyard clinics are moving to some form of computerized multiphasic physical examination scheduling. Some of them schedule specialty training requirements for the particular hazards that individual workers encounter and keep records of training completion. There is a perceived need for this training, and several of the yard-clinic combinations are really working at it. Most of the shipyard occupational health training is given only at the supervisory level. Records could not substantiate individual worker knowledge of hazards in most settings. The system calls for the supervisor to get the word to his people, but in answer to the question, "Do we really get the word down to the worker?", we cannot prove that we are. Individual exposure records are virtually nonexistent. Several people view the occupational health accident critiques--conducting

a critique after an accident or an acute problem--as a potential tool for enforcing and educating but don't see it as being used much. The administration and management of claims varies significantly from place to place. In some places, we see heavy participation by medical personnel in developing good claim data to represent the Navy, and in other places we see almost none. There is great variation in this area.

Most individuals involved with occupational health agree that industrial hygienists are in short supply and that their functions can be split between professional and technical issues. They agree that technicians can be obtained and can be trained. Most agree that there are different rational ways of accomplishing the industrial hygiene function of the shipyards. Most agree that some of the routine, well-defined industrial hygiene type work could be conducted by trained shipyard personnel, so long as they are under professional, technical and qualification review of the NRMC professional.

Several shipyards have hired industrial hygienists or technicians to help resolve some of their immediate occupational safety and health problems. While there is variation, acute medical care is viewed by most of the shipyards as quite good.

Lastly, in most cases the shipyard NRMC personnel believe that the Navy already has the talent to develop good and efficient occupational health programs and to implement them. In a lot of places I kept asking, "Hey, we've got a lot of problems. You're talking about the problems and you're describing them. Now, do we have the talent in the Navy to develop solutions that apply to those problems?" And we'd usually go through the same kind of dialogue.

"Yeah, but they won't listen to us up there."

"Well, if they did listen to us up there, do we have the talent to do it? Can we put together implementation plans that don't take all the resources in the world to accomplish?"

And over and over came the same answer, "Yes!"

Many people out in the field are enthusiastic about putting something together and implementing a practical program.

Back to the project that I've been assigned to. The next step is to formulate some options for both short- and long-range shipyard occupational health program improvement. Then we must return to the field to discuss these options and flesh them out. The goal is to recommend specific options to the Surgeon General and to the Commander of Naval Sea Systems Command in March of this year.

In conclusion, after travelling to all eight of the Naval shipyards and the associated clinics and meeting with a large part of the Navy's occupational health professionals, I'm personnaly convinced that we are capable of putting together occupational health programs at the Naval shipyards and at other Naval industrial activities that can efficiently

meet the requirements of law, executive order and instructions from higher authority. There is an extremely capable, enthusiastic and cooperative group of professionals dedicated to improving occupational health out in the field.

Now that the intense attention has been focused on this subject from the highest levels in the Navy, it only remains for operations personnel and the occupational health professionals to work together swiftly and jointly to develop and implement a program. I think 'jointly' is the big key to it. From my point of view, this meeting, this conference, is a tremendous step in the right direction.

Back to the question I was asked, "What is operations' major role in occupational health?" I think it is two-fold. I said at the beginning I think it's to be pragmatic and critical. Occupational health is a sideline for people who run shipyards. We want to fix ships and get them out. Second, operations personnel should take the routine and administrative matters of occupational health off the professionals' hands. Give me a set of rules to work by, a set of engineering principles, something you can codify, and I can make it happen and keep records of it. The NRMC medical professionals need to audit us, monitor us, make sure that we've got people doing things right, but they should not spend all of their time trying to do the day-to-day things while they are still trying to look ahead toward the more sophisticated and less definitive problems that they are trained to do.

Thank you very much for asking me to participate here. I'm sure it's going to be an interesting and worthwhile two days.

OCCUPATIONAL MEDICINE

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Naval Regional Medical Center
Bremerton, Washington

My topic is the role of occupational medicine in the delivery of Navy Occupational Health and Safety Programs.

Occupational medicine is not as new a field as some would have you believe. Rather than being new, it is a medical discipline that has received a lot of new emphasis in recent years. It goes back quite a number of years, and Ramazzini, who is often called the "Father of occupational medicine," wrote in the 1700's:

> The arts that men practice are various and diverse, and from them may arise various diseases. Accordingly, I have tried to unearth in the shops of craftsmen, for these shops are schools whence one can depart with more precise knowledge, whatever may appeal to the tastes of investigators, and, which is the main thing, to suggest medical precautions for the prevention and treatment of such diseases as usually affect the workers, a doctor should question carefully what occupation does he follow?

That is a three hundred year old capsule statement of the role of occupational medicine, and its charter hasn't changed in those three hundred years. Marked progress has occurred in occupational health during the past three decades and occupational medicine has become a specialty in its own right since 1955, officially occupying a position with aerospace medicine and public health under the American Board of Preventive Medicine.

Occupational medicine is based on preventive medicine. Its broad purpose is the promotion and maintenance of the physical and mental health of persons at work. In 1950, the World Health Organization defined occupational health as follows:

> Occupational health should aim at: the promotion and maintenance of the highest degree of physical, mental and social well being of workers in all occupations, and the prevention among workers of departures from health caused by their working conditions, the protections of workers in their employment from risks resulting from factors adverse to health, the placing and maintenance of the worker in an occupational environment adapted to his physiological and psychological equipment; and, to summarize adaptation of work to man and of each man to his job.

Now, to be a little bit more basic, my first question is, "What is the role of occupational medicine in occupational health programs?" I believe there are several basic functions peculiar to the practice of occupational medicine. Because of this group's diversity, it may be worthwhile to describe the basic responsibilities of an occupational medical physician at the Bremerton Shipyard, at Pearl Harbor, or at any other Naval industrial activity.

One of the most basic responsibilities is the pre-placement evaluation of individual work force members. These medical examinations are important in placing the prospective employee in a job that is both physically and psychologically appropriate.

The second responsibility is the periodic medical evaluation of the worker who is potentially exposed to hazardous work conditions. This exam's purpose is to insure the maintenance of health and the freedom from occupational disease. It is during these periodic medical evaluations that we look for evidence of health effect--not always injury but sometimes just health effect--caused by the work environment. This evaluation amounts to biological monitoring of the work force as opposed to industrial hygiene's role of environmental monitoring of the work place. I believe that the evaluation of the worker must be the controlling force, since the worker's health is our ultimate concern. Nevertheless, the role of the industrial hygienist and that of the occupational physician are very closely tied together.

The third occupational medicine responsibility, a catch-all, includes termination and transfer, fitness for duty, return to work, disability and retirement examinations. These names are fairly descriptive.

The fourth occupational medicine responsibility is the treatment of occupational injury and illness. My personal philosophy is that this is a responsibility that recognizes some of the failures of our occupational safety and health programs. I think that sometimes our line managers may have a misconception of the lesser relative importance of this function in comparison with the prevention functions.

Finally, the occupational medicine physician must keep his line management accurately informed of the health status of the work force. There are many subparts to each of these five areas of responsibility, but those I have listed represent gross responsibilities.

To meet these responsibilities, the occupational medicine physician must be familiar with the work place. This includes familiarity with the working conditions, with regulated requirements, as well as with the standards of good occupational medicine practice.

The second question is, "What is the role of occupational medicine in developing and implementing future occupational health programs, concepts, and methods?" I am sure my bias shows when I try to answer this question, but I think there is a simple answer. If we are to develop and attempt to implement a Navy-wide high quality occupational health program, then occupational medicine must have the lead role. I think that is a single

statement that needs to be supported a little bit, but first I think an informed top line management must decide what level of occupational health program they want and are willing to support with appropriate resources. We then need clear-cut organizational lines with commensurate responsibility and authority. Equally important, occupational medicine, and thus all of occupational health, must have strong and knowledgeable leadership to set the course of occupational health programing and planning for the future. The implementation of occupational health programs for the future must be well enough directed and controlled to lessen the impact of the often times politically motivated crisis medicine we've been expected to respond to at times in the past.•

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INDUSTRIAL HYGIENE

LCDR L. E. Doptis, MSC, USN
Head, Fleet Occupational Health Program
Naval Medical Research and Development Command

Admiral Lukas and other distinguished guests, I am really very happy to be here this morning and to have the opportunity to give you some insight into industrial hygiene. I have been given the same tasks as the previous speakers--to discuss two specific questions with you: first, the role of industrial hygiene in an occupational health program; and then a more difficult matter, the role of industrial hygiene in developing and implementing occupational health programs and concepts. I feel that this second question gives me the opportunity to discuss my own personal opinion(s).

I think my comments will complement those of the previous speakers and may even be somewhat redundant. I hope this repetition will increase the emphasis on such matters, particularly those noted by CDR Nelson, since, as Dr. Bloom suggested, industrial hygiene is very closely linked to occupational medicine.

Industrial hygiene is that science and art devoted to the recognition, evaluation, and control of the environmental factors or stresses, arising in or from the workplace, which may cause sickness, impaired health and well-being, or significant discomfort and inefficiency among workers or among citizens of the community. I believe that industrial hygiene serves as a bridge between the operational and the medical communities because it links the clinician, the occupational medicine physician, and staff personnel of the line command in a manner which can result in sound industrial hygiene practices for various work operations.

Let me briefly summarize the basic elements of what industrial hygienists do. They examine the work environment and its environs. They study the work operations, the materials and associated equipment used, the products and by-products of an operation, the number and sex of employees working at various processes and, of course, the hours of work.

Additionally, the industrial hygienist takes appropriate measurements to determine the magnitude of exposures incurred by employees. This is not a simple task; it involves a sequence of actions, starting with the identification and evaluation of various materials and work situations in the work place and the collection of any health related information that might have relevance to worker health status. This operation is followed by the proper selection of sampling and analytical methods and the conduct of field surveys in places where the work is actually performed. Also, in conjunction with the medical or occupational health clinic, industrial hygienists are often involved in the analysis of biological specimens that might aid in the assessment of degree or extent of exposure(s).

Of course, there is also the interpretation of environmental findings. This is by far the most significant function of the industrial hygienist since it is integral to decisions about the proper controls to be applied within the workplace, the formulation of rules, regulations and standards for the conduct of work, and the preparation of recommendations for labeling materials that might come in contact with employees. Many of these functions are accomplished in conjunction with parallel efforts by others and, I believe, reflect this "bridging" between the medical and other line and staff operational and supporting communities.

Of course, industrial hygienists are also involved in the delivery of education programs and, hopefully, are furthering scientific knowledge about the relationship between health and occupation. This latter endeavor is often accomplished through the identification of areas that require further exploration by researchers of other professions, development of analytical procedures for application to certain environments, or the actual conduct of epidemiological studies that relate health status to characterized environment(s) and work practices.

In summary, I think it is important to point out that most industrial hygienists strive to provide the commands they serve with the necessary information for ensuring compliance with laws and regulations, as well as for protecting and safeguarding the health of personnel working at those activities. I think it is also fair to say that most industrial hygienists feel that they provide functional support to commanders; they are not inspectors or enforcers.

Now, what would be the role of industrial hygiene in developing and implementing future programs or concepts in this area? At present I think it's fair to say that most people in the field are dealing with brush fires. There has not been much opportunity to develop a strategy for attacking problems related to occupational health. This has to be done, so I will address the matter after spelling out a few assumptions: first, a baseline must be identified. I think we've got one to start with right now. We have fairly well defined baseline requirements in current regulations. These regulations, along with past programs in industrial hygiene, establish a baseline for minimum support and protection of the worker. We have what I feel is a credible history of industrial hygiene support within the Navy. We have had our problems, but we do have credible professionals.

The next assumption is that a well-managed, controlled and supported program of industrial hygiene exists, that current issues of professional control and communication are resolved.

If these assumptions are accepted, I think industrial hygienists would be in a real position to direct their efforts toward the design of improved program documentation, record keeping and information retrieval systems necessary to alert management as to where the problems are, to provide the employee with information necessary to satisfy his right to know, to allow us to comply with many of our statutory requirements, and, at the same time, to further scientific knowledge related to occupation and health. Another valuable role of industrial hygiene in future programs would be the identification of recurring or ongoing problem areas

that require continuing command attention and an active role in the establishment of engineering controls when feasible. Yet another role would be the timely identification of regulatory and scientific trends so that command organizations can anticipate additional resource requirements in phased planning, programming, and budgeting actions and can thus preclude unscheduled impacts on other programs.

Another interesting role would be the development of strategies to offset the impact of continuing regulatory actions and, at the same time, to improve cost effectiveness. As an example you may know that the OSHA standards for airborne contaminants were derived from the 1968 Threshold Limit Values for Chemical Substances and Physical Agents in the Workroom Environment, published annually by the American Conference of Government Industrial Hygienists, Inc. In certain cases we really don't have sufficient criteria to back up all of these limits, as is evident in the contested actions of the Occupational Safety and Health Administration related to asbestos and noise. In the American Conference of Governmental and Industrial Hygienist's threshold limit values (TLV's), there are approximately 800 TLV's for chemical agents in the workplace environment. But of these TLV's, approximately 65 are presently associated with National Institute of Occupational Safety and Health (NIOSH) criteria documents and 50 or so have been evaluated by the National Cancer Institute's Carcinogenesis Bioassay program. This means that not all of the facts or limits pertinent to these chemicals may be known and that considerable judgment must be exercised in the application of these particular TLV's. Professional evaluation of limits and criteria germane to Navy workplaces would allow identification of those limits or standards without sufficient criteria, unregulated materials or chemicals, chemical carcinogens, and chemicals for which existing regulations may be inappropriate to naval applications. For each category a prospective stragety of industrial hygiene evaluation, control, surveillance, research, education and training, or substitution may be employed singly or in combination to offset the effects of other agencies' regulatory initiatives related to health and environment.

Each of these approaches or strategies should be focused into thrusts for improved management. One such thrust is dealing with operational activities--such as shipyards--where work materials, conditions and practices are known, and the principal concern is to ensure surveillance and prevention of unfound or unexpected health hazards. Another thrust would be education and training, where the training has to get down to the people in the trenches who actually perform the work. It is imperative that additional training be given in the technical schools so that lower level workers are taught how work should be done properly and safely in a healthful environment. Industrial hygiene should also have in-depth participation in the development of future facilities and platforms. Real cost effectiveness and prevention can be achieved by integration of industrial hygiene controls into modernization programs at the various facilities, not to mention the development of new systems. And, of course, a major thrust must be undertaken in the area of research and development in order to reduce uncertainties in decision making that may affect operational practices or conditions.

And lastly, one of the most important thrust areas, and one that requires much more time than we are able to provide at the present, is that of communication and coordination--not only within the Navy but with other federal and private sectors as well. This is extremely important, because if the Navy is to have a credible program in this area, extramural communication and interaction must be a cornerstone of the program. Such communication would facilitate technology transfer in two directions--benefiting the Navy from technology received, and hopefully, resulting in more reasonable approaches to regulation and control of environmental parameters by transfer out. Current executive orders related to occupational and environmental health suggest that the federal government should be a leader and a national example in these areas. One of the best ways to do this is to work, hand-in-glove, with our sister federal agencies.

I have spoken about industrial hygiene and various approaches and thrusts that might be employed in future occupational health programs. I would like to conclude by pointing out certain issues that must be considered and resolved prior to achieving such a "future program." Very careful consideration must be given to line/staff responsibilities. Each has had traditional roles within the Navy, the line possessing the role of responsible individual and the staff possessing the role of technical advisor. But it must be recognized that the technical advisor role includes areas of functional responsibility and authority that have to be considered. The level of responsibility and authority provided industrial hygienists can be a key determinant of the success in "bridging" the line and medical communities. I think the issue is particularly focused in industrial hygiene or environmental monitoring within the workplace. Lack of industrial hygiene access and control hampers the formulation of decisions necessary for the operation of an effective occupational health program and stifles professional careers. Similarly, access to facility, material, acquisition, health and personnel records is also necessary.

Another issue of note is centered within the Medical Department. It is simply one of curative versus preventive medicine. One of the real problem areas here is to preserve a priority for preventive activities as opposed to those of acute illness.

The last issue I have identified is related to program management. As I look at the industrial hygiene "program" in the Navy, I see the elements of a program but no coordinated, cohesive, or integrated program. In mentioning program thrusts (operational activities, education and training, future facilities and platforms, research and development, communication and coordination), I outlined a systems approach initiated through program elements or budgetary appropriations. These thrusts should be properly woven together in a programmatic manner, moving toward a common goal. Some progress has been made in this area over the past several years, but considerable room remains for improvement and coordination of elements germane to industrial hygiene.

EPIDEMIOLOGY/ENVIRONMENTAL HEALTH

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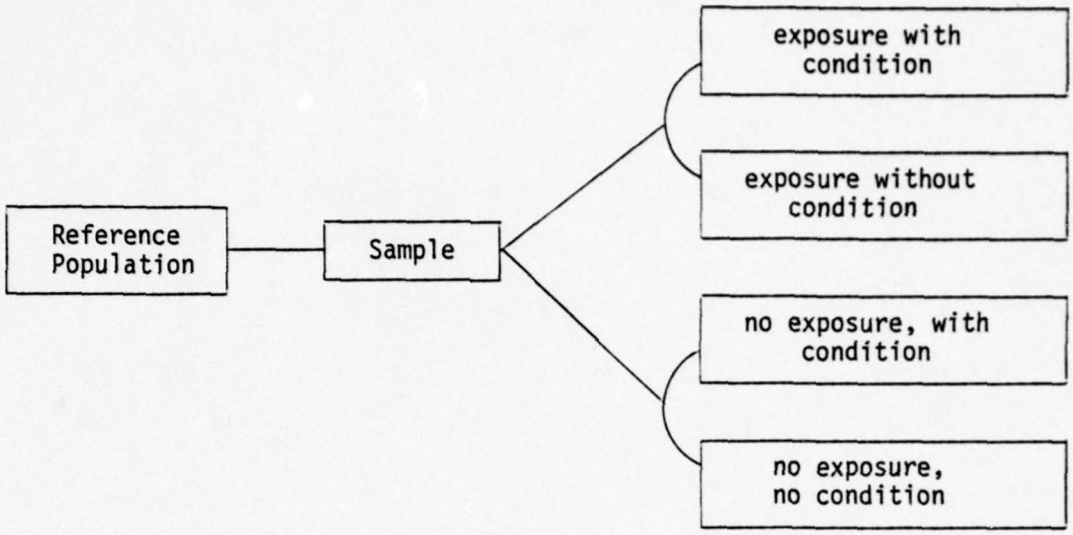
As has been discussed by other speakers in this conference today, occupational health is a concept which considers all aspects of the health and safety of employed persons. This includes the evaluation and control of hazards in the working environment that may affect health, comfort and efficiency. One of the most important concepts in the design of an occupational health and safety program concerns the development of a systematic procedure for collecting and recording occupational environmental exposure data and for systematically linking this information to individual employee health records. The underlying objective of such activity is the development of a data base that can be used to conduct both retrospective and prospective studies of the health experience of all employees in relationship to their exposure on the job. Studies of this nature are referred to as epidemiologic studies, because they investigate the occurrence of disease, death or accidents in groups of persons exposed to specific occupational hazards. Epidemiologic studies do not merely represent an adjunct use of occupational health data, but, in fact, are an absolutely essential element of an effective occupational health and safety program. This is because it is only through epidemiologic analysis of occupational health and medical surveillance data that one can reliably link specific health effects with particular job-related activities, and thus provide the information prerequisite to job safety evaluation and occupational hazard control. Perhaps of even greater importance is the fact that epidemiologic studies provide the only means of assessing the risk of future adverse health effects resulting from present exposure to job-related activities. This aspect of epidemiologic studies is of particular importance now, because of the recognition of the large number of substances or conditions encountered in the work environment that may cause long term debilitating effects in workers often many years after participation in those activities has stopped. As I will discuss shortly, one of the principal examples of this reality is the asbestos situation, where occupational exposure 30 years ago is now manifested in increased risks of various types of respiratory cancers.

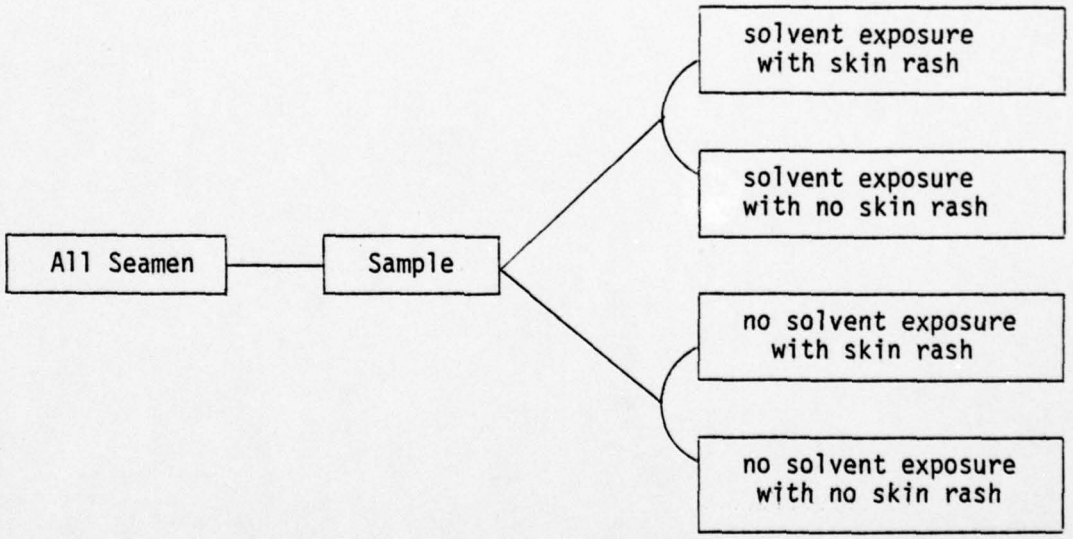
Several types of epidemiologic studies can be employed in both the implementation as well as in the systematic revision and modification of occupational health and safety programs.

One such type of study is the cross-sectional or prevalence study, which is used to examine the existing relationship of accidents or illness conditions to job hazard exposure at any particular point in time. (Figure 1) In these studies the prevalence of a condition is determined in a sample of a population that is exposed to some hazardous job condition, and then compared with that in another population that is not exposed to that hazard. Thus, for example, cross-sectional studies could be performed

FIGURE 1

Cross-Sectional Study





among Navy personnel of a particular rate to evaluate to what extent burn injury or other conditions common to high heat occupations were more prevalent among engineers (BTs or MMs) than occurs among other jobs that do not involve high heat exposure. As another example, cross-sectional studies could be performed to determine whether the prevalence of eye or skin irritation among seamen who are directly exposed to solvents and solvent fumes exceeded that observed among seamen of other ratings or among higher ranking deck personnel who do not experience as much direct exposure to solvent vapors.

These types of studies really amount to surveys of existing conditions and can be performed on a relatively inexpensive and short term basis within essentially any sized organizational unit ranging from an individual ship or port to an entire fleet or service. The principal contribution of cross-sectional studies to occupational health and safety programs is that they can define and characterize working populations at increased risk, and thus focus attention on immediate occupational health problem areas which need to be followed up by more detailed types of analyses and corrective procedures.

Once specific occupational hazards or high risk populations have been identified by cross-sectional studies, other types of epidemiologic techniques can be used to ascertain the nature and magnitude of the risk associated with exposure to particular occupational situations. One of the most well known epidemiologic procedures used currently to study the incidence of diseases or adverse health conditions that occur following exposure to specific occupationally encountered health hazards is the retrospective or case history study. (Figure 2)

This type of investigation begins with people who already have a particular disease or condition, as identified by medical or occupational health surveillance records, and then investigates them retrospectively to see whether or not they have experienced some common occupational exposure which might be the cause of that condition. As in all epidemiologic studies, a control group of noncases is always used for comparison. This type of study, for example, has been used to describe the association between the incidence of mesothelioma and broncogenic carcinoma (both lung cancers) in persons who had been occupationally exposed to asbestos some time during their working lives. Case-history studies have also been used to analyze the association between occupational exposure to sulfur oxides and the increased incidence of acute and chronic respiratory diseases seen in persons whose work involved exposure to smoke gases containing those substances. The relationship between smoking and lung cancer was also demonstrated with case-history studies. As with surveys (or cross-sectional studies), case-history studies can be short term and are relatively inexpensive. Their value to an occupational health and safety program is that they can be used to demonstrate a positive association between exposure and disease, and can even show a dose-response relationship with respect to disease incidence and duration, or amount, of exposure to some occupational health hazard.

A third type of epidemiologic study procedure which is important in assessing occupational health problems (in addition to surveys and case-history studies) is the follow-up or cohort study. (Figure 3)

FIGURE 2

Case History or Retrospective Study

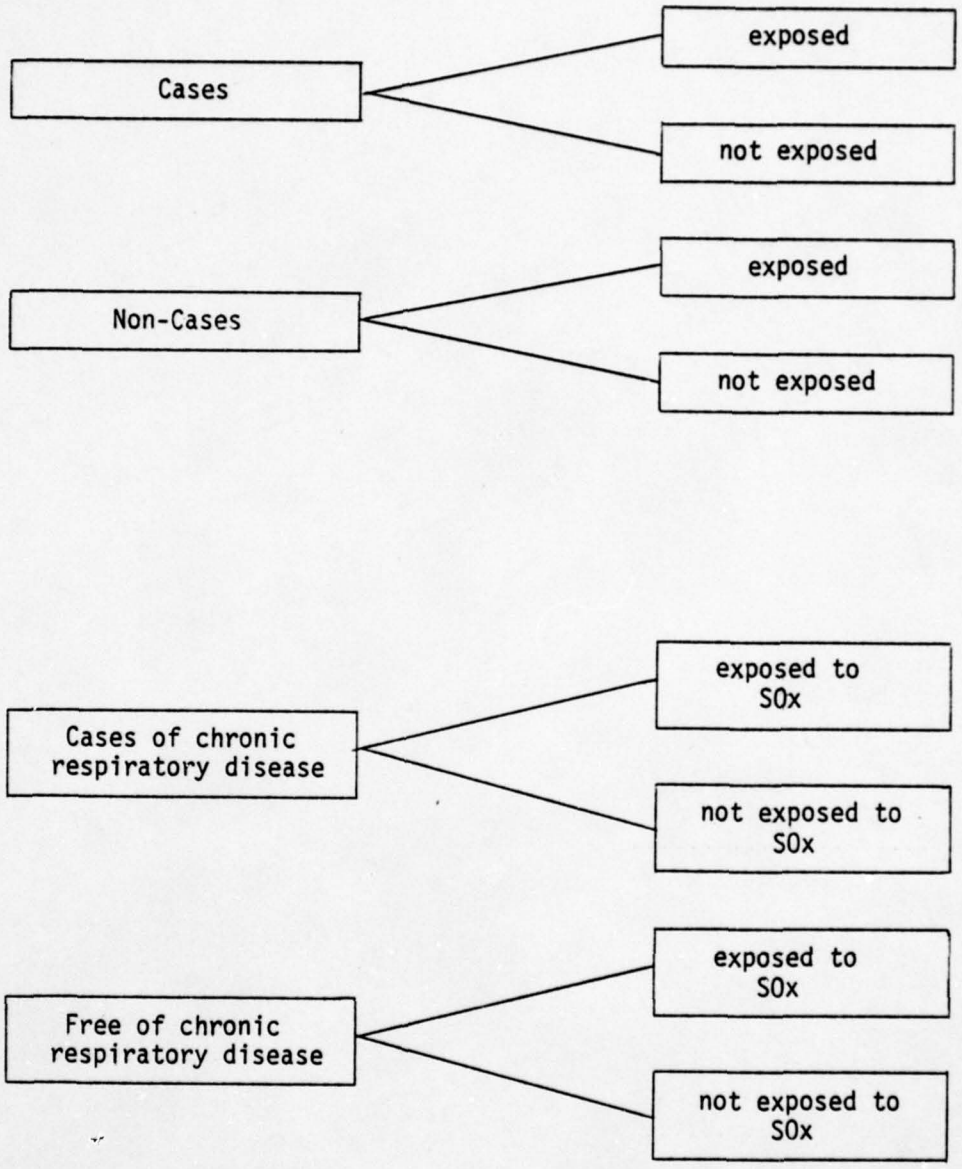
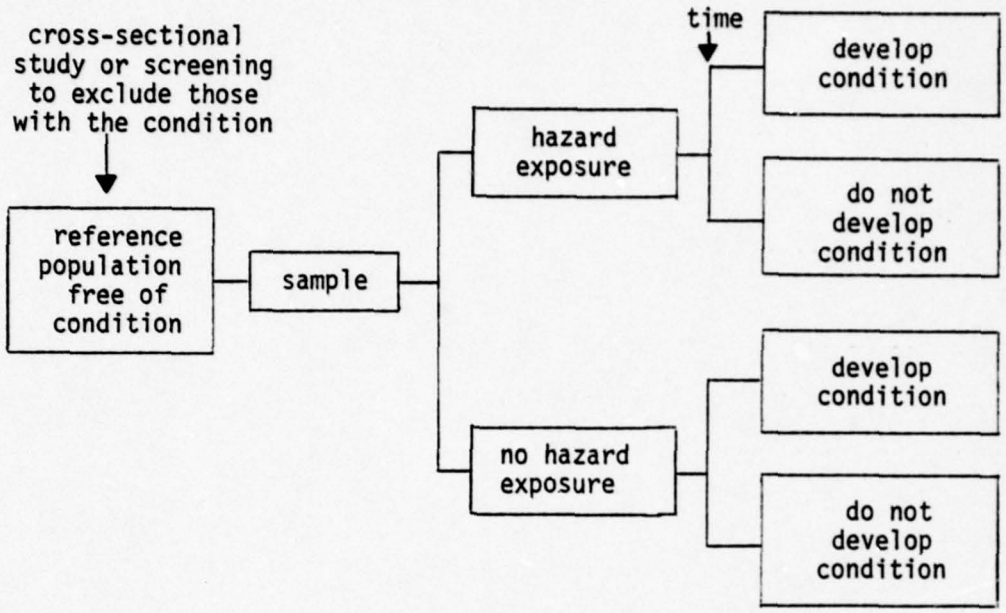
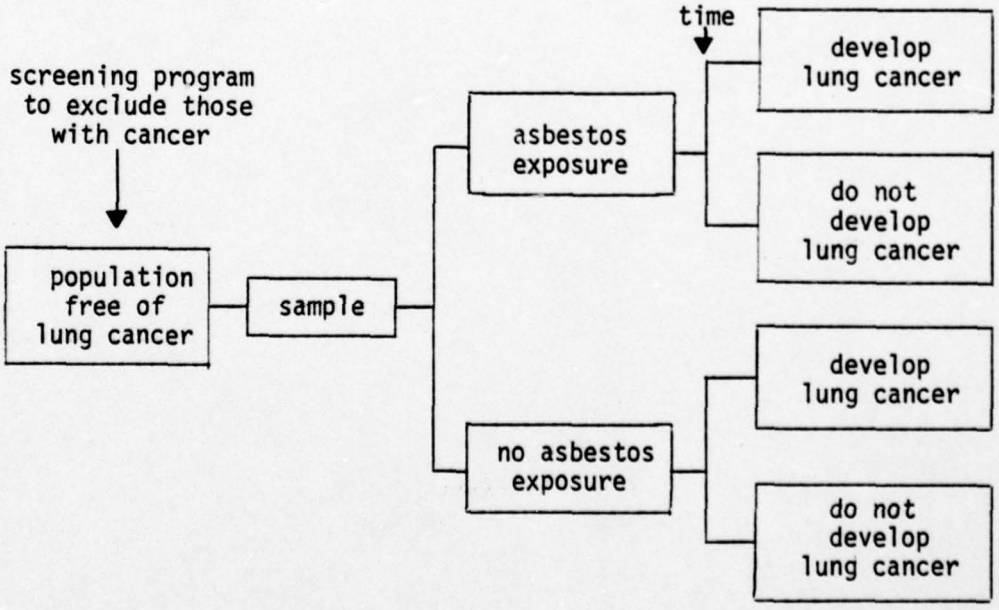


FIGURE 3

Cohort or Prospective Study



EXAMPLE



This type of study provides the most definitive information about the causes of occupationally-related health problems, and gives the most direct measurement of the risk of developing a disease some time in the future. Cohort studies are prospective in nature and begin with a population of persons who are initially free of any kind of adverse health condition. For example, this might be a group of new enlistees who are just beginning a tour of Navy service. The group is divided between different job classifications, one of which involves exposure to a specific occupational hazard. Both exposed and unexposed groups are then followed for a specific period of time in order to determine if, and at what rate, some specific adverse health effect appears in the exposed group, as compared with new enlistees in other job classifications who are not exposed. Often, in this case, a screening or cross-sectional study is conducted first to make sure the starting population was, in fact, free of any adverse health conditions.

One of the major advantages of this type of study is that the investigator can determine cause and effect relationships between exposure and disease, since everyone is free of disease when the study begins. Cohort studies also allow you to quantify the risk of developing a particular health condition at some time in the future for everybody in a particular job classification (even if they are not part of the original study) and to determine how long it might take for a particular adverse health effect to develop. Being able to make this kind of a risk estimate is particularly important today, since, as I mentioned before, it may take many, many years after occupational exposure has occurred for cancer or some other type of chronic illness to become apparent.

One of the most well known examples of how a prospective epidemiologic study can be used to establish the risk of an occupationally related disease is the study by Selikoff (1968) and his colleagues on asbestos exposure, smoking and lung cancer.

In that study a group of white male asbestos insulation workers with no evidence of lung cancer at the start of the study were observed for a period of 4-1/2 years to determine if people who are exposed to asbestos on the job have a higher risk of dying of lung cancer as compared with the general white male population of the country during that same time period. In addition, it was also discovered that asbestos workers who smoked cigarettes had over 90 times the risk of dying from lung cancer as did men who neither smoked nor worked with asbestos.

Results such as these can be directly translated into recommendations and decisions for establishing and modifying occupational health and safety policy oriented toward better protection of employees from health risks directly associated with specific job hazards. They can also be utilized to encourage preventive health behavior, such as reduction in smoking or wearing protective clothing, through the implementation of informational and educational programs directed at high risk occupational groups. These, then, are some of the highlights as to the role of epidemiology in the implementation of occupational health and safety programs. To summarize this role:

1. Epidemiologic studies of occupational environmental health data comprise a basic and essential component of effective occupational health and safety programs, in that they provide the only means for reliably linking specific health effects with particular job-related activities.

2. Two types of epidemiologic studies can be conducted: cross-sectional and case-history studies can be performed on a relatively short term and inexpensive basis, and are useful for quickly identifying high risk occupational groups, and for demonstrating a positive relationship between a particular health condition and a specific job-related activity.

3. Cohort or prospective studies are useful for following up suspected health effects on a long term basis and, when complete, allow the investigator to make precise risk estimates about what future health effects a particular job condition will have on persons who are currently employed in that occupation if those conditions are not changed.

From this point of view, epidemiologic analysis of occupational health data is essential to the systematic identification and control of job-related health hazards, providing information required to meet changing organizational needs and objectives in the area of occupational health and safety.

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ECONOMICS AND DECISION ANALYSIS

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My intention this morning is to tell you a little about what is being done these days in the fields of decision analysis and economics, what kind of research is underway, and what significance the techniques in those fields may have for the occupational safety and health issues addressed in this conference. What I have to tell you may sound like the opposite of some of the positive comments already made, because I find many problems and proposals raising questions that are quite difficult. They have substantial implications for future Navy performance that are not simple to predict, measure, or even describe. There are some deep and subtle issues, of more than a technical, medical, or statistical nature, involved in planning an occupational safety and health program. I hope our research will help us find better ways to recognize, face, and resolve these issues.

Let me begin by exploring the term you have heard already: cost effectiveness. It's a term often attached to the particular professional fields of economics and operations research and is a way of going about making decisions. In a sense, any process used to make decisions can be characterized as a cost effectiveness thought process or analysis. We use investment analyses. These terms all refer to quite a wide variety of ways of making decisions--a variety that includes in some cases considerable detail and the use of computers and mathematical models, and in other cases does not. That distinction is important because I think in many cases we hear criticisms that denigrate cost effectiveness or cost benefit as though it were something narrow and necessarily selfish. Sheldon Samuels of the AFL-CIO has said cost benefit analysis is an insult to the country's workers. But he acknowledges that's true only if it's interpreted narrowly. "Cost benefit analysis really isn't that bad," he said. "It's just the way some people use it." So I ask you to consider a broader view before casting out cost-effectiveness. I do prefer the obviously broader term: decision analysis.

What is the Office of Naval Research doing in this business? Commander Ron James and I began a program in occupational safety and health methods and cost analyses about a year and a half ago. Our principal objective is to investigate prospects for application of research results to improve the Navy's safety and occupational health program. The primary emphasis is on the quality of the economic and decision analyses that are made, and we think that some significant improvements might be achieved by using methods emerging from basic research. We think that some techniques are available for more careful scientific analysis of all the short run and the long run costs and benefits and the probable effect on the Navy's capability to perform its missions.

If the Navy develops a consistent and documented response to the national policy objectives, we will be able both to do a better job and to show that we are doing a better job. Captain Bloom commented that the Navy is doing a pretty good job on asbestos safety. How is it that the rest of the nation perceives us as having done such a poor job? Is it that we were aware and negligent; or that we were slow to get started but are now belatedly taking adequate steps? It is here that research can assist in identifying the factors, the procedures, and the data needed to measure our performance and give specific meaning to "slow" and "adequate" response.

One distinction I do want to make quite clear, though. What we have been thinking about primarily is the use of decision analysis for specific decisions on occupational safety policies and actions. It is another matter to consider the use of decision analysis for the organizational issues, the organization design, the structure of management, the structure of monitoring, and the power and authority for resource allocation decisions. That's very different from a specific analysis of what actions we ought to take to identify dangerous asbestos in buildings. I want to comment about the usefulness of decision analysis in those two areas, and to put it quite frankly.

In specific decisions on occupational health and safety actions we may take, I think decision analysis is useful. It can help develop explicit quantitative probability measures and utility preference judgments. It can help avoid bias and testing for consistency of judgments. But when it comes to the focus of this conference, i.e., planning of programs, management, centralization versus decentralization, local autonomy versus control from above, the state of the art is that we don't have reliable techniques. I have checked with ONR psychology division. They say we don't really have much in the way of understanding and predicting organizational performance. We don't know why one organization structure seems to perform better than another. As a matter of fact, in many cases we find that there isn't even very much agreement on what the performance was in the past.

Look at the Navy's past decisions on the handling of asbestos. They were not very good, according to Dr. Irving Selikoff of the Mt. Sinai Hospital in New York. On the other hand, were our decisions much different from the rest of our society? In June, at the New York Academy of Sciences meeting on asbestos hazards, the statistical presentations raised many questions. Whether some other Navy command organization could have been more effective is not yet something our predictive or historical analyses can determine, beyond obvious statements that greater concern for hazards will lead generally to better programs.

What is decision analysis? I think of it in the sense that Professor Ron Howard at Stanford University, Ward Edwards at the University of Southern California, and Howard Raiffa of Harvard use statistical decision theory. That means a kind of decision analysis that specifically attempts to separate out four steps in the process of thinking about decisions. The first we call structuring; the second is estimation of probable outcomes; the third is elicitation of a utility or preference function; and the fourth is mathematical solution. Under each of

these general headings we have some particular terms and techniques. I'm not saying this four-step process is the way I think about every problem or that I do so in that order. But for the purposes of discussing a decision problem with somebody else, I can always do better if I try to make that separation. In fact, to save time, I usually perform what we call a reductionism over these four steps. And we all do these reductionisms, and they're the most efficient way we have to make decisions. But for purposes of analysis, for purposes of communicating between each other, I think I'm consistent with the authorities in the field of recommending those explicit four steps.

In the area of structuring the common term is decision trees. One figures things out in terms of a decision tree. Another term, which deals with the hardest problem in structuring, is option generation. This means ways by which we can stimulate the creation of options that we didn't even think of before. This is important in the asbestos hazard analysis. If we're going to go out and do an inventory of all the asbestos in all the buildings, we should think ahead about what kind of repair we might be doing. We might miss something that may be perfectly obvious. A little piece of materials research or research on some special kind of sealant might discover a way to provide cheap protection over some years. We want to understand such option generation. Now on the other side of structuring is what (in the trade) is called pruning. One has to prune the decision tree because they can become tangled jungles. You've probably seen some. Two choices here and six choices under those, and each of those six produces eight more and each of those eight produces some more. So we need to be aware of available techniques in pruning.

The second step is the estimation of probable outcomes. Here, current research is on the ways in which we update probabilities. Bayesian techniques are not adequate. We're trying belief functions, a wider concept, and heuristics, which are related to the way we prune the tree or organize it. And we are also trying to find out whether we can calibrate the way people make probability judgments, in order to identify and avoid asymmetries which are biases. I don't want to sound too technical on this because all of this is not really so esoteric. Techniques of probability estimation are being developed and improved.

The third step is utility functions, or multiple criteria decision making. It concerns the mixture of goals, the mission objectives we have in mind. We try to find ways of eliciting goals and in particular of identifying dependencies among goals. Contained in the utility function is also the handling of risk preference. We call it risk aversion or willingness to take risks or action to avoid risks. It is a big research area; we think we have some techniques that can be used for specific questions about actions. We're not yet ready to handle much in the way of organizational and group methods for discussing risk and arriving at choices, although social welfare theorists have made some progress recently.

The fourth step is optimization, a mathematical solution to find the decision that will maximize expected utility. If we have built a big decision tree with a lot of possibilities and the utility function is at

all complicated, we may need a very sophisticated method of solution. Often we substitute some kind of approximation to avoid the mathematical programming difficulties of finding an exact optimum.

Finally, in economics research, theorists are spending a great deal of time looking at the value of information. We are trying to find optimal behavior when information itself is quite incomplete and very costly. Classical economic theory solves everything under the assumption of perfect information. Under that assumption, the general principle of equalizing everything at the margin works out very nicely. In the classical theory of economics, the so-called "hidden hand" causes every one of us to behave in the way which is in fact good for all of us. But when the assumption of complete and perfect information is replaced with uncertainties and probable asymmetries, as in occupational hazard analysis, a new definition of optimal decision making is needed. We do not have much more than simple tradeoff models at this time, comparing the cost with a crude estimated value of data.

I have described some elements of the techniques of decision analysis, and tried to indicate that these techniques are useful today only under certain conditions. These are that all the four steps be performed, and that the decision maker or group take the time and care needed to specify their goals and their probability judgments explicitly. Then and only then can cost-benefit or cost-effectiveness analyses be trusted as scientific tools for human and social decisions. Finally, we have had success with individual action decisions, but do not know how to design organizations with those tools at this time.

ORGANIZATIONAL BEHAVIOR

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Of the disciplines that have been presented so far, the discipline of organizational behavior is probably the least recognized and understood by most people. I'd like to create an image of what organizational behavior is by asking and answering nine key questions.

First of all, is organizational behavior a discipline? A lot of people argue that it is not, I feel that it is. It is immature. It is emerging. It's very self-conscious, and most of the people in it are still trying to define what it is, what its subjects are and indeed trying to find an academic home for themselves. Some of them are found in business schools. Some of them are found in psychology or sociology departments. Others are found in schools of education and still others in research organizations.

What is organizational behavior's heritage? At best it's a mixed heritage--mixed in terms of the kind of disciplines that have gone together to make it up. Some people who are in the discipline are from psychology backgrounds, others from sociology, others from anthropology, while still others have business school educations and say that they were "trained" in organizational behavior.

It is perhaps easier to answer my third question, "What is organizational behavior concerned with?" At this point in its history it is concerned with almost everything having to do with the design, behavior, and effectiveness of organizations. Almost no topic that has to do with organizations and the behavioral phenomena that occur within them, between them, and in the interaction between them and the larger societal environment seems to fall outside the purview of organizational behavior.

That leads to the fourth question. What kind of topics have been covered? A wide range--control systems, information systems, stress, roles, health, motivation, organization design, individual satisfaction, to mention some key ones.

Another way of looking at organizational behavior is to ask the question, "What does it try to predict?" In other words, when we look at organizational behavior as a field, what are the dependent or outcome variables in most of the research? Common to most research are issues of productivity or effectiveness, satisfaction, occasionally health, and sometimes motivation. Both individual level outcomes and organization level outcomes have been focused upon.

What variables does organizational behavior use to predict these outcome variables? Again, a wide range, depending upon the particular background

of the individual investigator. Organizational behavior research has focused on organizational structure, technology, policy, personnel practices, the design of jobs, reward systems, the leadership style of managers, the kind of environment that the organization operates in. All of these have been predictor variables in studies of organizational behavior and indeed, some of them also have been dependent variables in studies.

Our discussion of variables raises the question of what kind of measures and what kind of methodology does organizational behavior use. It uses a fairly wide range of measures, although I suspect that the predominant one has been surveys. People in organizational behavior long ago discovered, and perhaps overutilized, surveys as a quick and easy method to gather data about the characteristics of organizations and the people in them. Interviews, because of their greater cost, are probably in second place. More recently there's been a trend toward looking at records and also doing actual observations of behavior such that we now find organizational behavior researchers watching people behave, recording what's going on, and working with health care records, productivity records, financial records, in short the full array of archival data that's available in most organizations.

What research designs are used? Probably the same designs that are used in most disciplines: correlational and experimental designs. Of these two, correlational studies are the most common. Recently, evaluation research seems to have become more popular. In evaluation studies, researchers in organizational behavior are going in and looking at the impact of a new control system, a new job design, a new reward system or a new policy.

That brings us to my ninth, and perhaps most crucial question: "What does organizational behavior have to offer in the area of occupational health and safety?" I think it has a considerable amount to offer although at the present time it's relatively underutilized. Let me first mention the areas where I think it has the most to offer. One topic that has dominated much of the research in organizational behavior is that of organizational change. Issues include resistance to change, implementation of change, and developing support for change. These are just the issues that must be addressed if occupational health and safety practices in organizations are going to change and are going to be implemented with a minimum of dysfunctional consequences.

Very much related to the issue of organizational change is that of employee involvement and motivation. Much of the research in organizational behavior has been concerned with how you involve people in decisions and the impact of that on their willingness to implement a decision that has been made. This seems to me to be particularly pertinent to the issue of health and safety. We've known for a long time that employees do not practice the kind of behavior that they know will maintain them in a safe situation. We also know that motivation at the management level is crucial in health and safety programs. Health and safety is just one pressure on management, always competing

for time, resources, and energy; and thus, the issue of how you motivate somebody is a critical one in getting implementation of the policies, practices, and physical changes that are needed in the workplace.

Another area that seems to be quite relevant and where there is considerable behavioral research concerns information, control and audit systems. How people react to them and the reasons that they often produce counterproductive behavior are fairly well known at this point and can be a useful input into decision making about how they should be structured and how they should be implemented.

The ability of organizational behavior researchers to do surveys and to gather employee opinions is another very relevant skill. Employees often have a tremendous amount of information about what is safe, what is not, what is healthy, what is not, and what is wrong with health and safety programs. Surveys are a good tool for gathering these data. In addition, surveys can open up the area of stress and the impact of job-related stress, role definition, role ambiguity, and role overload on health care issues.

The recent work in organizational behavior on evaluation research and particularly the evaluation of organizational change, seems to have a natural application to the area of health and safety. If, indeed, experimental programs are going to be tried, it is crucial that they be evaluated. This is an area where organizational behavior researchers have considerable relevant knowledge and experience and are able to identify the rather broad range of issues that need to be looked at. When a significant change is made in a control system, a part of the organization's structure or a part of the physical environment, it is very dangerous to look narrowly and myopically at a single outcome variable or even several outcome variables in assessing and evaluating the impact of that change. Most changes in organizations, because of the systemic character of organizations, produce multiple changes. The message is clear: if you're going to do a reasonable cost benefit analysis or cost effectiveness analysis on any change, you need to look at that wide range of variables, and not simply limit yourself to one set of outcome variables.

Organization structure seems to be another area where organizational behavior has some knowledge that is crucial to the delivery of health care. I agree with the people at ONR that we don't know a lot about the impacts of different kinds of structures. But I think we do know some things. Indeed, by studying the impact of different organizational structures on the delivery of health care, we could make an important contribution to our understanding of structure as well as to how we can best deliver health care.

Another topic that has been mentioned strikes me as very much within the purview of organizational behavior. It has to do with careers and staffing. Two aspects of careers and staffing are relevant. One, career and staffing issues involve the professionals who deliver health care and who maintain safe environments. Two, psychologists have had a long concern with placement and selection decisions. They have pointed out

that a good fit between employee and job characteristics is a necessary condition for occupational safety and health. Fit has been shown to relate very much to the kinds of health effects that I haven't heard talked about too much here, but which are probably the major ones that have been studied by organizational behavior: stress, role overload, and the kinds of health problems they produce.

Let me now switch from talking about the areas where I think organizational behavior has something to say to what it presently is doing and saying in the area of occupational health and safety. Unfortunately, I have to say that those people who come from an organizational behavior background at the present time seem to be doing very little. There was an early spate of research on accidents (why they come about, whether certain people are accident prone, using critical incident approaches to accidents) that has pretty much died out. At the present time I don't see much active research in this area by organizational behavior types. Considerable research on selection is still being done. There is increasing research on stress and its causes and consequences. Occasionally, health and safety is used as a dependent variable in some broad studies. Research, for example, on the quality of work life often includes occupational health and safety as a dependent variable. It looks to see if things like joint union management committees, new approaches to job design, decentralization, etc., can have a positive impact on occupational safety and health.

In general, however, I would have to say that organizational behavior people are not heavily involved in the whole issue of occupational health and safety. I hope that as a result of this conference and others, this will change. I think we have a considerable amount to learn from the field and indeed, I think we have something to offer.

TOPICAL DISCUSSION GROUP SUMMARIES

During the first afternoon of the conference, participants were gathered into groups mixed by discipline and profession. The purpose of this session was to have the individuals pool their diverse resources to address specific topics important to the Navy's occupational health and safety programs. Facilitators were assigned to the groups to keep them goal oriented and to provide a summary of the session. On the following pages, each topic is identified, described, and is followed by an edited version of its respective summary.

COMMUNICATION, EDUCATION AND TRAINING

Consider the effectiveness of alternative mechanisms for communicating to military and civilian personnel the importance of occupational health and safety. Consider whether educational and training programs are suitably designed to achieve compliance with occupational health and safety regulations and standards at the individual level.

The communication, education and training group noted that, at present, there are few widespread or systematic programs to meet the Navy's needs for education and training in occupational health and safety. While basic information exists in a variety of specific training manuals, published regulations, televised presentations, films, and other media packages, the mechanisms for communicating this information to the lower level sailor or shipyard worker are either inadequate or nonexistant. Regulations and instruction manuals are often couched in terms that are not understandable by this audience or are not easily translated into day-to-day behaviors. Training programs are frequently sporadic or out of phase with current operations. Finally, both shipyard commanders and occupational health professionals face difficulties in securing adequate funds for occupational health training programs. Even when the problems are acute, the funding cycle is lengthy.

Problems also exist with the upward flow of information. Too often, top level officers or managers are not given sufficient information about occupational health needs or working conditions. When solutions to health-related problems are suggested, they often consist of few alternative courses of action or appear inconsistent with other programs and operational needs. Because of these influences, existing mechanisms for informing lower level personnel about occupational health and safety are seen as poorly orchestrated and ineffective.

Several recommendations were made to overcome these problems. In regard to education and training, it was suggested that occupational health checklists and standards for personnel certification and qualification are needed. Equipment training and operating manuals should include occupational health and safety checklists along with the checklists for operational procedures. The nuclear Navy's personnel reliability program was suggested as a possible model. Also, when occupational health training programs or manuals are written, the target audience and the ability of the average sailor or shipyard worker to understand the message and to act upon it should be considered.

The group also offered a number of recommendations aimed at improved compliance with regulations and procedures. Individuals responsible for writing regulations should keep in mind the relationships among stated regulations, the persons responsible for implementation, and the motivation of the individual worker to comply. Also, compliance would be

greater if reward and punishment systems were geared toward providing a positive response to occupational health and safety procedures. It was suggested that communication, training, and compliance would be better served if individuals at the working level were involved in writing requirements, checklists, and so forth. These individuals are closer to the real situation and are more aware of what is and is not feasible and of how requirements may best be communicated.

Finally, compliance with training requirements and with occupational health procedures should be used as one criterion for the individual worker's advancement. Also, training records and records of individual compliance with procedures should be retained for use in possible future occupational health claims.

INFORMATION SYSTEMS

Consider the scope, value, and usefulness of existing data systems that are designed to provide managers with information about occupational health and safety conditions and preventive services in the Navy. Consider both the content of the systems as well as the process through which data are collected and used.

The information systems topic group attempted to identify basic problems in existing information systems and concluded that the Navy presently does not have a comprehensive occupational health information system that meets the needs of all users. While there are a number of individual systems, each oriented toward a specific problem or user group, there is little coordination among these systems. Current systems are not generally successful in getting information about occupational health hazards and correct procedures down to the lowest levels. It was felt that the greatest weakness in the current system is in disseminating information in a form that is useful to those workers most likely to experience the hazards.

The discussion of general information systems problems led to the identification of specific areas for attention and development. The primary need is for a readily retrievable information system that contains data about each individual's work history, experience and training, exposure episodes, and relevant medical and health data. To achieve this, several steps were suggested. A first step is to standardize and upgrade the information collected on individuals in the workplace, with special emphasis on documenting (1) the amount and type of exposure to recognized hazards and (2) the number and severity of illness and accident episodes resulting from exposure to workplace hazards. Along these lines, the group also agreed that there is a need to develop clear guidelines for data collection and to state regulations, guidelines and instruction in terms of realistic and obtainable goals. People generally agreed that guidelines and regulations should define exposure levels and should specify how exposure is to be measured and recorded. There is a further need for a clear designation of individuals or groups who are responsible for obtaining and disseminating relevant information. Appropriate lines of communication and responsibility for funding should be clearly stated.

A comprehensive and viable occupational health information system should provide data in a form useful to a wide variety of professionals and should allow individual records to be stored and easily retrieved over extended time periods. Finally, the group identified additional information systems or data bases that would be valuable for general occupational health purposes. These included the development of particular profiles of exposure that are likely to be experienced by different types of jobs, the assessment and documentation of exposures to non-physical hazards such as job-related stresses, and the development of an automated look-up file similar to the Physician's Desk Reference that identifies the hazards involved in using various trade-name products.

COST EFFECTIVENESS

Discuss the feasibility of conducting studies that estimate the costs and benefits of different kinds of preventive and safety programs. Consider the impact of externalities and uncertain information on the process of estimating costs and benefits, and discuss techniques for mitigating these problems.

The group first explored the meaning of "cost effectiveness." The group agreed that cost effectiveness should be thought of as a criterion by which choice among alternative programs is made on the basis of efficiency of resource allocation. Therefore, cost effectiveness analysis was viewed as a means for quantifying a program's impact in terms of dollars. Cost effectiveness was specifically contrasted with a politically-dominated selecting process where some projects receive shares of the research or occupational medicine budget in excess of any reasonable payoff expectation. Concern was expressed that asbestosis and radiation protection, though important problems, do not warrant the overwhelming attention they currently receive.

The group agreed that decisions about occupational health and safety generally should involve four considerations: (1) can the impact of implementing an occupational health and safety program be measured in terms of expended budget dollars and reduced morbidity savings using accepted analytical models and cost-estimation techniques? (2) to what extent will implementation of occupational health and safety policies cause disruptive or wasteful shifts in operational functions; e.g., lengthening shipyard turn-around time with possible effects on fitness ratings? (3) can short-term results including lowered absenteeism, reduced on the job accidents and health problems, and other immediately measurable consequences of specific program efforts be readily demonstrated? and (4) what opportunities exist to identify long-term health costs and benefits as well as underlying physical and behavioral factors so that an overall perspective on program strategies and results can be achieved?

Unfortunately, most operational decision makers are <u>not</u> likely to attend to long-term health and safety considerations because of the small likelihood of visible effects during their term of responsibility. To incorporate long-term perspectives into the decision making process, higher levels of command must accept more responsibility for long range objectives and impose appropriate constraints upon the discretion of lower level commanders in these areas.

To achieve cost effective occupational health care, the risk of adverse consequences must be assessed through an extensive program of individual health monitoring that identifies problems before they reach crisis proportions. Monitoring individual exposures and health consequences will require a coordinated effort to develop a comprehensive data collection and reporting system that serves all important user needs.

Strategies for developing cost effective research programs were also discussed. Major efforts to answer specific, crisis-generated questions probably decrease the overall cost effectiveness of research programs and reduce long-term payoffs. There is an optimum level of effort in any particular research area, and this level should be considered when funding decisions are made. It was suggested that greater cost effectiveness would be achieved if research funding was directed toward the study of basic issues underlying a number of occupational health programs rather than to a succession of disconnected, crisis-oriented problems.

AUDIT, CONTROL, AND COMPLIANCE

Consider the structure of existing mechanisms for insuring a high level of occupational health and safety in the Navy. Deal with the issue of the relative importance given to occupational health and safety in the Navy's reward/sanction system. Consider means to insure that standards, regulations, and inspections can be more fully taken into account in management decision making.

In discussing audit, control, and compliance issues it was pointed out that present standards are enforced in the name of the Inspector General and cover only civilian employees. While the CNO has a potential system to cover all personnel, some question remains about when it will be implemented. At present there is no systematic, organized program with a corresponding review and enforcement system. It is not always clear what is to be done or who is responsible. The current program, brought about by a presidential order to implement OSHA guidelines as a local option and without a designated auditing agency, has led to a series of separate orders for specific hazards. The little auditing that does occur is often carried out independently for each hazard. The problem is further complicated by the fact that occupational health instructions are often issued by BUMED and lack the force and legitimacy they would have if issued by CNO.

These problems were seen more intensely at the local level. There are often conflicting pressures between occupational health programs and the more traditional responsibilities of field commanders. In the shipyard, occupational health is often viewed as much less important than getting the ships out. When conflict does arise, the operational unit commander is free to decide what level of occupational health program implementation and enforcement is practical. Currently, managers in the field are not held accountable for occupational health claims and problems, and claim costs and compensation are charged not against the local budget but are charged to other agencies. The resulting attenuation of financial responsibility and the fact that many hazards have no serious or discernible short-term effects make it extremely difficult to sell preventive programs. As evidence that greater accountability leads to greater effort to achieve prevention, the group mentioned the current safety program. Because accidents influence days lost and indirectly affect production costs, they can hurt a manager's chances for promotion. Thus, most facilities have active, viable safety programs.

Other problems in obtaining compliance were noted. For example, disciplinary action is often effective in enforcing compliance but is rarely taken or is directed only against the individual worker. The occupational health professional's low status is yet another obstacle. Within medicine, the occupational health physician has low status and low priority. The industrial hygienist is viewed similarly. The military hygienist cannot hope for promotion beyond captain, and the Navy currently has only two GS-15 civilian hygienists. Thus, promotion potential is seen as limited and only partially based on merit.

The group offered a number of suggestions to resolve some of these problems and to improve the current occupational health situation. Most important is the need for central leadership that establishes priorities and assigns specific responsibility and accountability. In other words, there should be specific directives that make clear what is to be done and by whom. These directives should specify what resources are needed and how they will be provided. They also should specify minimum levels of compliance and should initiate an audit function, perhaps out of the Inspector General's Office, to ensure such compliance. It was suggested that the audit function be coupled with a more comprehensive management information system that could be used to identify possible compliance problems or other meaningful trends. Managers as well as employees should be evaluated in terms of compliance with safe work procedures, and employees need to be involved in the occupational health care process so that they will be motivated to behave safely. The group cited lower level management, unions, and other employee groups as additional key factors in achieving this involvement and compliance.

Finally, the group offered several suggestions that could be implemented at each facility. First, there should be greater coordination between safety and industrial hygiene functions. Cross-training between the two professions was suggested. Further, the two groups should report to the same superior and should have a direct link to the shipyard commander. Other suggestions were that there be a set of regular inspections by both hygienist and safety personnel. The results of these inspections would be reported directly to the unit commander along with a report of actions taken. Ongoing or recurring problems would be considered as part of the Inspector General's command review.

ORGANIZATIONAL STRUCTURE

Consider whether existing organizational structures and supports for occupational health and safety programs are most appropriate for maximum impact. Consider whether alternative organizational structures, staffing, and program design would be more suitable for effective program implementation.

The group assigned to discuss structure-related issues noted that the Navy faces a broader array of occupational health needs and opportunities than any other organization. With this perspective, the group cited a number of strengths and weaknesses inherent in the current occupational health program. One of the major strengths of the existing program is the variety of highly talented, motivated, and professionally competent individuals. Other strengths are excellent physical facilities and a clearly defined target population.

Unfortunately, the group also identified serious shortcomings in the way that Navy occupational health care is currently organized. They pointed out that there is little integration of occupational health programs into other Navy programs. Also, the Navy lacks clearly stated policy guidelines to determine priorities in goals, resources, or funding when competition or conflict occurs. Currently, there appears to be insufficient specification of authority and inadequate allocation of funds and priorities to consider occupational health as a distinct and viable program in the Navy. Often resources and manpower must be obtained at the expense of clinical medicine or operational command requirements.

Crisis-oriented task forces further drain resources in a variety of specific, uncoordinated programs. Programs in the field appear to reflect the perspectives and energies of the occupational health and operations professionals at each site more than any Navy-wide, programmatic movement toward effective occupational health care. And finally, responsibility for funding a program is often the task of one agency, while responsibility for ensuring compliance is relegated to a second group with a different chain of command, and record-keeping responsibilities are assigned to yet another agency.

Such observations led to several suggested modifications in the existing organizational structure. Many of these modifications focused on coordinating and integrating the activities of different professional groups; several involved corporate level participation. A need was felt for clear policy guidelines promulgated from the top down. These policies should be geared to achieving the goals of the Navy's occupational health program, namely reducing morbidity and mortality, achieving compliance and regulation, and providing professional leadership in the occupational health field. It was further felt that, at the level of the Department of the Navy, there must be a link between occupational health care providers and the rest of the Navy so that there is an effective coupling of resources, people, and needs. One part of this coupling is the development

of a more effective interface between operations, research, education, and training functions within the occupational health care field. In general, there was agreement that occupational health care programs in the field functioned well in dealing with specific issues but needed coordination, guidance and support from the corporate level policies and structure of the Navy.

Among the proposals for restructuring the Navy's occupational health program was the suggestion that occupational health should be separated from its current ties to clinical medicine so that the two areas are not in direct competition for resources or personnel. It was also recommended that occupational health and operational safety professionals should ultimately report to the same person. And finally, the group noted that the current organizational structure should be expanded. This expansion would extend the roles of occupational health professionals into specialties other than industrial hygiene and medicine. Further, the expanded structure would be designed to integrate professional and operational users in the process of defining occupational health needs.

FIELD EXPERIMENTATION

Consider the feasibility of conducting field experiments that would assess the relative effectiveness of some alternative organization changes that may surface in the discussion of other topical areas. Such studies would involve direct alteration of some of the Navy's approach to implementing occupational health and safety programs. Design this in light of research that has been conducted in the fleet and its test applicability for the shore establishment. Consider whether there are problems in implementing programs involving both civilian and military personnel.

The field experiment group emphasized the importance of well-designed studies to assess program needs and to guide program implementation. Field conditions pose special problems for such studies because a random assignment of individuals to situations or treatments is generally not possible. Thus, conclusions are often less precise than those encountered in more classical experimental settings. In spite of such drawbacks, however, field studies and experiments produce valuable information about environmental risks in the workplace and about the factors that influence the effectiveness of prevention and safety programs. With these points in mind, the group identified several areas where field research and experimentation might prove valuable.

It was felt that one of the most immediate needs was the development of comprehensive longitudinal indices of health status. The first task in this area is to develop better medical records and exposure documentation systems that could provide basic health data and that would identify high risk populations or groups. As a bonus, these record systems and their data would also help to document areas with no apparent adverse effects and would thus help counter possible illegitimate occupationally-related disability claims. In building a better occupational health information system, existing record systems and information bases should be reviewed to determine their quality, uniformity, completeness, and retrievability. At a minimum, a new occupational health record system should include information from preplacement physical exams, work history, routine periodic physical exams, toxic exposure episodes and special exams associated with known exposures, and all referrals, diagnoses, treatments and follow up exams for other clinical conditions. Only when the necessary records and health status indices are available will it be possible to evaluate the impact of environmental conditions on worker health or to evaluate the effectiveness of specific preventive or remedial measures.

Another area recommended for field research is how to structure and organize occupational health units for maximum effectiveness, and there were many relevant research questions for this area. For example, what mixes of professional and technical staff are needed for different types of facilities? Who should have responsibility for specific functions such as training, prevention, health care, etc.? How should priorities be determined and resources allocated?

Also recommended for research were questions about how to obtain compliance with occupational health and safety regulations. Are education and training efforts effective? Are strict enforcement procedures and penalties necessary or even desirable? What type of reward or incentive system is effective? Should the worker be taught that he is primarily responsible for his own health and safety? It was also suggested that field experimentation might be a profitable means of comparing various approaches to assuring compliance.

Additional studies suggested as being particularly valuable in Navy shipyards included the investigation of factors that would increase compliance with hearing conservation programs, the identification of critical factors that lead to a high incidence of flash-burns in welding operations, and the exploration of hazards and the suggestion of possible remedies for nitrogen-oxide inhalation/ventilation problems.

Group members pointed out that field studies that are identified by line commands as serving their needs would tend to be short-term. Thus, long-term studies also are needed to evaluate the effects of chronic exposure and to ensure adequate follow-up. Finally, the group noted that many of the occupational health problems faced by the Navy are shared by other federal agencies and by civilian industry. Therefore, it was suggested that there be a thorough review of programs and procedures developed by these groups for possible application in Navy settings.

PROFESSIONAL GROUP PLANS OF ACTION

After a brief general session on the second morning of the conference, persons with similar professional backgrounds met to discuss the issues identified in the summaries of the first day's topical discussion sessions. This second discussion group was designed to focus the expertise of each professional group on the problems that their group could best address and resolve.

After convening in their respective discussion groups, conference participants were asked to review the topical issues. These issues were to be sorted into three categories: issues that are currently outside the scope of their professional group; issues that are within the professional group's scope but which need more information to be adequately addressed, and issues that could be addressed now. Groups were to prioritize and discuss the issues in the last category. Also, the groups were to identify specific needs for new information, develop plans in terms of what the group can do now, and provide a clear summary of researchable issues.

The plans of action resulting from each group are in this section of the proceedings. They were presented in an afternoon general session by the respective group facilitator.

OPERATIONS

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I haven't had a chance to compare the results of our group to those of any other group to see whether or not we're going in the same direction. But here's what we did. We took the sheets from yesterday's efforts and decided to separate out the cogent facts from an operations point of view and distill them down to things that might be worked on in the near term. That is, we tried to convert some of the words and thoughts to a couple of questions reflecting an operations point of view. The main question was as follows: What are the important issues that need further work? We started with the structure from yesterday's papers: information systems; audit, control and compliance; and so on. We went through each area and distilled out the basic thoughts and ended up with much less paper.

Yesterday's effort, at least as I saw it, might be characterized as something closely akin to structured brainstorming. Today, it looked like our task would be to sift that material for the nuggets, but this turned out not to be the easiest thing to do. Discussing any one topic led to another, and around and around and around. What we ended up with was a series of points that answer the questions, "What are the important issues that need further work?", and, "Who should do that further work?" We did not key them back to yesterday's broad topics, such as information systems or audit, control and compliance. We merely let them stand on their own, and they number one through seven. We then classified everything into two priorities: one or two.

1. There is a need for a promulgated system of safety and health requirements in corporate decisions that will meet the requirements of law, executive order, and directions from higher authority, and that provide for consistent interpretation of laws and regulations. We labeled this as priority one.

2. There is a need for an open-ended record system that defines what records are to be kept and that makes these records readily retrievable for studies, for protection in claims, and for control and assessment of new hazardous materials. We further broke this issue into two subcategories; priority one, labeled for action by OPNAV, is to make the necessary decisions, and priority two, with CNO and BUMED doing the work, is actually carrying out the requirements once the decisions are made.

3. There is a need for an organization that is properly resourced with facilities, personnel and funding, that can administer the requirements of law, executive order and directions from higher authority, and that provides good coordination between safety and hygiene functions. Our

discussion led to a probable structure that I'll try to describe. Let me start at the BUMED/NRMC level. Here we have physicians and industrial hygienists providing medical examinations, acute care, and rehabilitation counseling. We also have nurses, audiologists, optometrists, and professional audit people. Moving over to the shipyard, functions such as inspection, training, hazard abatement, engineering, monitoring, scheduling, auditing, recording, supervising are the responsibility of industrial hygienists working there. Normally this group contains a supervisory industrial hygienist with a number of technicians. As a probable structure for queueing up the requirement stated above we recommend shifting to the line the responsibility for those functions that can be managed directly, that is, things that can be described, written down and done. An industrial hygienist should manage them for the activity boss so that these functions have good professional supervisory control. The BUMED side then has the audit function from a higher level, that is, a professional audit function to insure that things done by the line are done properly and professionally.

We said earlier that we need an organizational structure that is properly resourced, implying we don't have this now. One of the advantages of the structure described above is that the funding will flow directly from existing sources to the line to support the level of activity needed to do the job. Over on the BUMED/NRMC side, we are talking about no change in the basic funding concept, if there is appropriate funding at the OPNAV level to support the levied requirements. Earlier, I said that the problems are how to promulgate requirements to the field and how to define what has to be done. This sounds simple, but it is not done very well now. If it is to be done and done at the OPNAV level, then the same level should bear the requirement for providing funding. We go on to say, "Consider an OPNAV level project manager to facilitate." We label this as priority one and say OPNAV is going to do it.

4. There is a need for an effective system of getting the information and requirements needed by the worker from headquarters down to the worker. There is a need for (a) better and clearer requirements for the workers, in the form of technical manuals, check-off lists and detailed procedures, (b) specific training courses on these requirements for those that need them, and (c) some kind of testing of the workers' qualifications. The system should be able to be changed rapidly as requirements change. We identified this as a priority two item. We also concluded that it is up to all of us to do the work and to make the improvements that we see are necessary from an activity level all the way up to CNO and BUMED.

5. There is a need for a centralized audit function that measures compliance with the laws, executive orders, and regulations from higher authority. After much discussion on this topic, we concluded that the audit function will be reasonably well defined if requirements are defined. From where we sit now we aren't going to get very far by trying to improve what's going on in the field as the requirements and other things aren't handled properly yet. When this is done, auditing can be more clearly addressed and will be substantially simpler. This is a priority two item and is the responsibility of OPNAV.

Cost effectiveness is another area that we backed into but didn't take on directly. Evaluation of cost effectiveness must proceed dynamically from the inception of any program. Evaluation elements are continued epidemiological study and appraisal of new options, technology, engineering design, etc. We were saying that to single out cost effectiveness and address it all by itself is hard to do. Evaluation will follow from making some basic decisions at corporate levels. Implementing these decisions will greatly affect costs, but after the basic implementation stage we can fine-tune programs from a cost effective point of view to get the most benefit for the least cost. Decisions must be made on such basic questions as: is the Navy really going to do epidemiological studies seriously, for the next 20, 30, or 40 years? Are we really going to go out and look at the information we have at the work sites to make smarter decisions later? I don't know. But it doesn't look like these decisions have been clearly made today. They certainly have not been made about funding. Funding is a pivotal issue that has to be settled before we can even begin to talk about cost effectiveness. So, what we're calling for are some big decisions that must be made at corporate levels. We must decide what we're going to do corporately, then we can talk about cost effectiveness. Who makes the decisions? The superstructure of the Navy, I think. We are really talking about BUMED and OPNAV coming up with a decision. We've listed a few key decisions that need to be made in this context. First, is the Navy going to do epidemiological studies? Second, do we legislate, substitute, isolate, or provide engineering control or do we focus on personnel protection, clothing and so forth? Decisions need to be made at CNO level about what we are first going to put our money into. These need to be written up on the wall so that they will be adhered to. Without policy being stated loud and clear and driven from the CNO level, things will be left to local discretion. You're taking potluck and don't really know what's going to happen. A pivotal policy decision needs to be made. Third, should the Navy keep extensive records to minimize claims? Again, we're talking about cost effectiveness. Somebody has got to make the decision about what we're going to do, and then start doing it. Then cost effective ways of doing things will evolve.

6. Will we consider impact on the product and production time? And, if so, how much will this concern be allowed to influence our decisions?

7. To what extent are new materials and processes in the field allowed to correct, monitor, or evaluate the condition?

We could go on with a longer list. We just tried to highlight some basic thoughts.

And last we discussed field experiments and research. We said these are part of the coordination to keep the program improving. Projects should originate largely from the field and be promulgated by the top echelon to the selected research arm. Setting the rules for this area should be the purview of the research community. One example of the kind of research or experiment that would be appropriate today is developing new techniques and methods for measuring toxic materials. We do not seem to be very advanced in this area. Our inability to measure levels quickly and report them seems to be one key limiting factor.

Another fruitful area is organization. Much theory and forecasting would have to go into any decision to change the organization we have now. This suggests that when you think about experimenting and research, you might zero in on one part of the community and make a change there first and carefully study it to see what really works.

That is the way we wrapped it up. We worked like hell and ran out of time. From my point of view, and I think I'm speaking for the group, it was good that it was a compressed time to do it in. If we tried to take three days to do the same thing, we might accomplish less. Thank you very much.

OCCUPATIONAL MEDICINE

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The occupational medicine group identified three broad issues that we feel directly concern occupational medicine and that have potential for being addressed now. The group also chose to comment on some of the other issues that surfaced in the summary sheets from Monday afternoon.

The first issue, and the one that we have given top priority, is one around which there was probably the least consensus. The Navy's occupational health programs need strong central management and the implementation of such a structure needs study. The needs are: (1) to couple program elements with resources, (2) for management by objectives, and (3) for an ability to audit field activity programs accurately. The feeling in our discussion was that the audit function should be separate from management resource controls and perhaps rest with the medical Inspector General.

Our differences of opinion concerned whether occupational health management could interface and continue to be a part of the Navy Regional Medical Center (NRMC) structure or whether it should be separated out and become a separate systems command. The latter has been recommended by some, with the idea being that occupational health management should bear no relationship to the NRMC's. This structure would usurp the present NRMC CO's responsibility for total health care in a specific region. While there was considerable discussion and a lack of consensus around this issue, we did feel as a group that the Navy occupational health program needs strong central management and that some of the fragmentation of our management chain needs to be looked at.

The second issue with second priority, is that there is a need for strong information systems designed to collect, store, and analyze standardized occupational medicine and industrial hygiene data. The data must be retained for extensive periods and must be useful to professionals. The data should include work history, experience, training, exposure episodes, medical health data, and mortality data. Exposure to recognized hazards should be included, incidents of illness and accidents relating to employment should be included, as should audit information. The individual should be traced not just to the termination of employment, but all the way to the death certificate.

Our third issue is that of education and training. We are concerned with the education of occupational medicine physicians as well as with their career tracking. The Navy only has 12 of 16 occupational medicine billets filled at the present time. Both the fact that we only have 12 billets filled and the fact that there are only 16 billets are insufficient.

And, because of the small number of occupational health physicians, we have need to provide some structured training of other Navy primary care physicians in occupational health. Thus, a side issue of education and training is recruiting for occupational medicine physicians, both from the private sector and within the Navy.

Those were the three issues that the occupational medicine group felt most strongly about. There also were a few comments regarding the six summary papers from yesterday's topical discussions that may be worth mentioning.

We took exception to some of the statements from the audit, control and compliance group. The first statement was "present system done in name of Inspector General covers only civilian personnel." We think you might not be aware of the NOSHIP program, the Navy Occupational Safety and Health Inspection Program. NOSHIP is for all military and civilian shore activities.

Another question was raised about the recommendation by the audit, control and compliance group that health and safety personnel need direct access to the line commander. We think that this is something immediately available and in some places it is already present. The use of additional duty orders and informal information exchanges can take care of the problem. There is nothing that keeps two organizations from writing instructions that permit information exchanges straight across the board to any level. We have such an agreement between the Puget Sound Naval Shipyard and our regional Occupational and Environmental Health Service. The same thing can occur at any of the other Naval Activities. I think this is a responsibility that we at our individual settings can address and answer.

We also want to add our group's approval to a few of the other items mentioned in the summaries. Regarding the cost effectiveness issues, we agreed that higher management levels, particularly line managers, must accept more responsibility and impose constraints upon decisions made by lower level commanders. While this is a broad statement, our intent is that we need to take our attention away from short range return items and to redirect it toward the correction of long-term issues. This will occur only when higher levels accept greater responsibility.

Another cost effectiveness item relates to our belief that compensation costs ought to be administratively charged back to the individual facility where the compensation costs arise. We think that this would help us, as field managers, become more aware of some of the secondary costs involved in our operation.

We also identified areas needing research related to occupational medicine and industrial hygiene. We think more information needs to be developed on how best to monitor work places and individual workers. We had a lot of disagreement among ourselves about the need for individual worker monitoring, i.e., individual versus workplace monitoring. We also felt that organizational changes in occupational health structure has some potential for research. Field studies on compliance in the use of protective equipment and the risk factors involved represent other areas of possible

research. Knowing the different types of injuries or health effects that occur and the risk involved would help us to better recognize these problems and to allow us to take corrective action.

INDUSTRIAL HYGIENE

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Yesterday I remarked that my comments were similar to those presented before mine. The same is true for this presentation. The discussions of industrial hygiene very closely parallel those of Captain McArthur and Commander Nelson. We, too, reviewed yesterday's summaries and identified those issues that we thought had relevance to our disciplinary area. We identified the area of organizational structure as being of most importance, followed by information systems, communication/training and education, field experimentation, audit control and compliance, and finally cost effectiveness. I would now like to review some of our priorities and needs.

Two needs were identified in the area of organizational structure. The first was that a mechanism be established that would prevent occupational health or preventive medicine and clinical care from competing with each other for personnel and fiscal resources. The second need was for the creation of an occupational health management system that integrates resource appropriations into a goal-oriented and time-phased program for delivery of industrial hygiene services.

Regarding information systems, the group felt that an effective system should be developed for providing ashore and afloat field units the guidance they need in industrial hygiene and occupational health. Also needed is an easily updated manual that clearly identifies all data required for collection pursuant to various occupationally related rules and regulations, and that establishes standardized reporting procedures to facilitate processing and referral/reference activities. Related to this, a mechanism is needed that can couple the information collected to individual medical and personnel records. Finally, uniform and improved methods and procedures should be established for reporting industrial hygiene information.

The group identified several areas that should be emphasized in communication and training. More emphasis needs to be directed toward educating lower level civilian and military workers in occupational health matters. This would result in achieving more healthful work environments and practices. Improved methods need to be developed for training and reinforcement training of top managers and supervisory personnel in matters related to occupational health. Thus, exemplars are needed. The final area related to training for professional industrial hygienists. This training should be provided in a coordinated, directed and consistent manner, and mechanisms should be identified whereby the Navy can attract, promote and retain such professionals.

The group felt that there were perhaps more potential research and development areas in field experimentation than in some of the other areas. Among those suggested are the determination of preferred means of providing industrial hygiene services, the evaluation and improvement of communication

methods among industrial hygienists that are apart from directives or formal command correspondence, and the evaluation of indices that may be useful for assessing the cost-benefits of industrial hygiene programs.

There were several issues of interest in audit, control and compliance, but the group saw them as of less immediate concern because of recent actions to form the Navy Occupational Safety and Health Inspection Program. One area of interest is the identification of information and reporting requirements necessary for documenting and evaluating an occupational health/industrial hygiene program, along with the minimum reporting requirements for evaluating its effectiveness. The second area of interest is the development of a strategy for formulation of Navywide target hazards (i.e., hazards singled out for special attention over a specific timeframe), that allows flexibility at the local or field level.

Cost effectiveness is an area that can provide practical applications to everyday decisions about industrial hygiene research and development, but it would require long-term efforts to obtain meaningful results. Two specific areas of interest are the determination of what Navy industrial hygienists actually do or how their work hours are allocated by function, and the identification of those indices of greatest utility in assessing the cost/benefits of an industrial hygiene program.

In addition to identifying our needs and priorities, we also considered two activities that could possibly be undertaken immediately in the course of providing industrial hygiene services as well as issues having potential for further investigation. One issue for possible immediate action is in the area of communication and training. A principal concern of the participants was the degree and type of training provided to lowest levels of personnel performing work. There was some disagreement over the effectiveness of current methods, but it was generally agreed that specific health precautionary and industrial hygiene guidance could/should be incorporated into various process instructions within industrial-type activities. Other approaches may be necessary for military personnel. It was also felt that current industrial hygiene training initiatives undertaken at the local level can direct or target this population with increased emphasis.

A second area for possible immediate action is in cost effectiveness. The industrial hygiene working group was somewhat uncertain about the meaning or application of this term to an industrial hygiene program, but felt more comfortable with alternative phrases such as cost-benefits or return-on-investment analyses. It was generally agreed that such analyses could and should be applied to routine decisions for purchase of support equipment, or in recommendation of workplace controls to persons directly responsible for safeguarding the health and safety of employees--whether military, civilian or both.

One issue for future investigation is in information systems as they relate to health surveillance of workers and the workplace. A strategy or system for collection/reporting and documenting employee exposures and the environmental conditions of a workplace are needed in order that sufficient information is available for entry, as appropriate, into medical and personnel records. The system must assure that data taken within a specific workplace for a group of employees find their way into all the appropriate

files. This information is needed to assure proper health surveillance and to refute unnecessary or unwarranted claims.

Another area for future investigation is in organizational structure. The industrial hygiene group feels that an organizational structure is principally a tool for getting a job accomplished, and the better the organization is known, the more effective one can be in performing his duties. The group feels that definition of organizational structure is a management responsibility. Further investigation or research may be needed in order to reduce the degree of uncertainty in one or more of these areas, but decisions related to organizational structure should consider the following: (1) the existing structure and its effectiveness, (2) variations in structure or program execution that improve or enhance effectiveness, and (3) formulation of an ideal structure and alternatives.

Finally, several specific field experimentation issues were considered for future investigation. One is the determination of the preferred means for provision of industrial hygiene services, by assessing regional differences in program delivery, structure, resources management, and interdisciplinary coordination. Another is the identification of pertinent data and data systems for identification of populations-at-risk and establishment of baseline health data necessary for the conduct of epidemiological investigations. Two others are the development of indices or criteria for evaluating the effectiveness of occupational health services in terms of the health status of the worker and the determination of optimum methods for assuring conformance with occupational health guidelines.

EPIDEMIOLOGY/ENVIRONMENTAL HEALTH

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A number of issues were considered by the epidemiology and environmental health group relating to the specific role of epidemiology in the implementation of an effective occupational health and safety program for the Navy. Many of the issues considered by the topic groups on the first day of the conference are within the scope of this discipline, given the availability of resources sufficient for addressing and accomplishing these objectives. The major issues which we dealt with relate to information systems and field studies, and several research priorities are recommended:

1) In dealing with the issues considered to be most important, it was recognized that the establishment and implementation of an effective occupational health and safety program within any organization requires, as an initial priority, knowledge of the prevalence of status of the number and types of occupational hazards encountered in the workplace, and an understanding of the health effects associated with exposure to those hazards. As a first approach toward accomplishment of this objective in the Navy, therefore, we recommend that a field study be undertaken to develop a current status classification system, which would assess and classify, with regard to potential health effects, the major occupational hazards to which Navy personnel are exposed in the course of routine work activities both on shore and at sea. Such a project could initially be undertaken as a pilot study concentrating on a selected cross section of the Navy community. Specific objectives of such a study should include (1) identification of major chemical and physical health hazards encountered in ship and shipyard activities, (2) determination of the numbers of personnel, by job classification, who are exposed to those hazards by virtue of being routinely engaged in those activities, and (3) development of a statement of current knowledge of the health consequences associated with both long and short term exposure to those hazards, as derived from available toxicologic, human clinical and epidemiologic studies.

Documentation of the prevalence status of occupational health hazards in this manner could serve as a model for future studies designed to assess both the retrospective and prospective health experiences of Naval personnel, and provide a foundation for effective decision making regarding modification of existing Naval occupational health and safety policies. The systematic association of job hazards with potential health effects would also provide insight into the magnitude of future health problems arising from current occupational conditions, and thus be of value to the issue of litigation of claims involving the possible association of health conditions with past occupational exposure situations.

2) Consistent with, and building upon, the development of a current status classification system for existing occupational health hazards in the Navy, we recommend, further, the implementation of an early detection program to monitor long term health effects on Navy personnel on a continuing basis. This program would be prospective in nature and would entail periodic monitoring of a selected cross section of personnel engaged in high risk occupations to identify the occurrence of changes in health conditions by job classification over time. A rationale for this type of study is that specific changes in health status may be predictive of ensuing morbidity regardless of etiology, and thus would permit identificaiton of potential health hazards in a variety of occupational settings. A major objective of this study would be to identify early symptoms of specific disease processes, such a chronic respiratory disease, dermatosis, etc., using judiciously selected morbidity indicators. This type of program could also be used to judge the effectiveness of current occupational health and safety programs using prevalence of specific health effects to assess acute and short term occupational problems, such as accidents.

An important aspect of this program would include identification of behavioral, as well as biological changes, that would be predictive of psychological stress on the job. This type of study, we feel, has immediate importance because of the sheer numbers of occupational conditions to which Navy people are exposed for which no specific health effects have been identified.

3) As a third area of epidemiologic and environmental health research, we recommend that retrospective or cross-sectional studies be undertaken for health problems that are currently known to be associated with specific occupational conditions. Areas of current concern in this respect might include hearing loss in high noise occupations, flash burns in welding operations, and respiratory embarrassment in occupations involving inhalation exposure to stack gases and solvent vapors. Studies of this nature could have a substantial impact in clarifying the magnitude of the health consequences associated with known occupational conditions, as well as in establishing negative biological effect data applicable to claims litigations.

Other recommendations made by members of the epidemiology and environmental health discussion group were:

1) Develop a computerized occupational and medical surveillance system which can serve as a data base that is easily accessible and available for epidemiologic analyses. Such a data base should include work histories and training experience of all Navy personnel, as well as exposure episodes and medical and health data for individuals in particular job categories.

2) Develop a Physician's Desk Reference-type of annotated look-up file to identify occupational hazards and their health effects.

3) Develop specific codes for classifying disease or injury from occupational causes to aid in the systematic classification of this information so that specific relationships can be studied in epidemiologic investigations.

4) BuMed or naval occupational health director survey and audit all shore facilities to determine the uniformity and quality of current record keeping systems with regard to job hazards and health effects.

5) Review industrial occupational health and safety information and incorporate applicable technology into Navy program.

6) Implement educational and training programs at the worker level with respect to identifying and reporting adverse health effects, especially those of a predictive nature. This would possibly involve the worker in the record keeping process and let him participate directly in implementing the occupational health and safety program.

Finally, there are a number of areas related to epidemiology and environmental health where specific needs for new information exist:

1) Women and other minorities--it is estimated that 40 percent of workers in shipyards are women, and the number involved in underway shipboard operations is increasing. Similarly, there is an increasing number of persons of minority status enlisting in the Navy. Information specific to these groups is required if meaningful assessment of their occupational health experience in the Navy is to be made.

2) Twenty-five thousand known chemicals can be found in the occupational environment, and several thousand new chemicals are introduced each year. Information regarding the prevalence of such chemicals and their potential long and short term health effects is essential to assessing the magnitude of occupational health and safety problems in the Navy.

ECONOMICS AND DECISION ANALYSIS

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The group that met on Decision Analysis and Economics as a discipline had a task different from the others, because we approached it in the sense of a discipline; i.e., of methods or techniques, rather than functions and operations. We first tried to find a list of issues and then categorize them into three types, (1) those outside the scope of the disciplines of economics and decision analysis; (2) those within the disciplines but which need more information if to be addressed adequately, and (3) those that can be addressed.

First, we found that there aren't any issues that are outside the scope of the discipline of decision analysis. Anything can use decision analysis. And as far as economics, there's a cost to anything. You can't ever get away from it. So, we decided to treat that a little differently, saying that there are some issues people think about, which professionally are closer to other people's fields, which professionally require the knowledge and skills of people in certain kinds of medical research, in physics, in statistics, and in psychology particularly. We decided to try to stay away from issues where we thought the prime considerations are matters with which psychologists deal, such as behavioral structure.

For the other two categories, we decided first to see where we are a little hesitant, where we don't think the methodology is quite up to handling the policy issues. I would like to tell you a little bit about how people in the field think about this. I will use material from an article by James March in the Autumn 1978 issue of the Bell Journal of Economics. He has been doing research studies on problem solving and how people think for some years. He wrote:

> Recently I gave a lecture on elementary decision theory, an introduction to rational theories of choice. After the lecture, a student asked whether it is conceivable that the practical procedures for decision making implicit in the theories of choice might make actual human decision worse rather than better. He asked for empirical evidence that human choice is improved by a knowledge of decision theory or by application of the various engineering forms of rational choice. I answered, I think correctly, that the case for the usefulness of decision engineering rests primarily not on direct empirical confirmation, but rather on the superiority of particular procedures in particular situations and on the willingness of clients to purchase the services of experts with skills in decision sciences.

Professor March also described various kinds of rationality, including bounded rationality and process rationality and tastes, and he did have one comment that I think brings a little insight to our business today. He discussed the way people treat their own preferences. He believes it is not done in rational and reproducible formulas, in terms of writing them down, one, two, three, and then doing all the decision tree work we have heard about. Instead, he comments, looking at ourselves and our friends, we find that we treat our preferences strategically. We confound our own preferences. Our deepest preferences tend often to be paired. We experience something, an outcome, with both pleasure and pain. We avoid our own preferences. Our actions and our preferences are only partially linked. We expect change in our own preferences. We have trouble describing the function about how we expect ourselves to change. And he added:

> We suppress our preferences. Consequential argument, the explicit linking of actions to desires, is a form of arguing in which some people are better than others. Individuals who are less competent at consequential rationalization try to avoid it with others who are more competent, particularly others who may have a stake in persuading them to act in a particular way. We resist an explicit formulation of consistent desires to avoid the manipulation of our choices by persons cleverer than we at the special form of argument called consistent rationalization. Human beings know that some people are better at rational argument than others, and that those skills are not particularly well-correlated with sympathy or morality. As a result, people recognize the political nature of argumentation more clearly and more personally than our techniques often allow. We are unwilling to gamble that God made clever people uniquely virtuous. We protect ourselves from cleverness by obscuring the nature of our preferences. We exploit cleverness by asking others to construct reasons for the actions they wish to take.

So our group moved on, after recognizing the dangers of oversimplification in analyzing the richness and subtleties of human intercommunication and decision, to asbestos problems, policies, and practices in the shipyards. In our own office, Commander James and I have found that all the policy and action problems of occupational safety and health can be found in the asbestos area. In what we're thinking about doing now, in medical research, in collecting data, and in considering abatement policies, we find practically every theoretical and optimization and measurement problem in decision analysis. We can find examples: whether to cluster the types of asbestos fibers as a simple hazard or to discriminate among them; whether to use OSHA standards or to use a different, more rigorous Navy standard; and whether to elicit a Navy utility function and measure costs, or to infer them from other government and industry studies. Also, we can find issues in centralization versus decentralization, e.g., the question whether local command should be required to furnish data to Washington, or should be paid to furnish data to Washington. To what extent we should try to standardize data? In addition, we find quite interesting issues in medical sciences, trying to say whether the knowledge we have about the mechanism of

asbestos fibers causing lung carcinomas is known with some subjective probability or whether there are three or five or ten or fifteen mechanisms. In decision analysis, when you shrink something down to two or three mechanisms, that gets much closer to certainty. Our problem (much of what we deal with in decision analysis) concerns variance and uncertainty. How much don't we know? And therefore, how much information should we buy and how much should we protect ourselves against the possibility that later on we'll get different information?

After discussing those specific problems, we came to the issues, as I said before. We organized the issues in two or three headings.

We think that the major issue is the extent of information and decision analysis transfer from researchers to users that is now appropriate, formally and informally. In other words, to what extent are decision analysis techniques usable for various levels and kinds of decisions now, and to what extent are they utilized? We think prospective uses should be divided into routine management decisions, risk analysis decisions of a larger investment nature, and evaluation of entire systems, particularly proposals for new systems and control policies. At the routine management level, decision analysis is usable and is being used informally in cost and benefit studies, but it needs to be done more carefully and within a required minimum framework that insists on explicit, documented human judgments.

At the second or risk analysis level, I want to pick out a particular policy statement to illustrate the practical and researchable issues that are far from resolution. It is the risk assessment section of our basic directive, DOD Instruction 5100.10D of 11 October 1978. In that document, a set of definitions and procedures for risk assessment are set forth. It is defined as "an expression of possible loss, described in terms of hazard severity and mishap probability, and expressed as a Risk Assessment Code." It ranges from catastrophic, critical, marginal, or negligible severity: I, II, III, or IV on one dimension; and from likely immediately, probably, maybe, or unlikely event probability: A, B, C, or D, on the second dimension. So there are sixteen possible scorings, from IA to IVD. But that's too many; that may require more discriminating judgments or measures than the professional engineer, physician, and hygienist can make! So the sixteen are grouped into 5 Codes--e.g., by equating a critical event likely to occur immediately condition with a catastrophic event that probably will occur in time. They also throw out the negligible severity set entirely, leaving only twelve to be grouped for the five risk assessment codes. They then suggest that priorities be set up by using those five. Now, I have some doubts about that as a decision analyst. It looks a little crude to me, a little inflexible. On the other hand, it is being used successfully in a current survey of all hazards at shipyards and ordnance stations. It is said to be very useful, because it <u>is</u> so general. It does make the separation between hazard severity as a measure of the loss or disutility function, and the mishap probability that something will happen and an outcome and event will occur. I was told that one advantage is that it doesn't require a user to put probability and utility numbers in it. It lets him assign severity for one area and one kind of hazard. It allows him to put a cardinal scale on that utility function. On another one, he

could use some other scale. It doesn't require a linear scale. It doesn't require that highly likely be exactly four times unlikely.

I think that's probably a good idea in this stage of our analysis process. I would rather have it more standardized and more specific, so that we can do things on a more common basis over many kinds of hazards. But there are dangers if we were specific about those scales; I don't think we know enough yet.

In general on the first issue of transferring analysis techniques, we didn't arrive at any general conclusion or recommendation beyond saying that we think that there are a good many places where a transfer and actual use of decision analysis and specific costing is desirable and can be done by experienced and cautious people.

Another issue was evaluation and development of regulations. There we talked about a preliminary analysis to decide whether collecting and processing a log of data are worthwhile. We believe some kind of checklist can be developed, using subjective probabilities and estimates of utility. On the other hand, if a fairly crude assessment results in wide discrepancies, or if we get views from different people that are so different that we can't reconcile their assessments quickly, then we must get into detail about the information they have. And we found, in reviewing the conference papers, that every speaker, every discussion talked about information systems and was concerned about adequacy of data. I think this may, however, reflect the common human reluctance to make judgments, the fear of being "subjective." I personally feel that this often leads to a wasteful inefficiency in looking for data and overvaluation of the so-called "hard facts."

Finally, we considered the use of multi-attribute utility functions to evaluate outcomes, and whether we want to use explicit time preference between short and long run future benefits and costs. We did find that nearly every topic in the group involved discussion about short-run and long-run effects, and about the utility trade-off between getting benefits for current workers now or later in their future lives, and the effect on Navy costs and mission performance. Sometimes these issues are institutionalized, e.g., the competition between acute care versus long-term health and preventive medicine. And sometimes they are also institutionalized in terms of particular commands or specialties. In decision analysis terms of the utility function, a particular course of action would have a utility for one community, or one command, or one region, or one weapons system, manager, or one systems command in Washington, and not for others with different basic criteria and objectives. There are, in the decision analysis techniques now, a lot of research tasks on group decision, committee decision making, cooperative and conflict situations. Some of these ideas sound appealing, and there are recently some enthusiastic, confident salesmen in this area. There are "how to" handbooks--e.g., ways to have ten people say what they want and talk to each other and put numbers on a blackboard (or computer terminal) and get an answer. I don't think that near enough research and testing and validation has been done to accept any one such technique, even Delphi, unless you have a good deal of experience with a group of

people and there's enough understanding of the assumptions implicit in the methods and scales and language used.

We did also discuss the consequences of keeping a record information system. We did consider setting feasible goals for an information system if we're going to try to develop one. And we talked about a decision analysis of the measures of uncertainty and risk for alternative data systems, in which we might invest Navy funds. We discussed how the Navy treats these at higher levels, and the common theme was evaluation of the trade-offs in terms of priorities.

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ORGANIZATIONAL BEHAVIOR

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We systematically went through each of the issues and classified them as fitting or not fitting into our area. I'm sure that it will come as no great surprise to you that most of them were found to fit into our area.

I would guess that we spent 50% of our time talking about the issues of organizational structure, communication, regulation, authority and responsibility, and information dissemination. We came to some interesting conclusions, ones that I wasn't anticipating when we started the discussion. First of all, we decided that many of the symptomatic issues that have been discussed stem from an underlying problem: the organization structure the Navy uses for the organization and delivery of health resources. Specifically, things like poor communication, lack of authority, lack of clear-cut responsibility, and lack of correct communication channels seem to stem from the lack of a well-developed appropriate organization structure.

We then went on to ask, "What does it mean to say that there is not a well-developed appropriate structure?" To answer this we drew on some literature which has looked at the integration problems of large organizations. They commonly have a problem integrating the activities of their smaller units. We noted that, with respect to the delivery of occupational health services in the Navy, there is a very high degree of what organizational theorists call differentiation, and a very low degree of integration. The growing professionalization of health care specialists, the tendency to organize around those professions and lose sight of the overall service that is being delivered is symptomatic of too much differentiation and too little integration.

We did not come to a clear conclusion on how to bring about greater integration in the Navy. We agreed that it needs to take place at the operational level. The only place where the delivery of health services seems to come together presently is at the very lowest level in the Navy. We decided that this is far too low and that it needs to come together at a much higher level with a clearer statement about the kinds of services that need to be delivered and about how much resources are going to be committed to them. We could not strongly agree on whether health services should come together at the very top of the Navy, or maybe one level or two levels down at the command level. As we debated this point, a number of us pointed out that there is considerable evidence in the organizational literature that centralization does not always lead to coordination and integration. Centralization is one way to produce integration, but it's not an automatic producer of good coordination and good service delivery.

We did agree that whatever structure emerged, there needs to be a much clearer placement of responsibility with the line organization for carrying out occupational health services and an information and cost system that is coordinated with the establishment of responsibility. Anybody who took an information processing look at the present system would say that everything is out of whack; the information doesn't get aggregated and attributed to the right level in order to get the key decision makers to feel responsible. For example, in the case of a shipyard, you need to aggregate the health cost information at that level and charge it to that particular operation. Otherwise, shipyard management is never going to feel the responsibility and ownership for the health impacts of their decisions.

We then went on to talk about the issue of motivation and compliance. We identified three groups who need separate consideration: the management people who make operating decisions, the professionals who are delivering the service, and finally the workers. We decided that overall this is an area where considerable research is needed. Looking at the employees, for example, it's obvious to us that employees often don't behave in their "long term best self-interest." We wondered why this is. We also contrasted the radically different position of unions at different Navy locations. This raises the issue of field experiments and possible work on getting unions on board so that health and safety is their issue as well as management's issue.

We also looked at how to get workers more involved in improving their own situation. It seems to us that the present approach to compliance is based on sanctions. We know sanctions are limited in a number of respects, one important one being that they tend to be effective only when someone is there watching the worker. Motivation based on involvement does not have this limitation. We also looked at the issue of group norms and leadership structure and decided that these are both ripe areas for research and experimentation in terms of getting compliance.

We then talked about managers, and we decided that the way things are structured now, most managers would be a little bit crazy (incidentally we decided to assume that most aren't) to pay much attention to occupational health, because for their own career it is a negative. They have little say in developing the system that they are subject to, and the measures and accountability just do not come down to them. So it seems clear to us that in order to increase their motivation, the measurement system would have to be changed so that it becomes more career enhancing for this to be a serious area of concern for them. In addition they would have to get more involved in writing the regulations so they would see them as reasonable, practical, and understandable.

We then looked at professionals and decided that they are in an almost impossible situation. They have low resources, low status and low power. Other than that, all is well. We didn't have any quick solutions for these problems other than to indicate that the approaches must be multiple. Some of them clearly must come from within the profession--certification, developing more meaningful career tracks, etc. But many must occur within the Navy structure, clarifying reporting relationships

and dealing with the classic line/staff problem, which is present in every organization, but seems to be particularly bad in the health services area. Such things as putting the responsibility for health services in a staff position with almost no ability to intervene to stop dangerous or hazardous practices and with very little access to the power people that need to be influenced seems a sure blueprint for problems. We went on to talk of career tracks, status, job design, reward systems and the kind of changes that might take place. We decided that was a good area for experimentation and obviously one that needs change.

We also talked about the management of change acknowledging that several groups stressed the importance of not liquidating the Navy's already strong assets in the area of occupational health and safety. We felt quite strongly that this is an area where there is considerable knowledge. There has been considerable research and writing in the last ten years on how you manage change in complex organizations. This ought to be looked at so that change gets managed in a way that doesn't turn off or drive away the competent people who are already in the system and destroy the resources that are already there.

We also felt quite strongly that attention needs to be given to linking the research on health care and occupational health to the actual practice. It was our observation that in this area, as in a number of other areas, research is usually ten to fifteen years ahead of practice. The area of research utilization is one where there is a considerable amount known that could help point the way to better application and research.

We also noted that whatever changes are actually implemented, the Navy should look at their effectiveness so that they can be fine-tuned and perfected. All too often this isn't done in organizational change efforts. We felt strongly that evaluation research is needed and should be an integral part of all planned changes in the way health services are delivered in the Navy.

Finally, we had a last thought concerning research. We feel that a measurement system should be developed and that it should contain variables in addition to the traditional medical type variables. We have some to suggest. We are interested in seeing measures of job stress, psychological climate, individual performance and some of the more typical independent and dependent variables that are used in organizational behavior included. We didn't say how they could be included, but the general feeling was that somebody with an organizational behavior orientation should be involved when the package gets planned and when it is implemented.

In summary, we are excited about the possibilities for research and change that exist in the Navy. We want to contribute some much needed research and want to issue a word of caution about how rapidly change takes place and how carefully it's studied. We know a lot more about change and how to put it in place than we did five or ten years ago. The message seems clear: with the proper integration between research and practice it can be handled effectively; without that integration it can be very destructive.

CONCLUDING REMARKS

INTEGRATION

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My wrap up of what is important from an operations point of view is heavily biased by my own experiences. But my experiences of the last three weeks are based on direct observation of what is going on in the field. I hope that these comments will be of some value.

Right now we've got to say that the Navy occupational health area is in real trouble. From a field commander point of view, I have become frustrated trying to figure out how to get a handle on the problem. Everybody is cussing at me for doing the wrong thing or not doing enough, and this is coming from all directions. We are now in a mode of getting in a position to survive. I have heard a lot of people say, "But we're better than most everybody else. We're damn good." And I think this is probably true. We probably are very good individually, but we are not good organizationally. Anybody who challenges us can cut us to pieces, and we must become better able to articulate what we're doing. We have to make people believe we know what we're talking about. And when somebody tells us, "Well, that isn't good enough," we must be able to stand up and say, "It is good enough, and tell us why it isn't if you've got something better." But we haven't been able to say that. We are on the run, so to speak, and we have got to stop, get our act together, and hang tough professionally.

I remember an old cartoon of two donkeys tied together who were trying to eat two different haystacks. The haystacks were 15 feet apart and the donkeys were on a rope 10 feet long. Neither donkey could eat very well since they were trying to go for the opposite stack. They finally got together and both made out like burglars.

There is a certain measure of this situation in the relationship between the operations and the occupational health communities. Traditionally, we have not been closely coupled. Up until very recently when the pressure built up, I didn't pay a lot of attention to what was going on in the clinic as long as I didn't get complaints about the ambulances not being on time or unless someone was really fussing at me. I had plenty of other problems; now, the tension is there. The problems have become focused and the bosses at the top are ready to listen. They're saying it in a lot of different ways, "What is it that we ought to do? What do we need to do as a community?"

Visiting and talking to all of the shipyard clinic people has been a fascinating experience. Everyone that we have talked with has been eager and willing to work together. What we see, however, is that they do not always have the backing and they do not have the funds. They don't have real good direction.

I think we need to get organized. Now, to do that we have to recommend to the corporate level that they make some fundamental, basic decisions: Where are we going to put our money? Where are we going to put our effort? What are our priorities? What are we going to do?

We then need to take those corporate level decisions and promulgate them clearly down to the field. Don't promulgate a bunch of wishy-washy ifs, and, or buts. Clearly say, "Do that, do that, and do that." Somebody's got to make the decisions. If they are not made at the corporate level and promulgated clearly, then they get made by default or everybody is doing things differently. This is one of our big problems right now.

We need to develop requirements that are quantifiable, crisp, clear, and that can be promulgated clearly. They should be taken off the back of the medical community and shoved over to the line manager. We can do that. Line managers can use check lists, follow rules, measure things and report them. There are too many things for the medical community to do that aren't quantifiable, and that require their professional analytic and decision making skills. They are already overloaded and I think they would be delighted to get rid of some of these tasks.

We talked a lot about organizational changes and many interesting views came up on this topic. Clearly, a lot of people are frustrated with some of the organizational structures that presently exist. We need to quickly take a look at this, but we should not do something that will shock the whole system. We need to consider how to evolve some changes that will give us the most for our money and allow us to enforce those things that need to be enforced. I urge that whatever we do, we should not shoot the horse we are riding and start shopping for a new one. We should go out and make some deliberate changes that are calculated to improve things and then see how they work. If they work well, then make other changes. We should work like this and not make some big sweeping moves.

One of the most important things, from the operations point of view, is that somebody has got to provide the funds. If the requirements are promulgated clearly, then somebody better provide the funds or authorize the funds to help meet the requirements. Otherwise, requirements will be kind of hollow and they will not mean much. Again, there is more than one way to fund things and we should look for alternative ways that will allow us real time to get on with our work and provide resources for doing those things that need to be done today.

Funding and staffing go together. We have the capability within the Navy to reorient things and to describe clearly and lucidly a good occupational health program that will meet requirements, comply with the law, and allow us to tell our story well. We don't need to agonize looking two or three years down stream and go get a bunch of other people to come in and help us. We are currently in a position where we need to take swift action and we need to do some rather simple things. We presently have the wherewithal to do these things ourselves if we just sit down and do it.

Again, back to the example of the two donkeys trying to eat, I think we are both eating off the same haystack quite well, and we need to let everybody know that the medical community and the line community are working together and are making progress. It is important to let everybody know this and get on and do it. And again, upper managers as I see it are ready to listen to what we've got to say, to take some recommendations and implement them. The timing of this meeting just couldn't be better.

Again, I want to thank you very much for the opportunity to come here and participate in this meeting. It has been a real great personal experience and I think that we will be able to look back on this someday and say that we really gained ground here. Thank you very much.

INTEGRATION

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I think many of my comments at this time would certainly be similar to those of Captain McArthur. I have been listening intently to the speakers and making voluminous notes. On hurriedly looking through the notes, it suddenly dawned on me that giving a summation of this conference should be a relatively easy task as six major themes apparently have been evolved in each discussion group and apparently are common to all. Captain McArthur mentioned these themes and outlined them. Each of the preceding speakers did also. Apparently, we are in grave trouble in certain areas of environmental health in the Navy. We are aware that there must be changes, and I think this group at this conference has very clearly delineated the areas requiring immediate attention.

First, there is an urgent need for unifying our present resources and developing a structural organization which has the responsibility to establish direction and guidelines, develop and administer resources, and possess the authority to see that the program is carried through to a successful conclusion. Earlier today one of the speakers said, "He who holds the bucks in his hands is boss." One of the problems that the Navy has had over the years lies in the fact that the task-master frequently is not the resource provider. We apparently need to have a marriage of the two. The above concept seems to be a very important issue developed in this conference as every working group has clearly delineated it in their list of issues.

The second major issue that I note is that of communication. In my opinion this issue runs concurrently with the first issue. It is my impression that this conference has outlined an urgent need for communication--up, down, and laterally. Presently, there are numerous command structures in the Navy that write directives and orders to lower echelons concerning environmental health matters. Frequently there is very little, if any, discussion between the various levels of command that lead to unification, understanding, and compliance with the directives and instructions. This leads to arbitrary interpretations with resultant variance in compliance throughout the Navy. It then becomes difficult to adequately and appropriately comply, leading to conflicts and, frequently, failure to adequately meet the needs. A major problem delineated by this conference has already been alluded to, namely, the issuance of a directive by a higher echelon for compliance by a lower echelon without proper integration of funding and other resources which must in turn come from a separate entity at a higher level. The latter perhaps could be paraphrased very nicely by stating that frequently "the left hand does not really understand what the right hand is about."

The third major issue which I noted is an urgent need for the development of a Navy-wide information system devoted to a world-wide commitment in the area of environmental health problems. I interpret what I have heard here to mean that this system should be capable of storing and being able to give back a detailed, comprehensive body of information pertaining to all the needs of environmental health--including information about the active duty sailor, the civilian worker, the work place itself, and other pertinent information. The Navy is charged with defending this country by safeguarding the oceans; yet, many questions pertaining to environmental problems that are vital for the line commander to accomplish this mission are not readily available in a format that is easily retrievable for his use. For example, specific, readily available information dealing with environmental health hazards that will be encountered in foreign lands or in combat situations, I am sure, exist in some place or another; however, it is very difficult to collate this information by any one planning group. As an aside, I have attempted during the past three and one-half months to find the number of civilian employees employed by the Navy world-wide and their specific locations. This information obviously exists; however, on going through regular, routine channels, I have been unable to obtain a complete list. I would like to say that I have been far more successful by turning to the Combined Federal Campaign rosters which are more complete and accurate. I think this conference has clearly recognized an urgent need. We do need an information system of this magnitude. We further need the data base that will be generated by this system. There is great need that the information be documented and documented accurately and correctly. We need to include information in it that may seem superfluous at the moment but will have meaning in the future. An area that is rapidly becoming a major concern, in which this data system could play a vital role, is the large number of possible law suits relating to environmental hazard exposures. I rather suspect that, at the moment, we do not have sufficient information to adequately defend the Navy in this area. We do not have hard, fast, "no-effect" data to refute these claims. As soon as the precedent is established in one or two cases, we will then spend the next 10 years trying to gather sufficient information to refute or accept these claims.

Another major issue that has been recognized by this conference, I believe, resides in the need for education and training. This has also been referred to by each of the prior speakers and was discussed at some length by the group in which I participated this morning. Education and training is needed not only for the workers but for the technicians, the line managers, and also for the health care professionals. This would prove to be a great incentive and motivating factor to keep our trained people, if the program is properly conducted and implemented. Dr. Nelson has commented that we have 12 out of a possible authorized 16 occupational medical specialists. I find it very difficult to understand why the U.S. Navy Medical Department has difficulty in attracting qualified individuals in this field. By the same token I find it difficult to accept that the needs of the United States Navy in all the territories in which it operates can be met with just this small number. These thoughts are all based on the realization that the United States Navy could be the world leader in the field of environmental medicine with the right organization, the right program, the right concepts, and the right resources.

Another issue that I think must be mentioned and dealt with openly is our inability to recruit appropriate people. Dr. Lawler discussed this topic somewhat in his comments, and I believe phrased it very poetically when he said, "low status, low income, and low pay--"; this contributes greatly to our problem. Captain McArthur phrased it somewhat differently when he stated that "we have not been able to sell our story well." I concur with both of these comments, and I must say that I think it is a sad state of affairs. I do believe that we have a most golden opportunity in the Navy to be the pace setter in the field of environmental medicine. It has been pointed out by several groups that we have the necessary raw materials in our populations, in our environmental operation arenas, in our facilities, and that we have a superb cadre on which to build in our present personnel. It is another reason why the first issue discussed--that of a proper organizational concept--must be given first priority to insure proper utilization of our assets.

The last issue that I see on my list is that of research. Each group has mentioned research, recognizing the absolute necessity for research to be included in any program that is devised. Research represents the orderly, scholarly approach to the systematic collection of data that can be collated into useable and significant information for the future. The field of environmental medicine has many, many areas, but deserves our research attention for the future, because it will be through research that our future program will be developed in an orderly, logical manner. If such a program had been in existance for the past 10 to 15 years, the Navy would be in a much better position to deal with problems such as the current asbestosis and radiation issues, as examples. Research is one facet of this problem, and the Navy is in a most desirable position to be a leader. The many different and varied environments in which the Navy operates has already been alluded to, each posing its own set of problems and potential problems. Environmental health issues are most fertile areas for research.

I think this has indeed been an excellent conference. I have enjoyed immensely being a participant, and on behalf of the Naval Health Research Center, the Naval Medical Research and Development Command, the Office of Naval Research and Battelle Institute, I would like to extend to each of you my heartfelt and sincere appreciation for the effort, the devotion, and the concern that you gave to your deliberations here. Thank you very much.

CLOSING REMARKS

J. E. Rasmussen, Ph. D.
Director
Battelle Human Affairs Research Centers

Thank you, Gene.

Our greatest concern in putting the agenda together was to focus on the issues and avoid parochial concerns. Our goal was to have diverse inputs that would help synthesize a focused and meaningful research effort. I think our goal was more than met. I have been absolutely delighted in the way all of you adhered to the stated task. I hope that each of you goes home richer in understanding and maybe with a little broader perspective. I know we met our goal, and I certainly hope that yours were also met.

Admiral Lukas, would you like to offer any comments?

CLOSING REMARKS

RADM J. R. Lukas, MC, USN
Assistant Chief for Operational Medical Support
Bureau of Medicine and Surgery
Department of the Navy

I've just been thinking of the things that people have said. Sometimes in conferences such as these, it seems like there is more noise than substance produced. One area in particular caught my eye. I was concerned about communication. I found that little five- and six-letter words that I thought were common to all somehow take on new meaning, depending on whether you're a professor, a line officer, a researcher, or an occupational health specialist, and I had a little difficulty with 'the King's English' as we went along. Maybe we've got a more difficult problem than we think; maybe we ought to do this more often, because we're going to get nowhere unless we can communicate at a very central level. And for that reason alone, I would applaud, approve and support a meeting such as this.

Some of the other suggestions that came up are innovative and perhaps a little shaky. I was part of some of the discussion that produced these suggestions but I'm a little fearful of this innovation and shaking now that I've heard some other people speak about it. Maybe we'd better not shock or disassemble the system yet, but I certainly think we ought to keep the dialogue going.

PERSPECTIVES ON OCCUPATIONAL HEALTH

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PERSPECTIVES ON OCCUPATIONAL HEALTH

Allan P. Jones, Ph.D.
Naval Health Research Center

John A. Drexler, Jr. Ph.D.
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Conferences such as this are characterized by their contrasts. An observer is sure to note frequent shifts between well-reasoned presentation and impassioned argument, between the enumeration of problems and the proposal of solutions, between public forum and private communication, and between broad perspectives and self-serving parochialism. Such vivid contrasts give life, energy, character, and value to a conference but are inevitably weakened, even lost, when spoken exchanges are translated into printed word. Thus, the objectivity and scientific perspective sought in this final section of the proceedings must acknowledge the influences of the sometimes subjective, often unscientific inputs that gave it existence.

Writing this final chapter required inevitable compromise. First, problems with the Navy's existing occupational health program were viewed somewhat differently by the various conference groups. For this reason, we concentrated on problems that appeared most clearly defined by the majority of the participants. Second, while many professional groups were involved in the conference, the last chapter clearly reflects strong influences from the authors' backgrounds in organizational behavior.

Perhaps nowhere are these influences more evident than in the labelling of the basic problem areas. We agree with Dr. Lawler that many of the problems addressed in this meeting are but symptoms of a more deep-seated difficulty, namely, the lack of an appropriate organizational structure to meet the stated goals of the Navy's occupational health program. In fact, recent months have seen at least several restructuring proposals designed to address some of the problems discussed here. Thus, a discussion of organizational structure occupies a substantial portion of the chapter. Other basic issues addressed in this chapter deal with priorities and reward systems, information and control systems, training and individual change, and large system organizational change.

Before continuing, it is important to spell out certain assumptions that were basic to our discussion. First, the Navy's occupational health program must be viewed as part of a larger organizational system that provides it with resources, guidance, and legitimacy. Thus, priorities and reward systems established for the entire Navy have major impacts on the occupational health program. Second, it is likely that the Navy's occupational health program will continue to be subordinate in priority to many operational functions. This point is illustrated in a recent comment by

RADM Chase, Assistant Deputy Chief of Naval Operations (Logistics): "Perhaps the single most important point about the development of our Navy safety program has been a continuing realization of the need for balance between the need for safety and the even more important need for operational effectiveness." (1978, p.24). The priority system is further underscored by OPNAVINST 5450.178A which spells out the missions and functions of the Bureau of Medicine and Surgery and OPNAVINST 5100.8E which describes and implements the Navy Safety and Occupational Health Program. The latter especially notes that the occupational health program is designed to (a) enhance operational readiness and mission accomplishment by reducing occupational injuries and illness, and (b) create and maintain safe and healthful working conditions for Navy civilian and military personnel. We also assumed that current trends toward more limited resources for the military are likely to continue so that decisions about occupational health priorities and resources must consider increasing competition for resources.

A final assumption deals with recommendations for intervention or prevention. As Firenze (1978) noted, occupational hazards may be attacked at a number of points. The hazard may be eliminated through redesign or the use of alternative materials. Engineering controls such as barricades or better ventilation can be developed. When these steps cannot be taken, personal protective equipment can be developed. In addition, biomedical and environmental surveillance can be conducted. Finally, when preventative methods fail, medical treatment can be performed. In the following discussion, we concur with Dr. Nelson that a viable occupational health program will give priority to active prevention over treatment of symptoms and that intervention will be more effective and less costly if directed toward design and environmental control rather than toward individual behavior.

ORGANIZATIONAL STRUCTURE

Throughout the conference there was considerable agreement that many existing problems with the Navy's occupational health program stem from an organizational structure that is inappropriate to the Navy's currently stated health goals. Such observations were accompanied by calls for more centralized authority in occupational health matters, for corporate level decisions about guidelines, policies and directives, for explicit allocation of responsibility at upper-management levels, and for specific and formalized lines of communication and accountability. While such modifications are attractive because they appear to resolve critical problems in rapid, easily implemented steps, they seldom result in optimal solutions. Very simply, problems of the magnitude, complexity, and longevity of those faced by the Navy's present occupational health program are not amenable to simple, short-term, or crisis-oriented solutions.

Many factors determine the appropriateness of one or another type of structure. Most organizations, including the Navy, are complex mixes of specialized suborganizations, each with its own goals and functions. Thus, within the Navy, specialized suborganizations have been created to provide the Navy the wherewithal to conduct its operations as well as to

provide services in such areas as medicine and personnel. These specialized suborganizations themselves have their own subspecialties such as engineering departments aboard operational units and occupational medicine and environmental health in medicine. To better accomplish their specific goals, the various suborganizations develop specialized vocabularies, professional expertise, and specially tailored structures. Such specialization is not without problems. It becomes harder to ensure that each suborganization contributes to the superordinate goals of the entire organization. It also becomes harder to ensure communication among the different suborganizations and to provide for proper resource allocation. Thus, a major concern in most structural decisions is to provide for optimal levels of communication, coordination, and integration among the various groups while still allowing for optimum performance within each.

Unfortunately, there is no single "best" structure for all suborganizations or even for the accomplishment of all of the goals of any single one. Instead, the design of an appropriate structure becomes an ongoing process where a particular structure must be selected from a variety of potential patterns. Such decisions are laden with compromise and political constraints. They generally seek some progress toward several goals rather than maximum progress toward any single goal. For example, decisions about the structural requirements of an optimal occupational health program must be weighed against the requirements of operational units and other medical care systems. Thus, this chapter will not recommend specific structural patterns but will instead review some of the basic considerations that decisions about appropriate structures should take into account.

One major consideration is the degree to which a particular unit is subject to environmental uncertainty or change. A suborganization that faces a stable, unchanging environment has very different structural needs than one that must constantly redefine its goals, its functions, or its relationships with other suborganizations. The same observation applies when a group working with an emerging technology or seeking innovative solutions is compared to a group working with an existing technology or proven method. Finally, developing a specific program requires a structure different from that required for a program that is firmly established and running smoothly.

In its structural requirements, the Navy's occupational health program comes closest to what Tosi & Carroll (1976) have called a "dynamic unit." It faces considerable environmental instability, is still evolving and in a state of flux, and requires the development of innovative technology and expertise to carry out its assigned missions. An organization is better able to deal with these conditions if it has a flexible structure. This means few fixed rules and policies, discretion in individual decision making, technical skill and expertise being very important, and relatively free and open exchange of ideas. For example, in matters relating to occupational health, the occupational medicine physician is likely to be accorded much discretion in decision making and may communicate directly with others who have occupational health concerns rather than always communicating through his or her chain of command. It has also been suggested that innovation and problem-solving are greatest when information exchange can be spontaneous and oral with less regard for formal organizational boundaries. This type of exchange is likely to occur at lower

hierarchical levels and requires less communication among the managers of different technical groups or among higher levels.

As problems are solved and policies are implemented, the pattern changes. There is less need for high levels of technical expertise and fewer requirements for open exchange across organizational boundaries. Functions originally performed by highly trained professionals are slowly shifted to technicians with considerably less training. Program maintenance and control needs become critical and are best served by decision-making and communication networks that are tighter and more centralized (Burns & Stalker, 1961).

These observations imply that occupational health programs in their current stages of development require a flexibly organized, relatively decentralized structure involving a group of highly trained professionals (design engineers, industrial hygienists, behavioral scientists, and persons from the allied medical and physical sciences) to bring a wide variety of expertise to bear on the development of viable programs. Once programs are designed, implemented and operating smoothly, maintenance and control functions may be shifted to applied technicians and to operational supervisors in the normal management hierarchy. In these latter stages, the needs for professional consultation and technical expertise are reduced and are easily filled by specific individuals whose job it is to span the boundary between professional expertise and organizational application as specific needs arise (Katz & Tushman, 1978).

Different stages of program development require different information systems. Innovation and problem solving stages require flexible information systems geared to the rapid processing of a wide range of information. This might be the case when a new hazard has been identified resulting in an immediate need to ameliorate or correct the condition. Information needs for dealing with this are often unpredictable, varying as different problems emerge. Once problems have been solved and programs are developed to deal with them, information needs are considerably different as they are more closely tied to audit, control, and program management needs. Thus, they are more predictable, less subject to change, and better served by standardized reporting procedures.

Lawrence and Lorsch (1967) suggested that functional specialization leads to increased professionalization as individuals develop the specialized expertise, vocabulary, and communication networks to deal with their assigned tasks. While this professionalization tends to increase motivation, concentrate resources, and even control behaviors through self-imposed ethics, it produces several problems. If adequate care is not taken, the specialized vocabulary and expertise that aid professional exchange may inhibit interaction with other groups and lead to fragmentation. Further, the increased growth, role expansion, and recognition sought by an emerging profession may introduce conflicts within the organization as other groups see their own roles threatened, as differences in perceived levels of professional status become evident, or as emerging professionals transfer allegiances from the parent organization to the parent profession.

In the Navy's occupational health program these issues are illustrated by the evolving role of the industrial hygienist whose specialization and expertise are becoming more central to preventive care. Success in a preventive role, however, may alter the roles of other professionals such as the occupational medicine physician and may itself prove a source of inter-professional competition. Thus, long-term structural decisions must consider alternative models of occupational health care in which new or emerging professional groups may play critical roles that differ substantially from those in current programs.

The anticipated evolution of occupational health care programs from innovation and development stages to later application stages demands a dynamic approach to decisions about organizational structure. Structural patterns designed to provide for short-term responses and program development will undoubtedly undergo extensive change as innovative technology is applied. Thus, the establishment of particular structural guidelines is less important than the establishment of appropriate organizational guidelines that allow individual groups to pursue their own goals in ways that consider the goals of all.

However, when subsystems with different structural characteristics are required to interact with each other, the coordination of their activities must be carefully structured. Tosi & Carroll (1976), noted several problems when a dynamic unit such as the one described above interacts with a more hierarchically structured unit. In contrast with the dynamic unit, a hierarchical unit is likely to have greater centralization, less individual freedom in making decisions, more formality and more emphasis on rules. There is more emphasis on position power and less informal exchange of information. In one of the most important differences, however, the hierarchical unit is likely to stress objectives that are short-range and oriented toward cost-effectiveness while the goals of the dynamic group are generally long-range and oriented to the development of some new product or technique. In another important difference, Lawrence & Lorsch (1967) suggest that performance is generally greater in hierarchical organizations when power and influence reside at higher management levels. For dynamic organizations, performance is greater when power and influence is located a lower management levels.

The implications for occupational health are evident when one realizes that the occupational health care professional (whose needs appear best served by a dynamic structure) must interact directly with the line community (which is generally represented as a hierarchical structure). In this situation, there may be major differences between the occupational health team manager and the line manager in goals and perspectives, even in the source and amount of power related to a particular position. Moreover, also to be considered are the structural arrangements among different occupational health professional groups.

There are several ways to achieve the necessary integration among differently structured units. For example, formally assigned liason roles can work to integrate subunits at lower management levels. This latter role was one that LCDR Doptis discussed as appropriate for the industrial hygienist. The specific structure of the linkages between suborganizations

is of less importance than a structure that allows for mutual influence between subsystems. This will be considered later when we deal with the issue of rewards in the section called priorities and rewards and when we deal with effector systems in the section called audit and control.

PRIORITIES AND REWARDS

In discussing priorities and rewards, it is worth restating that complex organizations exist as open systems (Katz & Kahn, 1966) designed to accomplish goals that could not be accomplished as easily in another context. As noted in the preceding section, it is these goals and the priorities they produce which guide structural decisions. In other words, the appropriateness of any structure must be judged in large part against the goals and priorities that have been set by higher levels of management.

Many of the Navy's goals and priorities are mandated by other groups, especially Congress. In fact, presidential and congressional action form a primary source of legitimacy for the entire occupational health program. Other sources of goals and priorities are specific charters, statements of missions and objectives, and broad professional ethics and goals. Because of a wide diversity in the sources of these goals, few organizations develop single or nonconflicting goals or place equal emphasis on each objective. It is the process of deciding which goals will be emphasized and which will be down-played that concerns us here.

Mr. Simpson's decision analysis discussion is helpful in understanding this process, especially if we remember our assumptions that occupational health goals will continue to be secondary to operational goals and secondly, that occupational health resources and programs will probably be obtained at the expense of other programs and goals that have been designated as lower in priority. Mr. Simpson noted several phases of the decision-making process. In many ways, presidential and congressional mandate has pre-empted the first of these, the structuring phase of decision making. This mandate has stated that there are no options to the implementation of an occupational health program. Rather, choices remain only in terms of how such a program will be implemented (i.e., what structure will be used, what proportion of available funds and manpower will be channeled to occupational health programs, how priorities and goals will be emphasized and disseminated). As noted by Mr. Simpson such decisions are determined by estimating the outcomes attached to each choice option, by developing some utility function for each outcome, and finally by determining the options that provide maximum return or maximum utility.

We are not suggesting that this decision process is top-down, live-with-established priorities event because the occupational health professional can play an important role in the process. First, within the existing system, the occupational health professional can provide clear evidence of the costs of an inadequate occupational health care program as well as the benefits of a successful program. Second, the occupational health care professional can become a valuable element in suggesting alternatives to existing procedures. Third, the occupational health professional can

be a force in ensuring that occupational health and safety risks are considered when new technological systems are designed or new procedures are implemented. These actions are likely to require the development of information systems and occupational health professional roles that do not currently exist, however.

A final comment is warranted. We wish to stress that occupational health requirements need to be given visibility within a command's priority system that goes beyond mere lip service to its importance. Research has shown that individuals attend to those aspects of performance that are measured and rewarded. If different aspects of performance compete for a manager's attention, it is likely that individuals will be most responsive to areas with visibly associated rewards. For example, if a shipyard commander's performance is largely rated on his ability to overhaul ships and little attention is paid to other performance areas, such as occupational health, it is unlikely that these other areas will be viewed as important in any practical sense.

INFORMATION AND CONTROL SYSTEMS

A key element in decision-making about structure and priorities is the underlying information system. Information is needed by system managers to find out what is going on, to evaluate how well objectives are being met, and to determine when corrective actions are necessary. When linked to the reward system, information can be used also for control purposes. Thus, information and control systems help to coordinate the activities of individuals and subunits by gathering information about work behavior, assessing discrepancies between expected and actual behaviors, and providing rewards or punishments to reduce any discrepancies that exist.

At first glance, it appears to be a simple task to establish systems that monitor performance of occupational health activities and make possible appropriate rewards and punishments. Unfortunately organizations often develop information and control systems that discourage organizationally desirable behavior and encourage behaviors that have dysfunctional consequences for the organization. Such systems may encourage inaccurate reporting, false claims of illness or injury, or negative behaviors such as absenteeism. In many cases, close scrutiny reveals that these behaviors have positive strategic consequences for the individual and can be seen as rational responses to organizational constraints. Anecdotal reports that some sailors are willing to accept minor but permanent hearing loss because of expected disability compensation may fall into this category. Similarly, inaccurate monitoring devices or procedures might encourage a supervisor to continue work in an unsafe environment or to curtail work in a safe environment. Accurate monitoring procedures linked to rewards/penalties would discourage such behavior. Finally, overreporting of information or obtaining information that is unlikely to be used tends to distract attention from desired areas and to make the use of relevant information more difficult. Thus information and reporting systems need to be designed with a clear eye to the proposed uses of those systems.

While a complete review of the information and control system literature is beyond the scope of this section, three major aspects are worth discussing briefly. Drawing on the work of Lawler and Rhode (1976), these aspects are (1) the sensor system that measures relevant variables; (2) the standards or criteria against which existing conditions or behaviors are judged; and (3) the effector system that initiates corrective action.

Regarding the sensor system, not only is it important to know what is and is not being measured, but also how complete the information is. For example, an effective occupational health information system should not only monitor the presence of toxic substances in the work environment but should also record individual exposures, causes of exposure, reactions to exposure, related job conditions, previous work history and training, and so forth. Failure to maintain a complete measurement system may result in individuals being rigidly attentive only to the measures that are present in the system. Managers may respond to the toxic agents or job stresses that are included in the reporting system but ignore others that are not. The timing of the measurements is important also in that frequent or continuous measurements will more likely result in compliance than infrequent or haphazard inspections.

Once the needed information is obtained, it must still be evaluated against some criterion or standard. For maximum impact on behavior, these standards must be internally consistent, must not be in conflict with other standards, and must be understood and accepted by those who use them. Often, when individuals either do not understand or do not accept the stanards, they may report inaccurately in an attempt to influence the standard or to reduce the credibility of the measurement system. If standards are in conflict with each other, individuals may totally ignore the entire measurement system.

While measurement systems and standards are evaluated in terms of the information they contain, effector systems should be assessed for the kinds of responses they produce and for the timeliness of the actions they initiate. Two issues are of major importance: the ability of the measurement system itself to generate sanctions and its ability to communicate relevant information to persons in authority.

In occupational health, users of the various information systems include not only managers who must monitor compliance but also professionals whose responsibility it is to monitor work activities, to prevent accidents and illnesses, or to treat work-related disease. Such persons may not be in positions to take corrective actions. Often they have no direct authority over the persons monitored, and their effectiveness may largely depend on their ability to persuade others to take corrective actions. In the absence of clearly stated priorities and reward systems that encourage effective occupational health procedures, effecting change depends almost entirely upon the quality of the relationship between the health professional and the operational manager as well as upon the importance of occupational health matters to the operational manager. To counteract this situation, structural decisions are required to facilitate direct

communication between occupational health staff organizations and operational organizations. Direct links between such groups need to be formalized, and the professionals need to be able to appeal to higher level persons when corrective action is required but not taken.

TRAINING AND INDIVIDUAL CHANGE

The foregoing sections have stressed the need for certain changes in existing structures and programs and in existing reward systems. Other changes are designed to alter individual behavior. Unfortunately, neither organizational nor individual change is easily produced.

Many organizational change and training programs appear to assume that it is sufficient to communicate the necessary information to the appropriate people in a usable form. However, the mere communication of information does not assure its use. Thus, any effective occupational health program must consider strategies that lead to greater utilization of occupational health information and training by all members of the organization.

A recent report on knowledge utilization (Glaser, 1976) noted a number of factors that are likely to affect the degree to which an operating unit uses its training in occupational health prodecures. Some of the more important were (a) evidence that the technique works, (b) the problems addressed are seen as sufficiently persistent or bothersome, (c) the advantages over existing procedures, (d) the ease in placing specific procedures into operation, and (e) the degree to which the new procedures permit a step-by-step trial without calling for an irreversible commitment. In other words, occupational health training programs appear more likely to be used if the transmitted information is clearly consistent with existing procedures and priorities or if changes are introduced through a series of easily reversible stages with clearly identifiable benefits.

The utilization of occupational health training is also influenced by the conditions that exist in the work place. Inadequate or inappropriate support for the behaviors often causes the training to be ignored while appropriate support and reward systems can encourage its use (Campbell & Dunnette, 1968). This is easily seen in the popular management training programs of the 1960s that attempted to increase effectiveness by training managers to be more sensitive to the feelings and needs of their co-workers and subordinates. These programs appeared generally successful in producing the desired knowledge and skills. Unfortunately when trainees attempted to use the newly acquired skills, their actions were often interpreted as disruptive and undesirable by the parent organizations. The new skills were quickly dropped. Based on such experiences, occupational health training programs will be more likely to result in the desired on-the-job behaviors if appropriate steps have been taken to prepare the parent work group.

For more effective utilization of occupational health training, a support system needs to be developed around those persons who are trained. This means first eliciting the commitment of officers and petty officers, foremen and supervisors before a training program can be successful. Senior echelon managers must be supportive of health oriented behaviors and discouraging of violations. As CAPT McArthur noted, senior Navy executives must articulate an integrated policy on occupational health priorities before training programs should be implemented. And this policy should then be transmitted through and accepted by succeeding levels of command.

Many years ago Lewin (1948) suggested that attempts to change behavior are better addressed to groups than to individuals. He further argued that change efforts are likely to be more successful if they seek to remove barriers to change than if they seek to produce change through persuasive or coercive messages. Such statements suggest that training programs should be addressed to intact groups, so that specific behavioral knowledge is conveyed to all the employees who will implement that knowledge. This strategy also communicates the commitment of all levels to the success of the training program and actively involves all levels from the beginning. More importantly, the involvement of all members of the intact unit helps to assure that the training will be compatible with other priorities. When conflicts do arise between operational and occupational health requirements, the training program provides a forum to promote mutually satisfactory resolutions.

Because of their knowledge of the situation in which new behaviors will have to be practiced, the members of an intact group may have information about special conditions under which the new behaviors may be difficult to apply. They may have specific suggestions for more effective ways of implementing a new health or safety program. Research has shown that such discussions result in greater commitment to and acceptance of change. Finally, follow-up sessions with the intact group should be held to assess whether individuals are having difficulties in using the new practices. If such groups are involved in generating change, if they understand and accept it, and if they are committed to seeing it through, the new result should be a positive transition from training to behavior in which group members mutually police each other in engaging in the new practices. If such steps are followed, occupational health training programs are more likely to be viewed as a dynamic, flexible and integral link in the process of obtaining effective mission-related performance and are less likely to become disruptive competitors for scarce resources.

In the case of civilian employees, an additional consideration for effectively using training programs is the active involvement of organized labor in the training and implementation process. Especially in situations where union leadership is effective in exerting influence over its members, compliance with requirements will be greater if the local leaders are involved. If local leaders are committed to the program, they can assist in breaking down resistance to new techniques and can help in the design of strategies for implementing programs. Further, their visible interest in the program is likely to yield greater compliance from their membership. Both management

and labor stand to gain by such involvement. Management should see results in greater compliance with safe and healthful practices thus reducing down time and claims; in a period where organized labor is sometimes viewed by its membership as distant and out of touch with worker needs, the union stands to gain increased credibility through the expression of interest. Versen (1979) has described situations where unions have been involved cooperatively in the prevention of injuries, and Lawler and Drexler (1978) in comparing union/management cooperation across ten organizations, have outlined strategies for involving unions in such matters.

A final caveat is in order. The general effectiveness of occupational health programs would appear to benefit from training in clearly defined requirements and procedures and from an explicit delineation of the lines of occupational health responsibility. There are indeed many benefits in such specificity and formal training. There are also potential pitfalls. As suggested by a recent NASA study of mid-air collisions and near-collisions in commercial and general aviation, the increase of formal assistance from ground-based controllers appears to have increased the level of risk because of an implied lessening of responsibility on the part of the air crew. Thus, occupational health training programs must take care that the initiation of formalized training programs not become an excuse for individual employees, managers, or even other parts of the system to pass on to others their own basic responsibilities for a successful occupational health program.

LARGE SYSTEM ORGANIZATIONAL CHANGE

Many of the conference speakers as well as several sections of this chapter have offered suggestions that imply a need for Navy-wide change. These suggestions require us to devote some space to the dynamics of change within large and complex organizations.

When people in organizations believe that some change is needed, it is important that the entire situation be thoroughly diagnosed. While attention must be directed to apparent organizational problems, it is equally important to identify other less obvious conditions that may have caused the problem. Attending to such conditions prevents the continuing resurgence of the problem that so frequently occurs when symptoms are treated without addressing possible underlying causes. For example, treating a communication problem between personnel at a Naval Regional Medical Center and a Naval Shipyard by encouraging the parties to communicate more may only result in frustration if one or the other party already sees itself as overworked, if the communication problem stems from a conflict in priorities established elsewhere, or subgroup norms or traditions preclude interaction between the parties. Unless these underlying conditions are addressed, attempts to encourage more communication may be ineffectual or may actually increase the problem.

Many techniques are useful for organizational diagnoses. Some investigators use questionnaires to identify major problem areas. The data can be collected relatively inexpensively and serve as a focus for later

problem solving efforts. Another technique involves structured interviews that allow the investigator to probe more deeply into the nature and causes of the problems. A final technique involves structured meetings in which different interest groups work together to identify problem areas.

A second important issue is deciding who should be involved in generating organizational change. It is almost a truism that key persons from all relevant interest groups should be consulted in the matter. However, we believe that this is particularly important in the case of occupational health. Occupational health is defined as an "inherent responsibility of command. . .to be implemented through the chain of command (OPNAVINST 5100.8E.)." The medical department's function in occupational health is to provide Navy commands with guidance and assistance (OPNAVINST 5450.178A). Because of support functions of the medical department and because current authority for implementing programs rests in the line community, the line community must be closely involved in generating any kind of change.

Finally, there is substantial evidence that change is not very effective unless top management accepts it and is committed to seeing it through. Since upper level managers establish priorities and support for lower echelon managers, it is important that this commitment be strongly expressed in the statements of priorities and goals, the reward systems, and the general policies and resource allocation decisions promulgated by top management.

Specific procedures for organizational change incorporate many of those mentioned in the previous section on individual and small group change. Additional procedures such as team building, conflict resolution techniques, and group problem solving meetings can also be used to generate and implement change.

While the technology of organizational change and development is still in its early stages, the Organizational Effectiveness Program of the Office of Naval Research has sponsored considerable research in both civilian and military settings. This literature provides an excellent nucleus for planning the changes that will be needed for a more effective occupational health program. Other references of interest in this area are Beer's (1976) review of change techniques and Franklin's (1978) annotated bibliography of studies on organizational development.

SUMMARY AND CONCLUSIONS

The conference and this final chapter have underscored the availability of knowledge that is directly applicable to many of the Navy's current occupational health problems. While the design of specific solutions was outside the scope of this conference, it did suggest avenues for short-term resolution of some major problems using existing resources. Among such avenues were clear statements of priorities, values and goals by upper level Navy management, as well as the choice of appropriate structural designs and the establishment of suitable monitoring, enforcement, and

reward systems to achieve such goals. Several suggestions were also offered about ways to improve existing information systems and to achieve greater utilization of occupational training programs.

While directly relevant knowledge exists and can be applied in the design of solutions to occupational health's most pressing problems, we do not wish to understate the energy, effort, and compromise that must be invested by all parties. Nor is this investment and its final product--a viable occupational health program--the unique responsibility of any single group. While current development must depend heavily on the staff and resources of the Bureau of Medicine and Surgery, in the final analysis, it is the operational manager and the Navy's military and civilian workers who must bear the responsibility, pay the costs, and give each program legitimacy. At the same time, it is also these operational personnel who will reap the greatest benefits as safer and more healthful workplaces allow greater proportions of the Navy's resources to be applied to direct mission goals.

Thus, it is imperative that we stress the long-term as well as the short-term perspective of occupational health. Our knowledge about exactly how to implement occupational health programs is limited, and numerous areas for future research remain. For many conference participants, research was seen as the necessary foundation for sound occupational health program development, and specific areas for research are described in the "Professional Group Plans of Action" section of the conference proceedings. It is possible here only to touch on a few research issues that surfaced during the conference. Emphasis will be given to those topics that seem most salient by presenting possible research objectives for future studies.

One objective is to determine hazards or risks present in the work environment. This requires a comprehensive occupational health data system that includes both environmental exposure data and biological or medical effects data. It is important not only to document known or suspected hazards but also to discover new ones through judicious examination of a large array of environmental variables, including more subtle or chronic job stresses. Needed studies will include the traditional epidemiological studies discussed by Dr. Woods as well as studies specifically designed to improve measurement and sampling methods. Further, the accomplishment of this objective will demand improved techniques of management and information retrieval using large data bases and the use of sophisticated multivariate and causal analytic statistical techniques.

A second objective is the development and evaluation of techniques to increase individual compliance with occupational health programs. Specific content areas covered in these efforts will vary widely, but they should include such topics as the assessment of training programs, the effectiveness of reward/punishment mechanisms for managers and lower level employees as well as for different kinds of jobs, the investigation of such factors as group norms and group discussions that could be useful in increasing individual feelings of responsibility for self-monitoring and protection, and mechanisms for eliciting cooperation and assistance in implementing occupational health programs from managers, unions, and employees. Meeting

this objective will require cross-sectional and longitudinal studies as well as studies comparing experimental and control groups. It might be useful to approach this objective initially through the use of pilot studies that involve a few local groups rather than to start with studies that are very large in scope.

A third objective is the design of field studies to answer specific questions about program needs or program implementation. Included in this category are intensive studies designed to assess or diagnose existing organizational conditions and practices at the local level. Such studies might consider questions about organizational structure and change, problems of differentiation and integration mechanisms, professionalization and specialization, conflicting demands placed on managers and workers, reward and control systems, and career development and enhancement. At present this is an area of rapidly growing knowledge, but little has been tested or applied in the area of occupational health programs. Initially, these studies may be approached by conducting in-depth interviews of local occupational health and operational personnel, both managers and non-managers. Useful information might then result from comparing the data across Navy units and perhaps from extending the study to a comparison of the Navy's occupational health organization and structure to other services as well as to private sector maritime industries. Another study might address how readable requirements and regulations are for those expected to implement them as well as existing blocks to implementing these requirements. Still other studies might be designed to assess local pressures for or against change.

A final research objective was drastically underrepresented in this conference but has great potential impact on future occupational health programs. This area is industrial design and the rapidly advancing engineering design technology. Through the proper design of equipment and operating procedures, professions such as biophysicists, behavioral scientists, and human factors specialists can accomplish major advances in preventive occupational health care. Thus, such elements form critical areas for future studies.

The foregoing examples illustrate the range of short-term and long-term efforts that can be applied to the development of a viable occupational health program in the Navy. They should not be viewed as exhaustive, but rather as preliminary avenues that can be profitably explored to better meet the Navy's health care and operational readiness goals.

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APPENDICES

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