SPECIFICATIONS FOR A NAVY OCCUPATION HEALTH INFORMATION MONITORING SYSTEM (NOHIMS): II. A FUNCTIONAL OVERVIEW

D. D. BECK & W. M. PUGH

REPORT NO. 82-6

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NAVAL HEALTH RESEARCH CENTER
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NAVAL MEDICAL RESEARCH AND DEVELOPMENT COMMAND
BETHESDA, MARYLAND
SPECIFICATIONS FOR A NAVY OCCUPATIONAL HEALTH INFORMATION MONITORING SYSTEM (NOHIMS):

II. A FUNCTIONAL OVERVIEW

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with the editorial assistance of
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Report No. 82-6 was supported by the Naval Medical Research and Development Command, Bethesda, Maryland, Department of the Navy under research Work Unit MF58.524.023-2022. The views presented in this paper are those of the authors. No endorsement by the Department of the Navy has been given or should be inferred.

* ADP Services

** Health Care Systems Department

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ACKNOWLEDGMENTS

The authors would like to express their gratitude for the continued efforts of Lawrence A. Hermansen and Michael J. Gorney throughout the development of this project. The authors also would like to thank Richard L. Cohen, M.D. for his assistance and Anne K. Burton who was instrumental in the development of the Industrial Hygiene Survey Form presented in this report.
The objective of the Navy Occupational Health Information Monitoring System (NOHIMS) is to provide an information system that will coordinate the components of the Navy's occupational health program in order to meet the requirements of the Occupational Safety and Health Act of 1970. The present report develops in greater detail the design concepts introduced in an earlier report, providing more specific information on the content of the personnel, environmental, and medical databases contained in NOHIMS. In addition, an overview of the functional specifications for NOHIMS is presented.

In the overall design of NOHIMS, the personnel data and environmental data have been subsumed under the more general label of industrial data. This structure assures the security of the medical data while allowing medical personnel access to needed environmental information.

The software for NOHIMS is written in the American National Standards Institute (ANSI) standard MUMPS programming language. Users may interact with NOHIMS at increasing levels of specificity by making choices from a hierarchical series of option menus.

The key features of the NOHIMS design that make it attractive for implementing an occupational health information system are its extensive flexibility and adaptability; its "user friendly" nature; its transferability from one Navy industrial facility to another; its applicability to small, large, or very large industrial settings; and its ability to link occupational health data from a variety of sources in a network of separate, distributed databases.

Information is supplied to NOHIMS in two ways. First, an occupational health file is constructed from personnel, environmental, and medical data on an ongoing basis. Second, the data contained in the various NOHIMS reference tables are entered initially and then kept updated. Forms specially designed for NOHIMS facilitate these data entry functions.

There are multiple users of NOHIMS data and reports. These users are industrial hygienists, safety specialists, occupational health care providers, work center supervisors, managers of Navy occupational safety and health programs, and finally, medical researchers and epidemiologists.
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</tr>
</tbody>
</table>
INTRODUCTION

The Navy employs hundreds of thousands of workers (both civilian and military) who are scattered across the country, involved in a variety of diverse industrial operations, and exposed to multiple health risks from an array of chemicals and other agents. The objective of the Navy Occupational Health Information Monitoring System (NOHIMS) is to provide an information system that will coordinate the components of the Navy's overall occupational health program in order to meet the requirements of the Occupational Safety and Health Act of 1970. In addition, NOHIMS will help satisfy the requirement that the Chief, Bureau of Medicine and Surgery (BUMED) develop a program for medical surveillance, establish appropriate records for an occupational health program, and provide an audit trail of actions taken or not taken and why.

Preliminary specifications for NOHIMS have been presented in an earlier report* which suggested that an interim system be implemented to test NOHIMS design concepts. Such an interim system has been developed and implemented at the North Island Naval Air Rework Facility located at the Naval Air Station, San Diego. This report presents more detailed specifications for the content of the primary NOHIMS databases, particularly the environmental database. In addition, this report provides an overview of the functional specifications for NOHIMS and discusses the basic database design and its advantages for occupational health.

REVIEW OF NOHIMS

In order to provide the information needed to coordinate the components of the Navy's occupational health program, NOHIMS utilizes a database consisting of several types of data entered into the system on an ongoing basis and a set of reference tables that make it possible to interpret the significance of a particular element of data. For example, the measured amount of a contaminant found in the workplace needs to be compared to a table of Threshold Limit Values* to determine if the exposure level presents a health risk to workers. Similarly, the result of a laboratory test on a patient needs to be referred to the range of normal values for that test to determine if the patient's result is abnormal. Thus, raw data supplied to NOHIMS need to be placed in a context that can provide a reference for appropriate interpretation and evaluation. Finally, it should be noted that these tables are dynamic because they are readily modified to reflect any changes in recognized standards.

Once raw data have been compared to standard reference points, it becomes possible to compile various reports and to exchange this information on a timely basis. This fundamental flow of information through NOHIMS from the collection or capture of raw data to the interpretation and evaluation of these data and their compilation in a report to users is shown in Figure 1.

Figure 1 shows that there are three basic types of data that comprise the NOHIMS database---personnel data (worker histories), environmental data (industrial activities, workplace environments, and hazards), and medical data (medical histories, physical exam results, and the results of laboratory tests). The reference tables utilized by NOHIMS to interpret and evaluate a particular element of data are a table of Threshold Limit Values* (TLV), a table of job titles, a required medical surveillance table, and the range of normal limits for lab test results.

NOHIMS provides six key reports. The first of these, the Industrial Hygiene Survey Report, is generated from both personnel and environmental survey data with input from the TLV and job titles tables. The three major users of this report are the industrial hygienist, the safety specialist, and the work center supervisor. When workers have been exposed to a hazardous substance or agent, NOHIMS notifies the occupational health physician of individual exposures in a second reporting function. The third report, the Patient Data Sheet, is a summary generated from the patient's medical history, pertinent recent medical data, and exposure data, with additional input from the job titles table, the table of required medical surveillance, and the range of normal limits for lab test results. This report is prepared for the occupational health physician before each scheduled patient visit, but may also be requested on demand for walk-in or emergency visits.

* Registered trademark of the American Conference of Governmental Industrial Hygienists.
Figure 1. The Navy Occupational Health Information System (NOHIMS).
In a fourth reporting function facilitated by NOHIMS, the occupational health physician, after examining a patient, provides medical certification that the worker is fit or unfit to perform his or her job. This certification is sent to the work center supervisor where the employee works. The fifth report prepared by NOHIMS, a monthly Compliance Report, utilizes personnel data and medical encounter data to monitor compliance with the required medical surveillance program. This report is forwarded to the Naval Regional Medical Center. Finally, NOHIMS presently produces the Medical Services and Outpatient Morbidity Report (NAVMED 6300/1) and the Report of Occupational Health Services (NAVMED 6260/1). However, the capability for generating additional reports or modifying the ones presently produced is a feature of NOHIMS.

CONTENT AND STRUCTURE OF NOHIMS DATABASES

A detailed presentation of the types of information contained in the NOHIMS database is shown in Figure 2. In this figure, personnel data (worker histories) and environmental data (industrial activities, work place environments, and hazards) have been subsumed under the more general label of industrial data on the worker population. Industrial data are transmitted as needed to the medical data portion of the NOHIMS database via the database access pathway. In order to assure the security of medical data on the patient population, the industrial data portion of the NOHIMS database cannot access medical data. Only those elements of medical data needed by the NOHIMS file structure are extracted by NOHIMS from the medical data portion of the database and then cross-referenced to appropriate data elements in the industrial data portion of the database.

The software for NOHIMS is written in the American National Standards Institute (ANSI) standard MUMPS programming language. MUMPS is a high level interpreter language specifically designed to efficiently create and manipulate text string transaction data and to provide a self-optimizing hierarchical disk file structure. MUMPS provides database management as well as information storage and retrieval capability, and is compatible with on-line time-sharing. The language has the unique capability to execute MUMPS code indirectly from variables, arrays, and file structures as well as to alter its own in-memory or stored coding. These language attributes are of critical importance in the NOHIMS design. They allow for functionally independent modules that can be either self-modifying or generated by the system itself according to specified parameters. This is necessary so that NOHIMS will have the flexibility required to adapt such a general processing system to a variety of potential site parameters with reasonable implementation effort and maintain operational efficiency and functional integrity.
Figure 2. Types of information contained in the NOHIMS database.
NOHIMS affords users the opportunity to interact with the information system at increasing levels of specificity by making choices from a hierarchical series of option menus. For users who do not wish to interact directly with the system, their information requirements can be ascertained by a NOHIMS representative and then provided as needed.

Figure 3 shows a display of the first-level menu in NOHIMS which provides the user with a choice of eleven primary system options. The first five of these options concern system functions performed on patient data—registering and scheduling patients, and entering, displaying, and printing medical data. The sixth option allows the user to generate standard or individually tailored reports. The seventh option is used by the systems manager to maintain and modify certain aspects of NOHIMS operation. Option 8, the mailbox option, allows NOHIMS users to leave messages for each other in the information system. The ninth and tenth options contain all of the laboratory data functions such as entering and editing lab orders and results, and reviewing and printing lab results and reports. Selection of the eleventh and last primary system option takes the user to a second-level menu which displays the six occupational health information options that are available, as displayed in Figure 4. Selection of any second-level option takes the user to a third level of choices and so on until the user reaches the exact level of detail needed for interacting with NOHIMS.

NOHIMS is applicable to small, large, or very large industrial settings. For a small application, NOHIMS can be implemented on a mid-sized minicomputer running standard MUMPS software such as a Digital Equipment Corporation (DEC) PDP-11/24. A large minicomputer configuration, such as a DEC PDP-11/70, with appropriate telecommunications would be required to implement a large NOHIMS application. A very large NOHIMS application would require a large mainframe computer with virtual memory, such as a DEC VAX, along with an elaborate communications network for linking occupational health data from a variety of sources.
REGISTRATION
SCHEDULING
ENTER MEDICAL DATA
DISPLAY MEDICAL DATA
PRINT MEDICAL DATA
REPORT GENERATOR
SYSTEMS MAINTENANCE
MAILBOX
OE/RR REPORTS
LAB OE/RR REPORTS
OCCUPATIONAL HEALTH INFORMATION

Figure 3. NOHIMS Primary System Options (First-Level Menu).
ACTIVITIES DATA
PERSONNEL DATA
ENVIRONMENT DATA
SURVEY DATA
HAZARD DATA
MAINTENANCE

Figure 4. Occupational Health Information Options in NOHIMS (a Second-Level Menu).
KEY NOHIMS FEATURES

The key features of the NOHIMS design that make it attractive for implementing an occupational health information system are its extensive flexibility and adaptability; its "user friendly" nature; its transferability from one Navy industrial facility to another; its applicability to small, large, or very large industrial settings; and its ability to link occupational health data from a variety of sources in a network of separate, distributed databases.

Flexibility and Adaptability

The omnibus cross-referencing feature of NOHIMS is one of the main characteristics of the system that assures its maximum flexibility and adaptability. Figure 5 depicts the pervasive multiple cross-referencing of data elements in the industrial data portion of the NOHIMS database. The NOHIMS file structure provides pointers from one type of data element to another so that it is possible to track workers by social security number through their entire work history and medical encounters. Thus it is possible to retrieve all of the environments in which an employee has worked, the industrial activities employing the worker, the dates and time spent in each work environment, hazards existing in these various work places, protective gear issued to the worker, levels of exposure to hazardous substances and agents, medical surveillance required for the worker, plus medical history and the results of physical exams and laboratory tests.

Because of the vast flexibility inherent in the design of NOHIMS and its extensive cross-referencing capability, it is possible to ask a virtually unlimited number of questions of the system. Some examples of the kinds of questions that NOHIMS is capable of answering are provided below.

- What hazards are contained in a particular environment?
- For a particular hazard*, what environments contain this hazard?
- For a particular environment, have workers there been exposed to any hazards? If so, who was exposed? To which hazards? When? How much? Does the amount of the exposure exceed the TLV for that substance?

* A hazard can be identified by just a few leading characters of its name or by a few leading characters of any of its synonyms.
Figure 5. The Pervasive Multiple Cross-Referencing of Data Elements in the NOHIMS Database.
- Which environments have experienced exposures of a particular hazardous substance? When? In which of these environments did the exposure exceed the TLV for that substance?

- In what environments has a particular employee worked? Did any of these environments contain hazards? If so, which hazards? Has the worker been exposed to any of these hazards at a level that exceeded the TLV? If so, when?

- For a particular environment, what employees work there?

- For a worker exposed to a hazardous substance, what are the values of a particular lab test over time used to monitor that worker's state of health?

- What workers have been exposed to, say, asbestos in the last year? In what environments were they working when exposed?

- What is the incidence of, say, dermatitis in a particular workplace environment over time (to be related to a list of contaminants or hazards present in that environment at different times)?

- What is the incidence of, say, respiratory ailments among all patients seen at a particular branch clinic during the past month compared to the incidence in the preceding 12 months (to be related to exposure data and to seasonal variations)?

The list of questions enumerated above certainly is not exhaustive, but it is illustrative of what inquiries can be posed to NOHIMS. Many additional queries are possible.

Other features in addition to the omnibus cross-referencing capability also contribute to making NOHIMS flexible and adaptable. The organization of each activity is defined in NOHIMS according to hierarchical organizational levels regardless of how scattered geographically they may be or how large or small the activity may be. Activities do not have to change how they do business to mesh with NOHIMS requirements. Each activity may use its own organizational names, acronyms, and codes, and NOHIMS will keep track of it all. If the organization of an activity changes, NOHIMS can be updated to reflect the reorganization, while not forgetting the time period covered by the previous organization. Thus, for example, work shops may be combined or a new shop maybe be added, and NOHIMS will keep track of this organizational history.
Furthermore, an array of entities may be defined as industrial activities. The following list of activities demonstrates this broad flexibility.

- Naval Ship
- Naval Air Rework Facility
- Shipyard
- Public Works Center
- A Laboratory

Similarly, a wide variety of work places, occupations, or events may be defined as an environment. The first three examples listed below reflect more conventional environments.

- Building No. 0028, Shop 65217
- The Forward Engine Room of a Ship
- A Paint Booth
- The Delivery Route of a Driver
- Runway 23 Ramp
- Industrial Hygienist
- Safety Specialist
- A Chemical Spill

**User Friendly**

NOHIMS has been created as a "user friendly" system and incorporates extensive user help, aids, and explanation techniques. This feature is of particular importance since the use, operation, and system maintenance schema of NOHIMS are devoid of requirements for professional ADP personnel as integral or essential to the successful operation of any aspect of the information system.
Transferability

NOHIMS' extreme flexibility will allow it to be quickly adapted to a variety of settings and sites such as a naval air rework facility or a naval shipyard. The NOHIMS software is exportable and can be used with any computer hardware that can run standard MUMPS software.

Wide Range of Applicability

NOHIMS is equally applicable to small industrial settings and to large ones as shown in Figures 6a and 6b. Figure 6a portrays a minimal NOHIMS configuration consisting of one naval industrial facility and one Navy branch clinic. A large NOHIMS configuration serving an entire Navy medical region is depicted in Figure 6b. A large configuration might include a number of naval industrial facilities such as a NARF, a shipyard, a public works center, plus any other industrial facilities existing in that medical region as well as several Navy branch clinics. Note once again in Figures 6a and 6b that the security of medical data on the patient population is protected in the NOHIMS design. Only those elements of medical data needed by the file structure are extracted by NOHIMS from the medical data portion of the database and then cross-referenced to appropriate data elements in the industrial data portion of the NOHIMS database.
Figure 6a. A Minimal NOHIMS Configuration: One Naval Industrial Facility and One Navy Branch Clinic.

Figure 6b. A Large NOHIMS Configuration Serving an Entire Navy Medical Region.
SUPPLYING INFORMATION TO NOHIMS

Information is supplied to NOHIMS in two ways. First, an occupational health file is constructed from personnel, environmental, and medical data. Two data collection forms facilitate the entry of these data into NOHIMS—the Industrial Hygiene Survey Form, developed by the San Diego NRMC Environmental Health Service, and the Medical Encounter Form.

The basic Industrial Hygiene Survey Form consists of ten pages. However, page 6 is an enclosure which must be completed for each material found in a work environment. An example of this form is included as Appendix A. It should be noted that once an initial survey has been conducted and the findings entered into NOHIMS, the information system generates the Industrial Hygiene Survey Report, which can be used as a starting point for conducting the next periodic resurvey. Similarly, NOHIMS can use the existing database to complete SECTION 5 - PERSONNEL prior to conducting the actual survey.

A Medical Encounter Form for use in Navy branch clinics was designed to expedite the ongoing entry of medical data into NOHIMS. An example of this form is shown in Figure 7. Many of the categories present on the NAVMED 6300/1 and NAVMED 6260/1 report forms were expanded, and this expansion is most notable in the augmented list of injuries, illnesses, and symptoms. The expanded list of categories permits a comparison of the data obtained with data coded according to the ICDA (International Classification of Diseases—Adapted) codes or with a variety of other coding schemes.

In addition to the entry of personnel, environmental, and medical data, the data contained in the various NOHIMS reference tables must be entered initially and then kept updated. Two specially designed forms facilitate the entry of NOHIMS reference table data—the Hazard Characteristics Profile and the Medical Requirements Data Sheet.

The nature of the hazards existing in a particular work environment and worker exposure to these hazards dictates the medical requirements for monitoring these workers. NOHIMS contains a Hazard Characteristics Profile for each identified hazard. This profile, an example of which is shown in Figure 8, includes any synonyms for the hazardous substance, mode of entry, exposure limits, body parts/organ systems affected, and the suggested length of medical follow-up after exposure. This profile could also contain additional information such as the molecular weight of the hazardous substance and indicated emergency treatment after exposure.

The Medical Requirements Data Sheet shown in Figure 9 is filled out for each hazardous substance that is identified. It is a work sheet for systematically recording the type, extent, and frequency of medical surveillance required for employees working in areas containing the material or hazard, and whether this surveillance is mandatory. Thus, together the Hazard Characteristics Profile and the corresponding Medical Requirements Data Sheet for the hazard determine the type, extent, and frequency of medical surveillance required and provide the basic data needed for establishing and maintaining the required medical surveillance table in NOHIMS.
### Patient Information (to be filled by patient)

1. Name: [ ]
2. Address: [ ]
3. Social Security Number: [ ]
4. Condition: [ ]
   - [ ] Very
   - [ ] Better
   - [ ] Dependable
   - [ ] Other
5. Date of Birth: [ ]
6. Age: [ ]
7. Sex: [ ]
8. Next of Kin: [ ]

### Visit Type (check any that apply)

- [ ] New Patient
- [ ] Follow-up
- [ ] Other

### Use in Navy Branch Clinics

<table>
<thead>
<tr>
<th>Date Of Birth</th>
<th>Place Of Birth</th>
<th>Race</th>
<th>Religion</th>
</tr>
</thead>
<tbody>
<tr>
<td>19[redacted]</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
</tr>
</tbody>
</table>

### Initial Examination

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Head</td>
</tr>
<tr>
<td>2</td>
<td>Neck</td>
</tr>
<tr>
<td>3</td>
<td>Eyes</td>
</tr>
<tr>
<td>4</td>
<td>Ear</td>
</tr>
<tr>
<td>5</td>
<td>Nose</td>
</tr>
<tr>
<td>6</td>
<td>Throat</td>
</tr>
<tr>
<td>7</td>
<td>Upper Airway</td>
</tr>
<tr>
<td>8</td>
<td>Neck</td>
</tr>
<tr>
<td>9</td>
<td>Shoulder</td>
</tr>
<tr>
<td>10</td>
<td>Upper Limbs</td>
</tr>
<tr>
<td>11</td>
<td>Chest</td>
</tr>
<tr>
<td>12</td>
<td>Left Lungs</td>
</tr>
<tr>
<td>13</td>
<td>Right Lungs</td>
</tr>
</tbody>
</table>
SUBSTANCE: 
SYNONYMS: 
CODE: 
CAS 
NIRQH 
NI|RC 
NIRQC MATERIAL CODE 
STATUS: 
( ) Prohibited 
( ) Carcinogen 
( ) Special Handling 
( ) Restricted 
( ) Navy Unique 
( ) Other 
MODE OF ENTRY: 
( ) Skin 
( ) Ingestion 
( ) Inhalation 
( ) Auditory 
BIOLOGICAL 1/2 TIME: 
(Suggested Length of Follow-up after Exposure)
( ) < 1 year 
( ) 1 - 3 years 
( ) 4 - 7 years 
( ) 8 - 15 years 
( ) > 15 years 
TARGET ORGANS: 

<table>
<thead>
<tr>
<th>BODY PART/ORGAN SYSTEM AFFECTED</th>
</tr>
</thead>
<tbody>
<tr>
<td>Auditory</td>
</tr>
<tr>
<td>Breast</td>
</tr>
<tr>
<td>Cardio-vascular</td>
</tr>
<tr>
<td>Ear, Nose, and Throat</td>
</tr>
<tr>
<td>Endocrine</td>
</tr>
<tr>
<td>Eyes</td>
</tr>
<tr>
<td>Gastrointestinal</td>
</tr>
<tr>
<td>Hematologic (Blood, Bone, Marrow)</td>
</tr>
<tr>
<td>Hepatic (Liver)</td>
</tr>
<tr>
<td>Lymphatics</td>
</tr>
<tr>
<td>Mouth and Teeth</td>
</tr>
<tr>
<td>Musculo-skeletal</td>
</tr>
<tr>
<td>Nasal Cavity</td>
</tr>
<tr>
<td>Nervous System</td>
</tr>
<tr>
<td>Central</td>
</tr>
<tr>
<td>Peripheral</td>
</tr>
<tr>
<td>Neurologic</td>
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</table>

EXPOSURE LIMITS 

<table>
<thead>
<tr>
<th>PARTS PER MILLION (PPM)</th>
</tr>
</thead>
<tbody>
<tr>
<td>TLV</td>
</tr>
<tr>
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</tr>
</tbody>
</table>

<table>
<thead>
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<th>OTHER SPECIFY</th>
<th>THE STANDARD</th>
</tr>
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KILLCRAGNS PER CUBIC METER (NC/M³) 

<table>
<thead>
<tr>
<th>PARTS PER MILLION (PPM)</th>
</tr>
</thead>
<tbody>
<tr>
<td>TLV</td>
</tr>
<tr>
<td>-----</td>
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</table>

<table>
<thead>
<tr>
<th>OTHER SPECIFY</th>
<th>THE STANDARD</th>
</tr>
</thead>
</table>

COMMENTs: 

Figure 8. NOHIMS Hazard Characteristics Profile.
### Medical Surveillance Required For:

- All those working regulated area
- All those exposed to at or above TWA
- All those exposed to at or above PEL or other action level without regard to use of respirator

### Medical History

- Personal Medical History
- Family History
- Previous Medical History

### Physical Exam

- Physical Exam
- Physical Exam

### Laboratory Tests

- Laboratory Tests

### Additional

- Other Tests
- Other Tests

---

**Figure 9. NOHIMS Medical Requirements Data Sheet.**

<table>
<thead>
<tr>
<th>Block Number</th>
<th>NOHIMS Code</th>
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<td>100</td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Preplacement Annual Semi-Annual Quarterly Number of years Upon exposure/emergency DMRP* Termination</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male only Female only Action TWA STEL</td>
</tr>
</tbody>
</table>
There are multiple users of NOHIMS data and reports as was shown earlier in Figure 1 (page 3). These users are industrial hygienists, safety specialists, occupational health care providers, work center supervisors, managers of Navy occupational safety and health programs, and finally, medical researchers and epidemiologists.

The Industrial Hygiene Survey Report (IHSR) is of particular value to the industrial hygienists. During a routine resurvey of a work area, the IHSR can serve as a guide or reference. The hygienists would know what contaminants to expect and be able to determine immediately what contaminants had been introduced recently. Special attention then could be given to the procedures used in handling the new materials. In addition, the IHSR would provide the hygienists with a list of personnel said to be assigned to the area of the survey. This list could be used to verify that information and to check on the medical certification of the employees.

The IHSR is also of special interest to the safety specialists. Information contained in this report, for example, would provide a cross check between worker training and the handling of hazardous materials.

The occupational health physician receives notification of individual exposures from NOHIMS. For those workers requiring medical surveillance, NOHIMS generates a Patient Data Sheet before each scheduled visit. The Patient Data Sheet is a summary of the patient's medical history, pertinent recent medical data, exposure data, and the type of medical surveillance required. An example of a Patient Data Sheet for a hypothetical patient is shown in Figure 10. When the patient arrives at the branch clinic, the occupational health nurse initiates the taking of an occupational health history, which the occupational health physician completes during the patient encounter. After the encounter, the physician certifies whether or not the patient is medically qualified to work in a particular work place. NOHIMS also can be used to generate in advance any required lab kits used by the occupational health technician in performing lab tests during a patient visit.

The work center supervisor constantly monitors the work situation, sending new workers or workers with new assignments to a Navy branch clinic for medical certification and to training sessions to learn proper work procedures. The work center supervisor receives notice of medical certification from NOHIMS and obtains information regarding the presence of hazardous substances in the work place through the Industrial Hygiene Survey Report.
**PATIENT DATA SHEET**

- **ANNUAL EXAM**

11 MAY 1982

**NAME:** JOHNSON, KATHY L
**SSN:** 555-99-8614
**SEX:** FEMALE
**AGE:** 23
**BIRTHDATE:** 12 MAY 1959

---

**WORK ENVIRONMENT**

<table>
<thead>
<tr>
<th>HRS/WEEK</th>
<th>JOB TITLE</th>
</tr>
</thead>
<tbody>
<tr>
<td>12/1/81</td>
<td>LOADING DOCK W. OF BLDG. 0094</td>
</tr>
<tr>
<td>6/19/81</td>
<td>BLDG: 0094 SHOP: 36112</td>
</tr>
</tbody>
</table>

---

**WORK PLACE HAZARDS**

<table>
<thead>
<tr>
<th>CONTAMINANT</th>
<th>EXPOSURE LEVEL</th>
<th>CURRENT LEVEL</th>
<th>PERCENT OF TLV</th>
</tr>
</thead>
<tbody>
<tr>
<td>AMMONIA</td>
<td>20 PPM</td>
<td>25 PPM</td>
<td>80</td>
</tr>
<tr>
<td>XYLENE</td>
<td>17 PPM</td>
<td>100 PPM</td>
<td>17</td>
</tr>
</tbody>
</table>

---

**PATIENT SUMMARY**

---

**REASON FOR VISIT**

6/19/81 PREPLACEMENT EXAM

**PROBLEMS**

MINOR

HX, TOBACCO USE

**PHYSICAL EXAM**

<table>
<thead>
<tr>
<th>VARIABLE</th>
<th>RESULT</th>
<th>DATE</th>
</tr>
</thead>
<tbody>
<tr>
<td>TEMPERATURE</td>
<td>98.4</td>
<td>6/19/81 SMITH, M</td>
</tr>
<tr>
<td>PULSE</td>
<td>80</td>
<td>6/19/81 SMITH, M</td>
</tr>
<tr>
<td>RESPIRATORY RATE</td>
<td>20</td>
<td>6/19/81 SMITH, M</td>
</tr>
<tr>
<td>BLOOD PRESSURE</td>
<td>112/72 LEFT ARM</td>
<td>6/19/81 SMITH, M</td>
</tr>
<tr>
<td>HEIGHT</td>
<td>63</td>
<td>6/19/81 SMITH, M</td>
</tr>
<tr>
<td>WEIGHT</td>
<td>104</td>
<td>6/19/81 SMITH, M</td>
</tr>
</tbody>
</table>

**PROCEDURES**

6/19/81 CHEST X-RAY

NORMAL

6/19/81 PULMONARY FUNCTION TESTS

FEV 1.0: 5.1 L/M (98% PRED)
FVC: 3.0 L (103% PRED)

**DISPOSITIONS**

6/19/81 SMITH, M MEDICALLY QUALIFIED FOR JOB PLACEMENT

---

*Figure 10. Example of a Patient Data Sheet Generated by NOHIMS.*
HEALTH EFFECTS OF WORK PLACE HAZARDS (SUMMARY)

KIDNEY DAMAGE
BLOOD CHANGES (SUSPECT)
LIVER DAMAGE
CNS NARCOSIS
SKIN
IRRITATION
BURNS
MUCOUS MEMBRANES (EYES, NOSE, ORAL CAVITY)
IRRITATION
INJURY
RESPIRATORY TRACT
IRRITATION
CHEST CONSTRICTION
PULMONARY EDEMA

MEDICAL SURVEILLANCE APPROACH RECOMMENDED

HISTORY, ESPECIALLY FOR:
PERSONAL HISTORY OF:
ALCOHOL INGESTION
EXPOSURE TO IRRITANTS
HOBBIES INVOLVING EXPOSURE TO AMMONIA OR OTHER IRRITANTS
EXPOSURE TO CHEMICALS CAUSING DAMAGE TO:
KIDNEYS
LIVER
WORK HISTORY OF:
PREVIOUS EXPOSURE TO AMMONIA OR OTHER IRRITANTS
EXPOSURE TO IRRITANT CHEMICALS
EXPOSURE TO CHEMICALS AFFECTING:
KIDNEYS
LIVER
PAST MEDICAL HISTORY AND REVIEW OF SYSTEMS:
KIDNEY DISEASE
LIVER DISEASE
ESP. CIRRHOSIS OF THE LIVER
SKIN
DISEASES
IRRITATION
MUCOUS MEMBRANES (EYES, NOSE, ORAL CAVITY)
DISEASES
DISORDERS
SYMPTOMS
RESPIRATORY TRACT
DISORDERS
SYMPTOMS
NEUROLOGICAL DISORDERS/SYMPTOMS
CONFUSION
IRRITABILITY

Figure 10. Example of a Patient Data Sheet
Generated by NOHIMS (Cont.).
PHYSICAL EXAMINATION, ESPECIALLY:
- SKIN DISEASE
- IRRITATION
- MUCOUS MEMBRANES (EYES, NOSE, ORAL CAVITY) DISEASE
- IRRITATION
- RESPIRATORY TRACT DISEASE
- IRRITATION
- LIVER
- HEPATOMEGALY DISEASE
- KIDNEYS
- DISEASE
- NEUROLOGICAL DISEASE
- TOXICITY

TESTS AND PROCEDURES:
- COMPLETE BLOOD COUNT WITH DIFFERENTIAL LEUKOCYTE COUNT
- KIDNEY FUNCTION TESTS:
  - BUN AS CLINICALLY INDICATED
  - SERUM CREATININE AS CLINICALLY INDICATED
- URINALYSIS, COMPLETE
- PULMONARY FUNCTION TESTS:
  - FORCED EXPIRATORY VOLUME (FEV1.0)
  - FORCED VITAL CAPACITY (FVC)
- CHEST X-RAY AS CLINICALLY INDICATED

* * * COMMENTS * * *

AMMONIA IS AN IRRITANT OF THE EYES, NOSE, THROAT AND SKIN. SYMPTOMS RANGE FROM MILD TO MODERATE IRRITATION AT LOW CONCENTRATIONS. EXPOSURE TO AND INHALATION OF HIGHER CONCENTRATIONS CAUSE SEVERE CORNEAL IRRITATION, DYSPNEA, BRONCHOSPASM, CHEST PAIN, AND POTENTIALLY FATAL PULMONARY EDEMA. MEDICAL SURVEILLANCE CENTERS ON THE SYSTEMS INVOLVED, AND INCLUDES A BASELINE CHEST X-RAY AND PERIODIC PULMONARY FUNCTION TESTS.

**********

XYLENE IS A COLORLESS LIQUID USED AS A SOLVENT. IT HAS NUMEROUS EFFECTS. THE VAPOR IS AN IRRITANT OF THE MUCOUS MEMBRANES (EYES, NOSE, ORAL CAVITY) AND SKIN. HIGHER CONCENTRATIONS CAN PRODUCE GASTRO-INTESTINAL SYMPTOMS (NAUSEA, VOMITING, ABDOMINAL PAIN) AND CNS SYMPTOMS (DIZZINESS, EXCITEMENT, DROWSINESS, INCOORDINATION, ATAXIA). AT VERY HIGH CONCENTRATIONS RESPIRATORY EFFECTS (PULMONARY EDEMA) MAY RESULT. ALSO SOME HEMATOPOIETIC DEPRESSION AS WELL AS LIVER AND KIDNEY EFFECTS HAVE BEEN NOTED. MEDICAL SURVEILLANCE EMPHASIS IS ON THE SYSTEMS AFFECTED. TESTS AND PROCEDURES INCLUDE BASELINE CHEST X-RAY, PERIODIC LIVER FUNCTION TESTS, CBC, AND URINALYSIS. IF SEVERE EXPOSURE IS SUSPECTED, SEE EXTENSIVE COMMENTS SECTION.

**********

Figure 10. Example of a Patient Data Sheet Generated by NOHIMS (Cont.).
The medical data portion of the NOHIMS database contains all of the information needed to prepare two management reports---NAVMED 6300/1 and NAVMED 6260/1. These reports are prepared for each Navy branch clinic, with copies forwarded to BUMED. A monthly Compliance Report, based on personnel and medical encounter data, informs management at the Naval Regional Medical Center of the proportion of workers in the region who are in compliance with their required medical surveillance. In addition, as the need may arise, specially requested reports can be prepared for managers of Navy occupational safety and health programs using the versatile features of the NOHIMS report generator.

Finally, on either a formal or informal basis there is a medical research function which first monitors illness and the laboratory results of medical examinations in order to detect any trend toward increased illness among groups of employees. Upon the identification of any such trend, demographic and environmental correlates are investigated in an attempt to identify causal factors. Consequently, the NOHIMS database is a rich source of valuable data for medical researchers and epidemiologists.
APPENDIX A

INDUSTRIAL HYGIENE SURVEY FORM
From: Commanding Officer
To: Commanding Officer, San Diego, CA
Subj: Industrial hygiene survey of
Ref: ( ) Survey request from on (date)

( ) OPNAVINST 5100.23A, Navy Safety and Occupational Health Program; implementation of 23 January 1981
( ) "Industrial Ventilation - A Manual of Recommended Practice," American Conference of Governmental Industrial Hygienists
( ) OPNAVINST 6260.2, Noise Control and Hearing Conservation, 20 Sep 79
( ) Occupational Safety and Health, General Industry Safety and Health Standards, (29 CFR 1910)
( ) NAVRECMEDCEN SDIEGO Instruction 6260.1A, Mandatory medical evaluations of Naval employees exposed to hazardous workplace conditions or substances, 27 Apr 79
( ) NIOSH Manual of Sampling Data Sheets, Department of Health, Education, and Welfare (NIOSH) Publication Number 77-159
( ) Industrial Health and Safety Criteria for Abrasive Blastcleaning Operations - NIOSH
( ) NAVFACINST 11300.2B, Utilization of Industrial Compressed Air Systems for Supplying Breathing Air
( ) OPNAVINST 6260.1A, Control of Asbestos Exposure to Naval Personnel and Environments, 8 Aug 78
( ) BUMED 6260.1A, Isocyanates: Measures for control of health hazards related to, 27 May 77
( ) NAVFACINST 6260.2, Reviews for health hazards during facilities design process, 9 Mar 81
( ) Other Specify

Encl: ( ) Industrial Hygiene Baseline Data
( ) Occupational Hazard Data Sheet
( ) Ventilation Survey
( ) Noise Survey
( ) Air Sampling Data
Subj: Industrial hygiene survey of

Encl: ( ) Evaluation of Data and Recommendations for Control
( ) Other
( )

1. In accordance with reference (a), the subject survey was performed by

of this command on _________________. References ( ) through ( ),

were used as guidelines for sampling and analysis. Enclosures ( ) through

( ) include a description of the shop area, and industrial hygiene and

control technology evaluations.

2. Instruments used during this survey were a:

______ Quest Sound Level Meter Type II No. ______, calibrated on ____________

and prior to use.

______ Alnor Velometer Model No. 60000-P No. 6, calibrated ________________

______ Dupont brand low/high flow personal sampling pumps calibrated prior

to and post sampling with a ____________ filter/tube.

______ Sound Level Meter Type I Octave Band Analyzer

No. ____________, calibrated on ____________ and prior to use.

______ Bruel and Kjaer Noise Dosimeters, calibrated on

and prior to use.

______ Other

3. Please inform the Environmental Health Service (Code JL), NRMC San Diego

of your subject correction plans. The contact point is ________________ at


T. V. McManamon
By direction

Copy to:

Safety Office
Division Director
Shop Supervisor
SMO
PMT

A-2
INDUSTRIAL HYGIENE BASELINE DATA

SURVEY NUMBER: __________________________
POINT OF CONTACT: ________________________
PHONE NO.: _________________________________
SURVEY TYPE:
   Initial Comprehensive ( )
   Periodic Comprehensive ( )
   Emergency ( )
   Other (specify) ___________________________

DATE: ________________________ UIC: ________________________

LOCATION: ____________________________ ACTIVITY: ____________________________

BLDG No. __________ DEPT: __________________________ DIVISION: ______________________
BRANCH: __________________________ SHOP CODE: __________________________ ROOM: ______________________

2. SPACE: This survey includes the areas listed below:

   Work Area Dimensions

<table>
<thead>
<tr>
<th>Width</th>
<th>Length</th>
<th>Height</th>
<th>IDENTIFICATION (include drawing if necessary)</th>
</tr>
</thead>
<tbody>
<tr>
<td>______</td>
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<td>____________________________________________</td>
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<tr>
<td>______</td>
<td>______</td>
<td>______</td>
<td>____________________________________________</td>
</tr>
</tbody>
</table>

3. PERSONNEL:

   Male  Female  Total

   Military ____________ ____________ ____________
   Civilian ____________ ____________ ____________
   Total ____________ ____________ ____________

   Job Description Number of Employees

   ____________________________________________ ____________
   ____________________________________________ ____________
   ____________________________________________ ____________
   ____________________________________________ ____________
   ____________________________________________ ____________
   ____________________________________________ ____________
4. **WORKLOAD:**

Number of shifts per day:  

Number of hours worked per day:  

Number of days worked per week:  

Number of manhours over time per week:  


5. **OPERATIONS/PROCEDURES:**

Job tasks performed can be described as follows: (Indicate the degree of confinement, whether the generation is continuous or intermittent, etc.)

Personnel with extraordinary exposures:

<table>
<thead>
<tr>
<th>Name</th>
<th>Rate/Series</th>
<th>Job Title</th>
<th>SSN</th>
<th>Exposure</th>
<th>Symptoms</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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<td></td>
</tr>
</tbody>
</table>
### 6. CONTROLS:

#### A. ENGINEERING

<table>
<thead>
<tr>
<th>Effectiveness of Controls (%)</th>
<th>List Locations</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-20</td>
<td></td>
</tr>
<tr>
<td>21-40</td>
<td></td>
</tr>
<tr>
<td>41-60</td>
<td></td>
</tr>
<tr>
<td>61-80</td>
<td></td>
</tr>
<tr>
<td>81-100</td>
<td></td>
</tr>
</tbody>
</table>

- **Noise controls are:**
  - 1
  - 2
  - 3
  - 4
  - 5

- **Natural ventilation is:**
  - 1
  - 2
  - 3
  - 4
  - 5

- **General ventilation is:**
  - 1
  - 2
  - 3
  - 4
  - 5

- **Local exhaust ventilation is:**
  - 1
  - 2
  - 3
  - 4
  - 5

- **Degree of isolation is:**
  - 1
  - 2
  - 3
  - 4
  - 5

#### B. PERSONAL PROTECTIVE EQUIPMENT:

<table>
<thead>
<tr>
<th>Required</th>
<th>In use</th>
<th>Effectiveness of Controls (%)</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
</tr>
</tbody>
</table>

- **Eye protection:**
  - Y
  - N
  - Y
  - N
  - 1
  - 2
  - 3
  - 4
  - 5

- **Coveralls:**
  - Y
  - N
  - Y
  - N
  - 1
  - 2
  - 3
  - 4
  - 5

- **Gloves:**
  - Y
  - N
  - Y
  - N
  - 1
  - 2
  - 3
  - 4
  - 5

- **Apron:**
  - Y
  - N
  - Y
  - N
  - 1
  - 2
  - 3
  - 4
  - 5

- **Boots:**
  - Y
  - N
  - Y
  - N
  - 1
  - 2
  - 3
  - 4
  - 5

- **Hearing Protection:**
  - Y
  - N
  - Y
  - N
  - 1
  - 2
  - 3
  - 4
  - 5

- **Respiratory Protection:**
  - Y
  - N
  - Y
  - N
  - 1
  - 2
  - 3
  - 4
  - 5

**Other:**

<table>
<thead>
<tr>
<th>NIOSH/OSHA Approval Number:</th>
</tr>
</thead>
</table>

29 CFR 1910.134 in compliance ______ Yes ______ No

Enclosure ( )
**Occupational Hazard Data Sheet**

**Hazard:** ____________________________  **TLV:** ____________________________

A. Measured Concentration:

1. **TWA:** __________
2. **Ceiling:** __________
3. **Other (Peak, Crab, STEL):** __________

(Circle appropriate numbers for following)

B. **Mode of Entry:**

1. Skin
2. Ingestion
3. Inhalation
4. Auditory

C. **Process:**

1. Manual
2. Mechanical

D. **Continuity of Process:**

1. Continuous
2. Intermittent
3. Temporary

E. **Type of Sample:**

1. Breathing Zone
2. General Area

F. **Sampling Strategy:**

1. Full single period
2. Partial period
3. Full period consecutive
4. Partial period consecutive
5. Grab

G. **Utilization/Exposures (Hrs/Wk):**

1. 0 - 1 hour
2. 2 - 8 hours
3. 9 - 16 hours
4. 17 - 24 hours
5. 24+ hours

H. **Overall Control Effectiveness:**

1. 81 - 100%
2. 61 - 80%
3. 41 - 60%
4. 21 - 40%
5. 0 - 20%

I. **Exposure Level:**

1. Generally under Action Level
2. Generally between Action Level & TLV
3. Generally between TLV & STEL
4. Often over STEL

J. **Medical Monitoring:**

1. Recommended
2. Not recommended

K. **Potential Hazard Severity:**

1. Catastrophic
2. Critical
3. Marginal
4. Negligible

L. **Mishap Probability:**

1. Likely to occur
2. Probably will occur in time
3. May occur in time
4. Unlikely to occur
VENTILATION SURVEY

1. Sketch and Measurements:

2. Analysis in accordance with reference ( ):

Enclosure ( )
# Noise Survey
(Sound Level Meter Survey)

<table>
<thead>
<tr>
<th>Date (Year, Month, Day)</th>
<th>Type Survey</th>
<th>1-Initial Survey</th>
<th>2-Re-Survey</th>
<th>3-Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sound Level Meter</td>
<td>Manufacturer</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Microphone</td>
<td>Manufacturer</td>
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</tr>
<tr>
<td>Calibrator</td>
<td>Manufacturer</td>
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<td></td>
</tr>
<tr>
<td>Model</td>
<td>Serial No</td>
<td>Model</td>
<td>Serial No</td>
<td>Model</td>
</tr>
<tr>
<td>Last Electroacoustic Calib Date</td>
<td>Year</td>
<td>Month</td>
<td>Day</td>
<td>Last Electroacoustic Calib Date</td>
</tr>
<tr>
<td>Wind Screen</td>
<td>Used</td>
<td>Not Used</td>
<td></td>
<td>Measurements Obtained</td>
</tr>
</tbody>
</table>

**Description of Areas/Duties Where Noise Survey Conducted**

[additional sheet and attach to form]

**Primary Source of Noise**

**Secondary Source of Noise**

**Sound Level Data**

<table>
<thead>
<tr>
<th>Location</th>
<th>Meter Action</th>
<th>dBC</th>
<th>dBA</th>
<th>Risk Assessment Code</th>
<th>None less than 85</th>
<th>Plug or Muff 85-108</th>
<th>Plug and Muff 108-110</th>
<th>Plug + Muff + Time Limit greater than 115</th>
</tr>
</thead>
</table>

**Protection Required** (ref. dBA Level)

**Notes:** Range of levels noted by f; i.e., 102/109. At operator work stations, measure at ear level. Meter Action: Enter F for fast meter action and S for slow meter action.

**Remarks:** (i.e., Area and equipment posted, hearing protection in use, etc.)

**More Detailed Noise Evaluation Required:**

- Yes
- No

(If "YES", identify topic evaluation needed.)

**Name(s) of Persons Identified for Audiometric Monitoring:** (Use additional sheet if more space is needed and attach to form)

**Name, Phone No., and Organization of Supervisor of Noise-Hazardous Area or Operation**

**Survey Performed By**

(Last Name, First Name, III)

**Hearing Conservation Monitor**

(Last Name, First Name, III)

**DD Form 1 SEP 79 2214**

**S/N 0102-LF-002-2140**

**Enclosure ( )**
EVALUATION OF DATA AND RECOMMENDATIONS FOR CONTROL

1. DEFICIENCIES:

<table>
<thead>
<tr>
<th>Management Contribution</th>
<th>Outstanding</th>
<th>Excelent</th>
<th>Good</th>
<th>Fair</th>
<th>Poor</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Worker Education:</td>
<td></td>
<td></td>
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<tr>
<td>Hazard Awareness</td>
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</tr>
<tr>
<td>(chemicals &amp; toxic effects)</td>
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<td>Housekeeping/Personal Hygiene</td>
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<td>Work Practices</td>
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<tr>
<td>(handling &amp; disposal)</td>
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<tr>
<td>Personal Protective Equipment</td>
<td>1 2 3 4 5</td>
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</tr>
<tr>
<td>(if, &amp; when to use &amp; obtain)</td>
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</tbody>
</table>

Unsafe Work Practices:

<table>
<thead>
<tr>
<th>Inadequacies</th>
<th>Standard Applied</th>
<th>Hazard Severity/</th>
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<tbody>
<tr>
<td></td>
<td></td>
<td>Mishap Probability</td>
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</table>

2. RECOMMENDED ACTIONS FOR IMPLEMENTATION:

Enclosure ( )

A-9
RECOMMENDATIONS (Cont'd):

________________________

________________________

________________________

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Enclosure ( )
### Functional Overview of the Navy Occupational Health Information Monitoring System (NOHIMS)

The content of the personnel, environmental, and medical data bases required by the Navy Occupational Health Information Monitoring System (NOHIMS) being developed at the Naval Health Research Center are described in detail. In addition, the overall design of NOHIMS as well as an overview of the functional specifications are discussed and key features of NOHIMS, such as its "user friendly" nature, transferability, and adaptability to settings that range from a very small activity to a large region are described. Attention is also
given to the various users of NOHIMS, and the reports generated for them are reviewed.