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

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SPECIFICATIONS FOR A NAVY OCCUPATIONAL HEALTH

INFORMATION MONITORING SYSTEM (NOHIMS):

II. A FUNCTIONAL OVERVIEW

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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.

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* 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.

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* Registered trademark of the American Conference of Governmental Industrial Hygienists.

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

DATA TYPES

- Medical Data
- Environmental Data
- Personnel Data

REFERENCE TABLES

- Normal Limits for Lab Test Results
- Required Medical Surveillance
- Job Titles Table
- Threshold Limit Value (TLV) Table

REPORTS

- NAVMED 6300/1 NAVMED 6260/1
- Branch Clinics
- BUMEL
- Medical Certification
- Compliance Report
- Patient Data Sheet
- Notification of Individual Exposures
- Industrial Hygiene Survey Report

USERS

- Work Center Supervisor
- Naval Regional Medical Center
- Occupational Health Physician
- Safety Specialist
- Industrial Hygienist

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In a fourth reporting function facilitated by NOHIMS, the occupational health physician, after examining a patient, provides medical cer*ification 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.
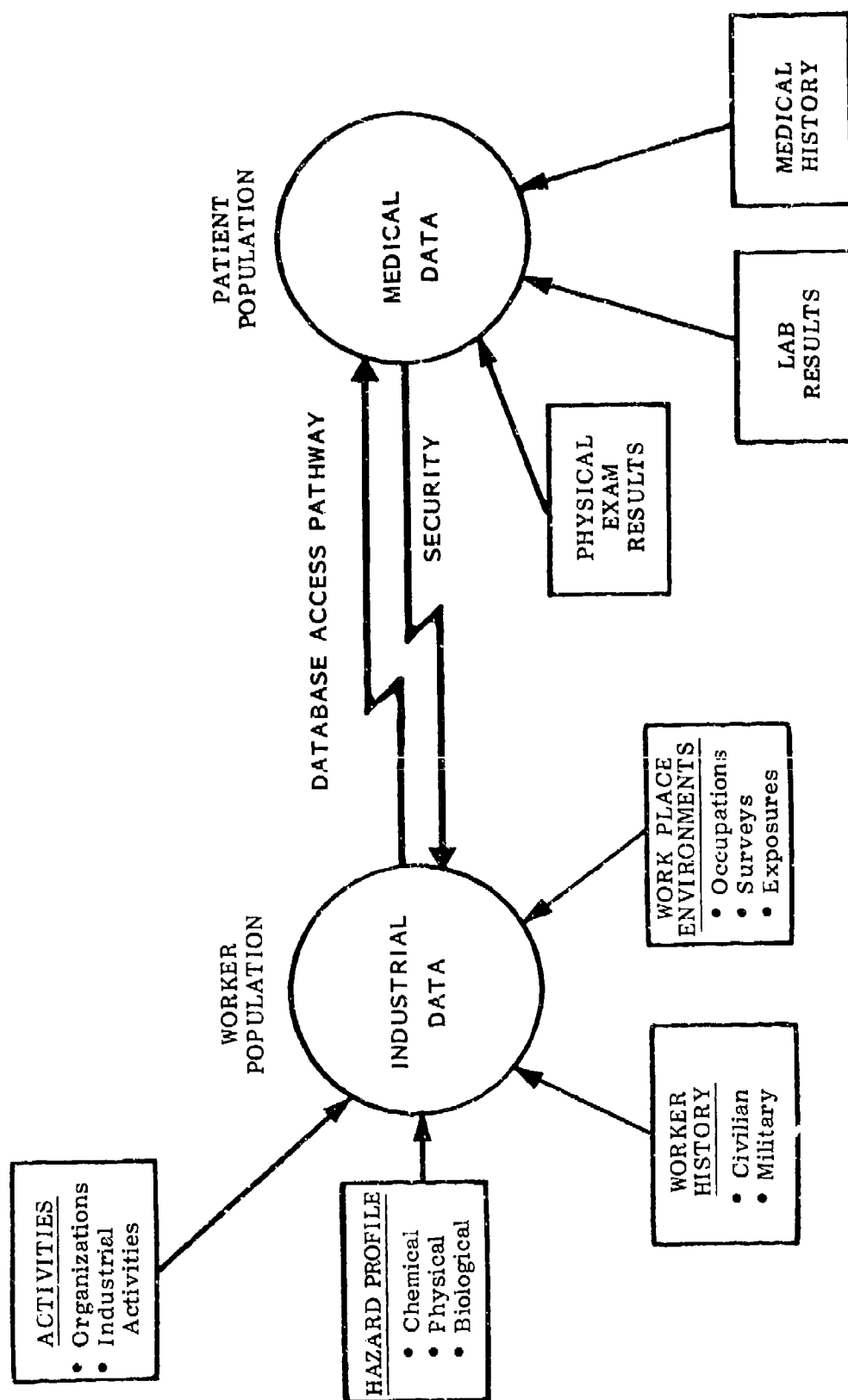
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Figure 2. Types of Information Contained in the NOHIMS Database.

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.

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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).

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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?

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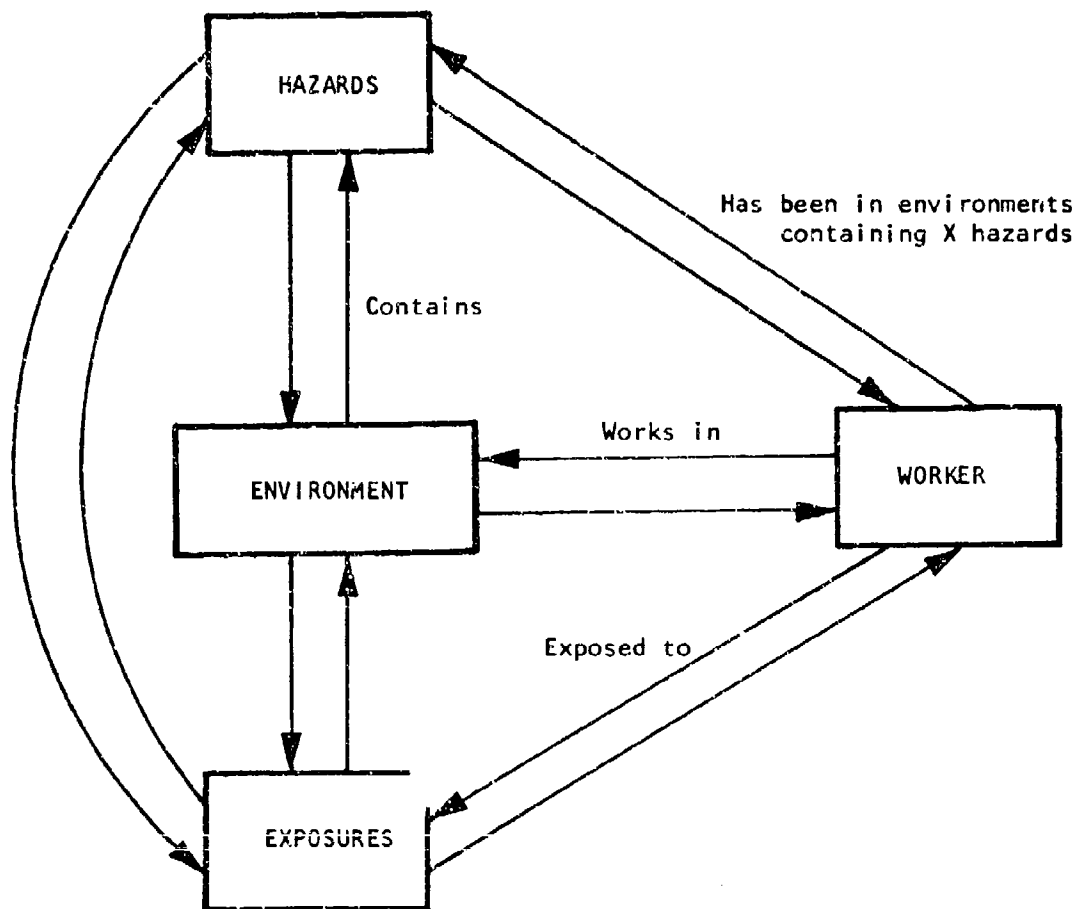
Figure 5.   The Pervasive Multiple Cross-Referencing
of Data Elements in the NOHIMS Database.

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- 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? Di, 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.

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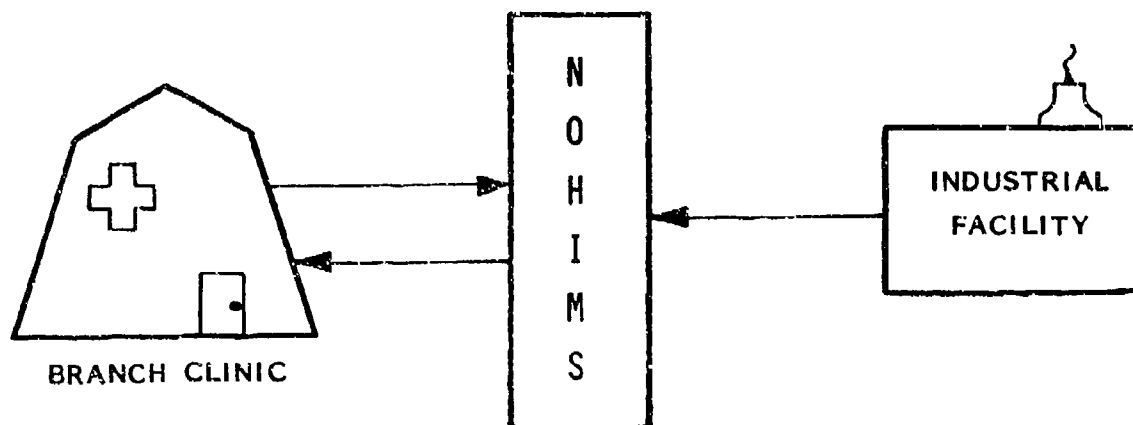
Figure 6a. A Minimal NOHIMS Configuration: One Naval
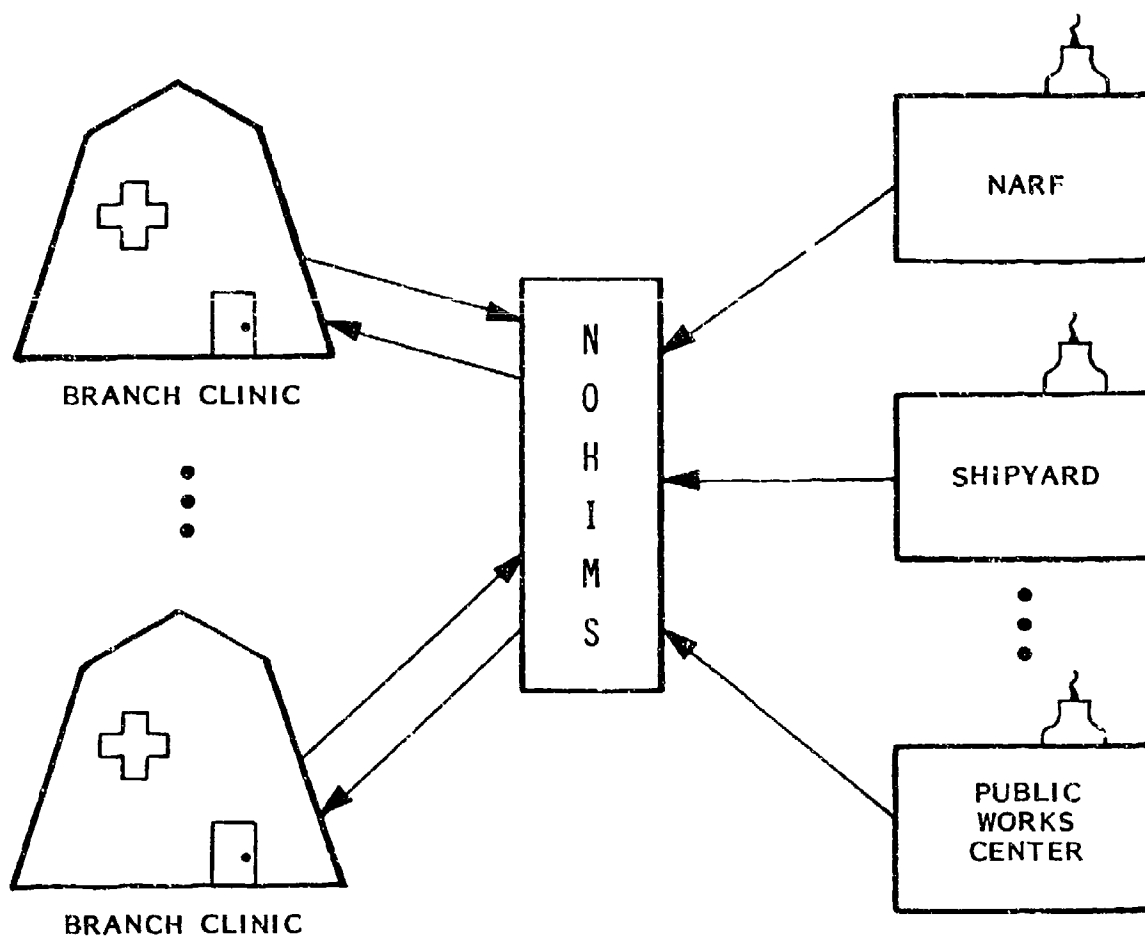Industrial Facility and One Navy Branch Clinic.

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

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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 Env'ron- mental Health Service, and the Medical Encounter Form.

The basic Industrial Hygiene Survey Form consists of ten pages. How- ever, 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 addi- tional 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 system- atically 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 sur- veillance required and provide the basic data needed for establishing and maintaining the required medical surveillance table in NOHIMS.

Figure 7. NOHIMS Medical Encounter Form for
Use in Navy Branch Clinics.

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SUBSTANCE: _____   SYNONYMS: _____

CODE: _____

   CAS _____   _____

   NIOSH _____   _____

   NHRC _____   _____

   NHRC MATERIAL CODE _____   _____

                                             _____

STATUS: EXPOSURE LIMITS

   ( ) Prohibited

   ( ) Carcinogen

   ( ) Special Handling

   ( ) Restricted

   ( ) Navy Unique

   ( ) Other _____

PARTS PER MILLION (PPM)

		TLV	PEL	NIOSH	OTHER ( )	THE STANDARD
PPM	Action					
	TWA					
	STEL					
	Ceiling					

MODE OF ENTRY:

   ( ) Skin

   ( ) Ingestion

   ( ) Inhalation

   ( ) Auditory

MILLIGRAMS PER CUBIC METER (MG/M^3)

		TLV	PEL	NIOSH	OTHER ( )	THE STANDARD
MG/M^3	Action					
	TWA					
	STEL					
	Ceiling					

BIOLOGICAL 1/2 TIME:

(Suggested Length of Follow-up after Exposure)

   ( ) < 1 year

   ( ) 1 - 3 years

   ( ) 4 - 7 years

   ( ) 8 - 15 years

   ( ) > 15 years

OTHER SPECIFY ( )

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

BODY PART/ORGAN SYSTEM AFFECTED

( ) Auditory	( ) Lymphatics	( ) Pulmonary/Respiratory
( ) Breast	( ) Mouth and Teeth	( ) Renal (Kidneys)
( ) Cardio-vascular	( ) Mucusmembrane	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.

Material (or hazard): _____ NHRC Code: _____

Medical surveillance required for:

____ 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 _____ (_____) specify scale

____ without regard to use of respirator

			Block Number	NOHIMS Code		Preplacement	Annual	Semi-annual	Quarterly	Number of years	Upon exposure/emergency	DBRP*	Termination		Male only	Female only	Action	TWA	STEL		>30	>35	>40	>45
M	1	PERSONAL/MEDICAL HISTORY	100																					
	2	WORK (EXPOSURE) HISTORY	200																					
	3	FAMILY HISTORY	300																					
	4	PHYSICAL EXAM (specify body part/system/symptom)	400																					
	5	CLINICAL LABORATORY TEST	500																					
	6	OTHER TESTS AS DBRP*	600																					
	7	PROCEDURES/EXAM (other than physical)	700																					
	8	COMMENTS	800																					

*DBRP — Determined by responsible physician

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 chits 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   EMPLOYEE NUMBER: 12666
SEX: FEMALE
AGE: 23   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)			CEILING (STEL)	
CONTAMINANT	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

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 eval-
          uations of Naval employees exposed to hazardous workplace con-
          ditions 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 1 Otave 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   _____

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INDUSTRIAL HYGIENE BASELINE DATA

SURVEY NUMBER:
POINT OF CONTACT:
PHONE NO.:
DATE:_____ UIC: _____ 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

Width	Length	Height	IDENTIFICATION	(include drawing if necessary)
_____ X	_____ X	_____FEET	_____	_____
_____ X	_____ Y	_____FEET	_____	_____
_____ X	_____ X	_____FEET	_____	_____
_____ X	_____ X	_____FEET	_____	_____
_____ X	_____ X	_____FEET	_____	_____
_____ X	_____ X	_____FFET	_____	_____

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:

Name	Rate/Series	Job Title	SSN	Exposure	Symptoms

A-4

6. CONTROLS:

    A. ENGINEERING   Effectiveness of Controls (%)

                                                                          List
                        0-20   21-40   41-60   61-80   81-100   Locations

    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:

	Required		In use		Effectiveness of Controls (%)					
	Yes	No	Yes	No	0-20	21-40	41-60	61-80	81-100	Comments
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 (   )

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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

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 (   )

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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 ASSESS MENT 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. DEFICIENCIES:	Out-standing	Excel-lent	Good	Fair	Poor	Comments
Management Contribution						
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:

Inadequacies	Standard Applied	Hazard Severity/ Mishap Probability

2. RECOMMENDED ACTIONS FOR IMPLEMENTATION:

_____

_____

_____

_____

_____

_____

_____

_____

Enclosure ( )

RECOMMENDATIONS (Cont'd):

_____
_____
_____
_____
_____
_____
_____
_____

Enclosure ( )

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
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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
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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

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