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

D. D. BECK & W. M. PUGH

NAVAL HEALTH RESEARCH CENTER - 82-6

REPORT NO. 82-6

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SPECIFICATIONS FOR A NAVY OCCUPATIONAL HEALTH
INFORMATION MONITORING SYSTEM (NOHIMS):

II. A FUNCTIONAL OVERVIEW

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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.

SUMMARY

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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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.

* Pugh, William M., & Beck, Donald D. Preliminary specifications for a Navy Occupational Health Information Monitoring System (NOHIMS) [Report No. 81-36]. San Diego, CA: Naval Health Research Center, 1981.

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 makes it possible to interpret the significance of a particular element of data. For example, the measured amount of a contaminant found in the work place 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, work place 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.

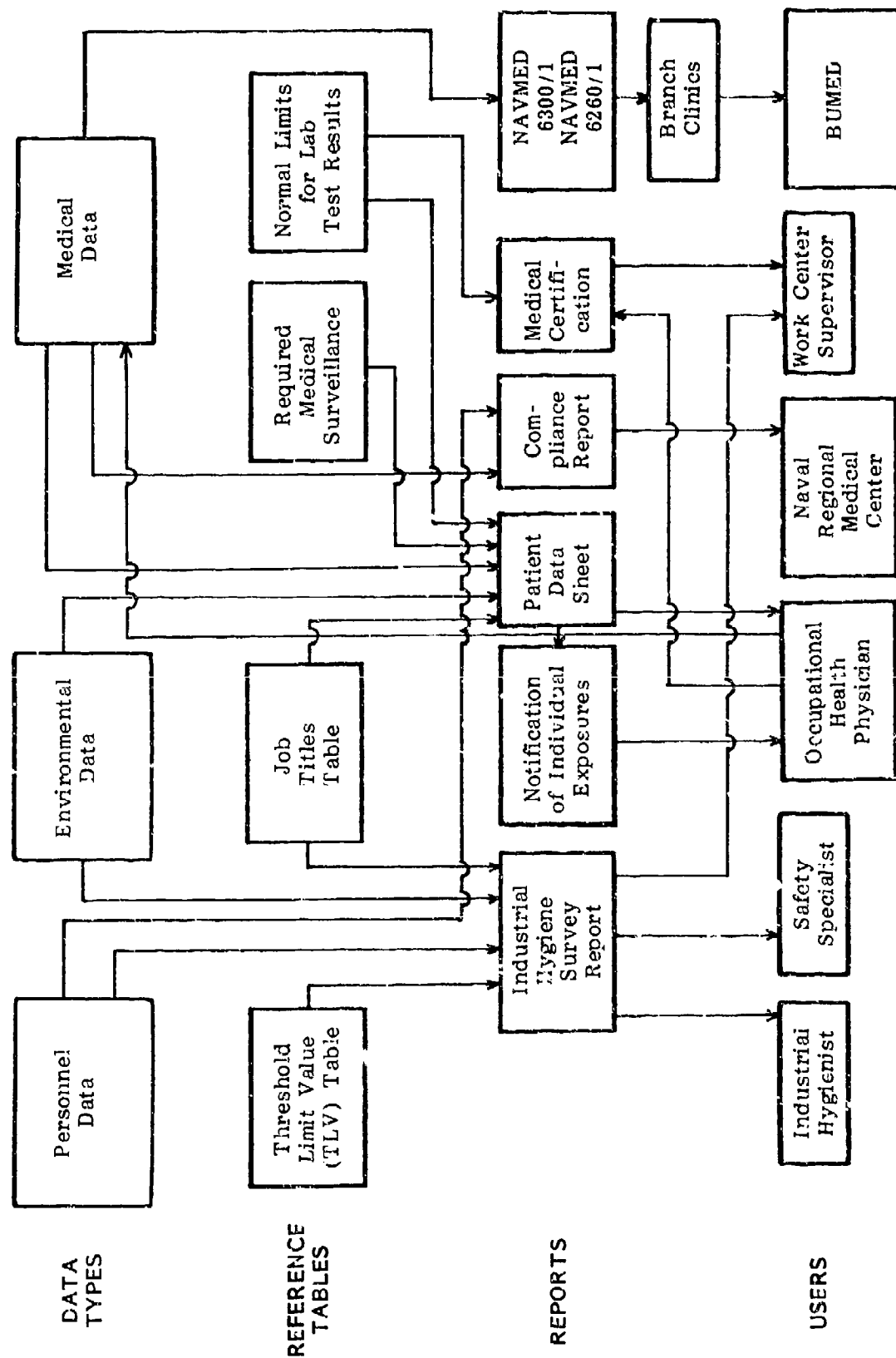


Figure 1. The Navy Occupational Health Information System (NOHIMS).

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.

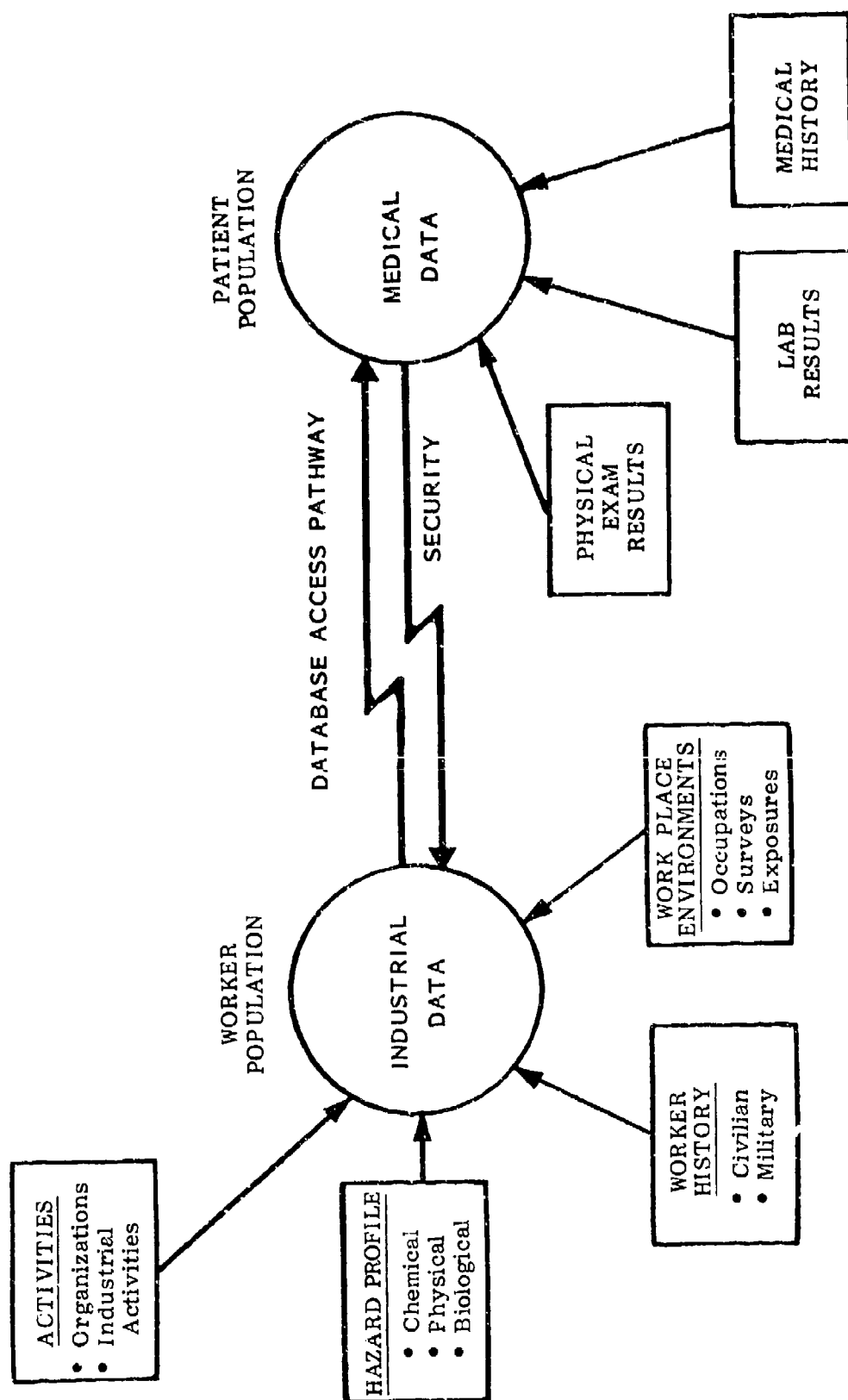


Figure 2. Types of Information Contained in the NOHIMS Database.

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 mini-computer 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.

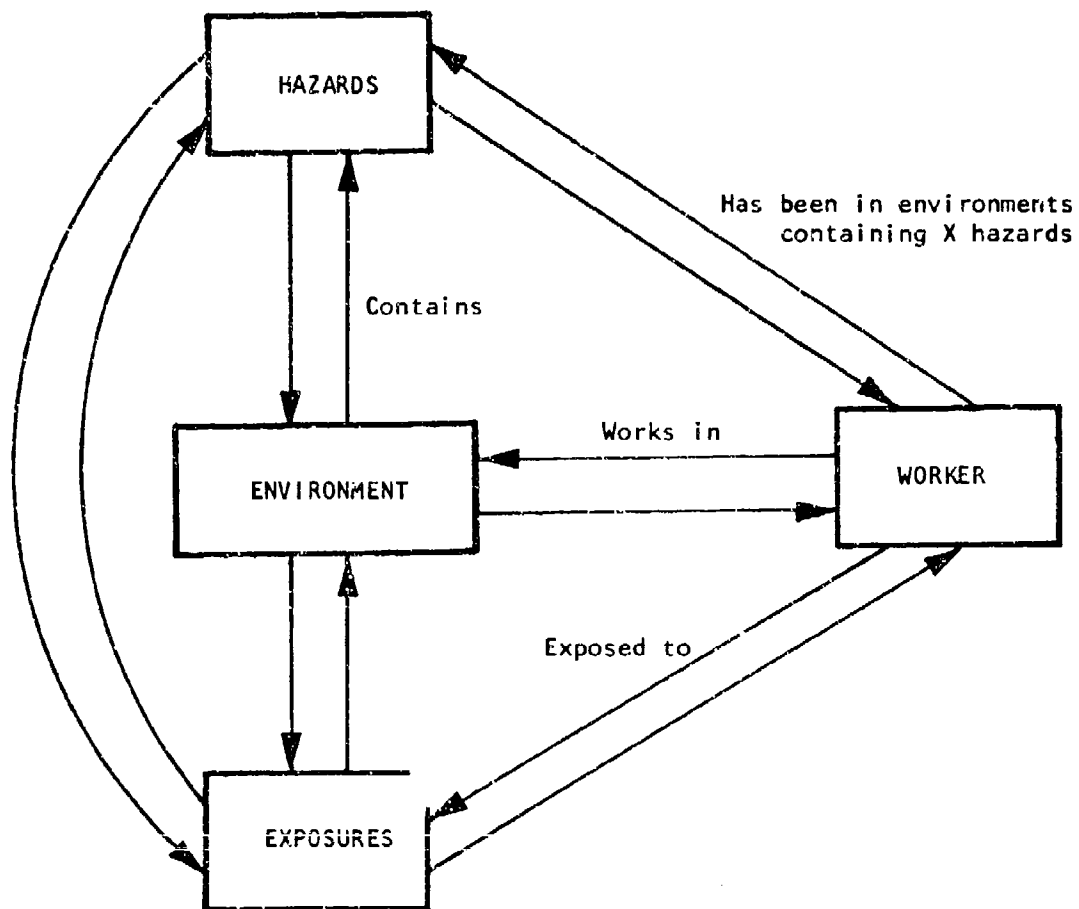


Figure 5. The Pervasive Multiple Cross-Referencing of Data Elements in the NOHIMS Database.

- 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 work place 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 may 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.

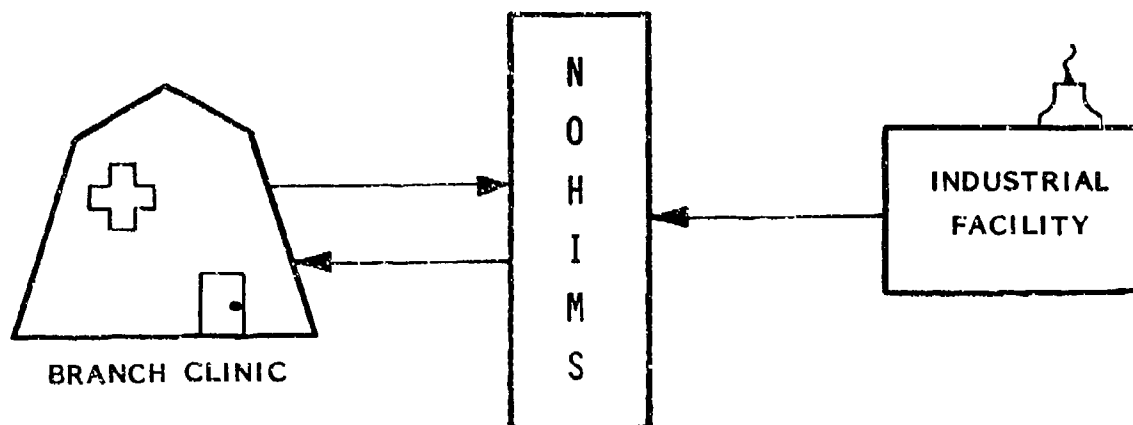


Figure 6a. A Minimal NOHIMS Configuration: One Naval Industrial Facility and One Navy Branch Clinic.

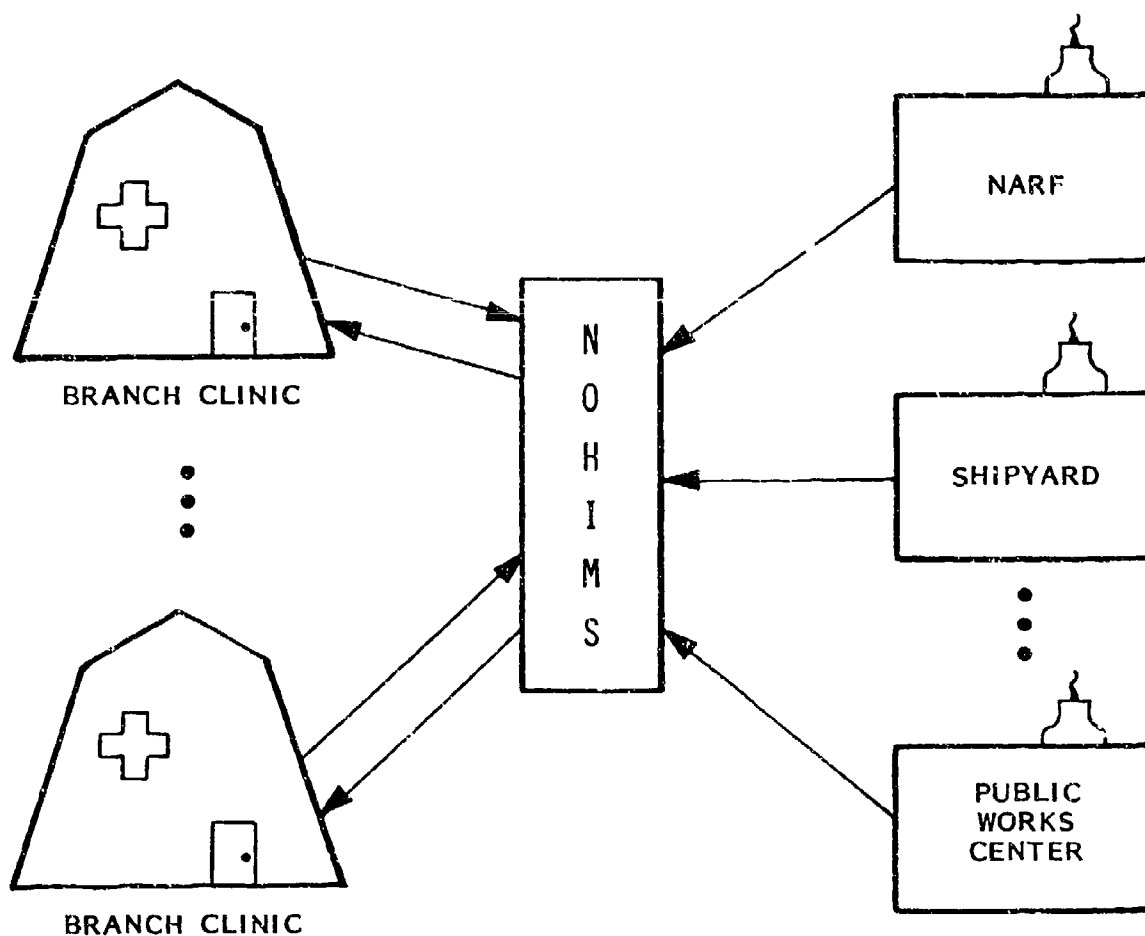


Figure 6b. A Large NOHIMS Configuration Serving an Entire Navy Medical Region.

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 NRM 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 those 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 IN BY PATIENT)	
1. Today's Date	Month _____ Day _____ Year _____
2. Name	Last _____ First _____
3. Social Security Number	_____
4. Civilian ☐ Navy ☐ Marine ☐ ☐ Other (specify) _____	
VISIT TYPE (Check any that apply)	
1. <u>EXAM</u>	10. Other Comprehensive Physical _____
2. New Case _____	11. Eye Examination _____
3. Return _____	A. Refraction _____
4. Referral _____	B. Refraction MC _____
5. Illness or Medical Condition	C. Spectacles Ordered _____
A. New Case _____	1. Single _____
B. Return _____	2. Bifocal _____
C. Referral _____	D. Sight Screening Examination _____
6. Periodic Physical for Health Monitor _____	E. Tonometry _____
7. Return from Sick Leave Evaluation _____	F. Plano Spectacles Issued _____
8. Food Habits Evaluation _____	G. Corrective Protective Spectacles Provided _____
9. Fitness for Duty Evaluation _____	H. Other (List Lamp, Field of Vision) _____
10. Disability Reimbursement Evaluation _____	12. Other (specify) _____
11. Flight Physical _____	

1. Abdominal pain	37. Cholecystitis	53. Biceps tenditis	79. Pharyngitis, strep.
2. Ataxia	38. Conjunctivitis	54. Biceps imp. type 2	80. P.I.T.
3. Abscess	39. Gonorrhea	55. Biceps rotator	81. Pneumonia
4. Bone	40. Gouty arthritis	56. Hypertendinitis	82. Prostatitis
5. Alcoholism	41. Cystitis	57. Hyperostosis	83. Puncture wound
6. Allergy	42. Cystocele	58. Hypothyroidism	84. Rash, non-specific
7. Anemia	43. Depression	59. Hypothyroidism	85. Scabies
8. Anorexia	44. Dermatitis	60. Prognathism	86. Scoliosis
9. Aural polypitis	45. Diarrhea	61. Impetigo	87. Strabismic strab.
10. Bad bite	46. Disrupt ear	62. Infectious mono.	88. Strabismic
11. Baiting	47. Diarrhea	63. Influenza	89. Strain
12. Arthritis, osteo.	48. Eczema	64. Inert spondylitis	90. Strain
13. Arthritis, rheum.	49. Epithelioma	65. Intestinal parasites	91. Syphilis
14. A.S.H.U.	50. Fatigue	66. Intest. bowel syndrome	92. Tetanus
15. Asthma	51. Fever (TBC)	67. Kidney disease	93. Tinea
16. Back pain	52. Fibrocystic br. dis.	68. Laceration	94. Tonsillitis
17. Breast nodules	53. Foreign body	69. Laryngitis	95. Toxicall. sh.
18. Bronchitis	54. Fracture	70. Neuromuscular syndrome	96. Urticaria
19. Burns	55. Gastritis	71. Menstrual disorder	97. U.R.T.
20. Burns	56. Gonorrhea	72. Nucleus again	98. U.R.T.
21. Cellulitis	57. Gonorrhea	73. Neuritis	99. Vaginitis
22. Conjunctivitis	58. Headache	74. Obesity	100. Vertigo
23. Cornealitis	59. Hearing loss	75. Otitis externa	101. Viral illness
24. Chest pain	60. Hematuria	76. Otitis media	102. Wasting
25. C.B.F.	61. Hemorrhoids	77. Pediculosis	103. Warts, venereal
26. Chicken pox	62. Hemiparesis, inf. viral	78. Pharyngitis	104. Warts

Use this space to enter any diagnosis not listed above...

16

SUBSTANCE: _____

SYNONYMS: _____

CODE: _____

CAS _____

NIOSH _____

NHRC _____

NHRC 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

EXPOSURE LIMITS

PARTS PER MILLION (PPM)					THE STANDARD
TLV	PEL	NIOSH	OTHER ()		
PPM {	Action				
	TWA				
	STEL				
	Ceiling				

MILLIGRAMS PER CUBIC METER (MG/M ³)					THE STANDARD
TLV	PEL	NIOSH	OTHER ()		
MG/M ³ {	Action				
	TWA				
	STEL				
	Ceiling				

OTHER SPECIFY ()					THE STANDARD
TLV	PEL	NIOSH	OTHER ()		
Other {	Action				
	TWA				
	STEL				
	Ceiling				

BODY PART/ORGAN SYSTEM AFFECTED

- | | | |
|--|---|--|
| ☐ Auditory | ☐ Lymphatics | ☐ Pulmonary/Respiratory |
| ☐ Breast | ☐ Mouth and Teeth | ☐ Renal (Kidneys) |
| ☐ Cardio-vascular | ☐ Mucousmembrane | Reproductive |
| ☐ Ear, Nose, and Throat | ☐ Musculo-skeletal | ☐ Male |
| ☐ Endocrine | ☐ Nasal Cavity | ☐ Female |
| ☐ Eyes | Nervous System | ☐ Respiratory/Pulmonary |
| ☐ Gastrointestinal | ☐ Central | ☐ Skin |
| ☐ Hematologic (Blood, Bone, Marrow) | ☐ Peripheral | ☐ Urinary Tract |
| ☐ Hepatic (Liver) | ☐ Neurologic | ☐ No Special |

COMMENTS: _____

Figure 8. NOHIMS Hazard Characteristics Profile.

NHRC Code: _____

- ☐ all those entering regulated area
- ☐ all those exposed to _____
at or above the action level
- ☐ all those exposed to _____
at or above TWA
- ☐ all those exposed to _____
at or above _____ ppm, _____ mg/m³
or _____ (_____) apcify scale
- ☐ without regard to use of respirator

[illegible]

Figure 9. NOHIMS Medical Requirements Data Sheet.

RETRIEVING DATA: NOHIMS REPORTS AND THEIR USERS

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 charts 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

EMPLOYEE NUMBER: 12666

BIRTHDATE: 12 MAY 1959

	WORK ENVIRONMENT	HRS/WEEK	JOB TITLE
12/1/81	LOADING DOCK W. OF BLDG.0094	40	SHIPPING CLERK
6/19/81	BLDG:0094 SHOP:36112	40	MAIL AND FILE CLERK

*** WORK PLACE HAZARDS *** TIME WEIGHTED AVERAGE (TWA)

CONTAMINANT	TIME WEIGHTED AVERAGE (TWA)			CEILING (ST'L)	
	EXPOSURE LEVEL	CURRENT TLV	PERCENT OF CURRENT TLV	EXPOSURE LEVEL	CURRENT TLV
AMMONIA	20 PPM	25 PPM	80		
XYLENE	17 PPM	100 PPM	17		

*** PATIENT SUMMARY ***

REASON FOR VISIT

6/19/81 PREPLACEMENT EXAM SMITH,M

PROBLEMS

MINOR
HX, TOBACCO USE 6/19/81 SMITH,M

PHYSICAL EXAM

TEMPERATURE	98.4	6/19/81 SMITH,M
PULSE	80	6/19/81 SMITH,M
RESPIRATORY RATE	20	6/19/81 SMITH,M
BLOOD PRESSURE	112/72 LEFT ARM	6/19/81 SMITH,M
HEIGHT	63	6/19/81 SMITH,M
WEIGHT	104	6/19/81 SMITH,M

PROCEDURES

6/19/81	CHEST X-RAY	SMITH,M
	NORMAL	
6/19/81	PULMONARY FUNCTION TESTS	SMITH,M
	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 (FEV 1.0)

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

JL/ :
6260.

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)
- () NAVREGMEDCEN 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 Environs, 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 _____ and _____ 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 _____

JL/ :
6260.

INDUSTRIAL HYGIENE BASELINE DATA

DATE: _____ UIC: _____

SURVEY NUMBER:
POINT OF CONTACT:
PHONE NO.:
SURVEY TYPE:
Initial Comprehensive ()
Periodic Comprehensive ()
Emergency ()
Other (specify) _____

1. LOCATION: ACTIVITY: _____

BLDG No. _____ DEPT: _____ DIVISION: _____

BRANCH: _____ SHOP CODE: _____ ROOM: _____

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

Work Area Dimensions

<u>Width</u>	<u>Length</u>	<u>Height</u>	<u>IDENTIFICATION</u>	(include drawing if necessary)
_____ X _____	_____ X _____	_____ FEET	_____	_____
_____ X _____	_____ Y _____	_____ FEET	_____	_____
_____ X _____	_____ X _____	_____ FEET	_____	_____
_____ X _____	_____ X _____	_____ FEET	_____	_____
_____ X _____	_____ X _____	_____ FEET	_____	_____
_____ X _____	_____ X _____	_____ FEET	_____	_____

3. PERSONNEL:

	<u>Male</u>	<u>Female</u>	<u>Total</u>
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:

<u>Name</u>	<u>Rate/Series</u>	<u>Job Title</u>	<u>SSN</u>	<u>Exposure</u>	<u>Symptoms</u>
-------------	--------------------	------------------	------------	-----------------	-----------------

_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____

6. CONTROLS:

A. ENGINEERING

	<u>Effectiveness of Controls (%)</u>					<u>List Locations</u>
	<u>0-20</u>	<u>21-40</u>	<u>41-60</u>	<u>61-80</u>	<u>81-100</u>	
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 ventila- tion is:	1	2	3	4	5	_____
Degree of isolation is:	1	2	3	4	5	_____

B. PERSONAL PROTECTIVE EQUIPMENT:

	<u>Required</u>		<u>In use</u>		<u>Effectiveness of Controls (%)</u>					<u>Comments</u>
	<u>Yes</u>	<u>No</u>	<u>Yes</u>	<u>No</u>	<u>0-20</u>	<u>21-40</u>	<u>41-60</u>	<u>61-80</u>	<u>81-100</u>	
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:	_____									

NIOSH/OSHA Approval Number: _____

29 CFR 1910.134 in compliance _____ Yes _____ No

Enclosure ()

Date: _____

Shop No.: _____

Occupational Hazard Data Sheet

Hazard: _____ TLV: _____

- A. Measured Concentration: 1. TWA: _____
2. Ceiling: _____ 3. Other (Peak, Grab, STEL): _____

(Circle appropriate numbers for following)

B. Mode of Entry:

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

H. Overall Control Effectiveness:

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

C. Process:

1. Manual
2. Mechanical

I. Exposure Level:

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

D. Continuity of Process:

1. Continuous
2. Intermittent
3. Temporary

J. Medical Monitoring:

1. Recommended
2. Not recommended

E. Type of Sample:

1. Breathing Zone
2. General Area

K. Potential Hazard Severity:

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

F. Sampling Strategy:

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

L. Mishap Probability:

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

G. Utilization/Exposures (Hrs/Wk):

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

JL/ :
6260.

VENTILATION SURVEY

1. Sketch and Measurements:

2. Analysis in accordance with reference ():

Enclosure ()

NOISE SURVEY (Sound Level Meter Survey)											
DATE (Year Month Day)						TYPE SURVEY ☐ 1-INITIAL SURVEY ☐ 2-RE-SURVEY ☐ 3-OTHER					
SOUND LEVEL METER				MICROPHONE				CALIBRATOR			
MANUFACTURER				MANUFACTURER				MANUFACTURER			
MODEL		SERIAL NO		MODEL		SERIAL NO		MODEL		SERIAL NO	
LAST ELECTROACOUSTIC CALIB DATE		year month day		LAST ELECTROACOUSTIC CALIB DATE		year month day		LAST ELECTROACOUSTIC CALIB DATE		year month day	
WIND SCREEN ☐ USED ☐ NOT USED				MEASUREMENTS OBTAINED ☐ INDOORS ☐ OUTDOORS							
DESCRIPTION OF AREAS/DUTIES WHERE NOISE SURVEY CONDUCTED (Illustrate on additional sheet and attach to form)								PRIMARY SOURCE OF NOISE			
								SECONDARY SOURCE OF NOISE			
SOUND LEVEL DATA								PROTECTION REQUIRED (re: dBA Level)			
LOCATION		METER ACTION	dBC	dBA	RISK ASSESSMENT CODE	NONE less than 85	PLUG OR MUFF 85-108	PLUG AND MUFF 108-118	PLUG + MUFF + TIME LIMIT greater than 118		
NOTES: Range of levels noted by /; 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 type 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, MI)						HEARING CONSERVATION MONITOR (Last Name, First Name, MI)					

DD FORM 2214
1 SEP 79

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Enclosure ()
S/N 0102-LF-002-2140

EVALUATION OF DATA AND RECOMMENDATIONS FOR CONTROL

1. <u>DEFICIENCIES:</u>	<u>Out-</u> <u>standing</u>	<u>Excel-</u> <u>lent</u>	<u>Good</u>	<u>Fair</u>	<u>Poor</u>	<u>Comments</u>
<u>Management Contribution</u>						
Worker Education:						
Hazard Awareness (chemicals & toxic effects)	1	2	3	4	5	
Housekeeping/Personal Hygiene	1	2	3	4	5	
Work Practices (handling & disposal)	1	2	3	4	5	
Personal Protective Equipment (if, & when to use & obtain)	1	2	3	4	5	

Unsafe Work Practices:

<u>Inadequacies</u>	<u>Standard Applied</u>	<u>Hazard Severity/ Mishap Probability</u>

2. RECOMMENDED ACTIONS FOR IMPLEMENTATION:

Enclosure ()

JL/ :
6260.

RECOMMENDATIONS (Cont'd):

Enclosure ()

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REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER Report No. 82-6	2. GOVT ACCESSION NO. AD A117489	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) Functional Overview of the Navy Occupational Health Information Monitoring System (NOHIMS)	5. TYPE OF REPORT & PERIOD COVERED Interim	
7. AUTHOR(s) Donald Beck William M. Pugh	6. PERFORMING ORG. REPORT NUMBER	
9. PERFORMING ORGANIZATION NAME AND ADDRESS Naval Health Research Center P.O. Box 85122 San Diego, CA 92138	8. CONTRACT OR GRANT NUMBER(s)	
11. CONTROLLING OFFICE NAME AND ADDRESS Naval Medical Research & Development Command Bethesda, MD 20014	10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS M0933-PN.003-0001	
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office) Bureau of Medicine & Surgery Department of the Navy Washington, DC 20372	12. REPORT DATE 19 April 1982	
	13. NUMBER OF PAGES 42	
	15. SECURITY CLASS. (of this report) UNCLASSIFIED	
	15a. DECLASSIFICATION/DOWNGRADING SCHEDULE	
16. DISTRIBUTION STATEMENT (of this Report) Approved for public release; distribution unlimited.		
17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)		
18. SUPPLEMENTARY NOTES Occupational Health Workshop on May 11 and 12, 1982, San Diego, California.		
19. KEY WORDS (Continue on reverse side if necessary and identify by block number) Occupational health Information System Distributed data bases Networking		
20. ABSTRACT (Continue on reverse side if necessary and identify by block number) 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		

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given to the various users of NOHIMS, and the reports generated for them are reviewed.

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