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IH Interface

NIOSH Database Development: The Industrial Hygiene Information System

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Introduction

We would like to discuss ongoing efforts to develop a historical exposure database from records of exposure assessments conducted by the Industrial Hygiene Section (IHS) of the Industrywide Studies Branch, National Institute for Occupational Safety and Health (NIOSH). When completed, this database, known as the Industrial Hygiene Information System (IHIS) will contain exposure data from more than 1300 survey reports written by IHS researchers.

Development of IHIS represents a collaborative effort between NIOSH and the National Cancer Institute (NCI). When completed, this database will provide an invaluable resource for exposure assessment in occupational epidemiologic studies. Exposures to chemical and physical agents in many standard industrial classifications can be obtained through the IHIS. While the initial users of IHIS are NIOSH and NCI researchers, our long-range plan is to provide access to a version of the IHIS for external users—other government and nongovernment researchers in the field of exposure assessment.

Survey reports in the IHS date back to the early 1950s. The database will include information on at least 120 major chemical and physical agents from over 120 different standard industrial classifications. The database system that we have developed has two main features: (1) ability to retrieve data for a given chemical by any of nine search strategies, and (2) ability to download retrieved data to an ASCII file for customized analysis. We believe IHIS will be an invaluable source of exposure information that provides expeditious access to data that describe current and past conditions in a wide variety of work environments.

In developing IHIS, we encountered a series of intellectual and technical challenges. These include justifying time and resource expenditures to our management; identifying users of the database; determining the needs of these users; selecting data to be entered; developing data entry, data search, and data output methods and software; developing quality assurance (QA) methods; and developing methods to access IHIS by internal and external users. We provide here a brief overview of how we met these challenges. We also present several examples of output from IHIS and discuss some future plans.

Why Build a Database?

Many of us—corporate industrial hygienists; industrial hygiene consultants; university, government, and private sector researchers—have faced (or will face) the inevitable: the need to evaluate one or more data sets of chemical X exposures—all contained in tables with informative headings, but in hard copy format. Generally, written hard copy reports of industrial hygiene surveys and investigations constitute a major source of information for occupational safety and health professional researchers who are conducting retrospective cohort studies of workplace populations. Unfortunately, the ability to expeditiously analyze data from this valuable source is hindered by the labor-intensive process required to obtain and productively utilize information from these written reports. To statistically analyze these data requires data entry into an appropriate electronic format—most likely in a spreadsheet or other statistical software package. If data were already contained in an electronic database, analysis could be completed much more quickly.

Who Are the Database Users?

We identified three major categories of NIOSH and NCI users: (1) those trying to identify new work groups to study; (2) those building a job exposure matrix in support of an EPI study; and (3) those doing health risk assessments based on previously collected exposure data.

Having identified our prospective users, we proceeded with five goals. The system must (1) retrieve beneficial information, (2) have the capability to output retrieved data to an ASCII file, thus permitting the user to perform customized analysis, (3) be easy to learn and understand, (4) be in executable software format, thus precluding the need to maintain hard disk space-consuming database programs, and (5) be simple to change and update.

What Kinds of Information Do Users Want?

Exposure sample data are probably the most important. But data need to be related to specific job titles, industries, and companies. For example, NIOSH and NCI researchers looking for possible study locations might want to identify the name of the company that has the job title and the exposures of interest.

Based on information needs described by IHIS peer reviewers, and the information content presented in IHS survey reports, we extracted the following information from each report: (1) general information about the survey, including beginning and ending dates, identification of NIOSH investigators, and reason for the survey; (2) general plant information, including facility name, standard industrial classification (SIC) code, number of employees, and description of medical, industrial hygiene, and safety programs; (3) information on process and operations; (4) identification of exposure control mechanisms, including engineering controls and personal protective equipment; (5) personal exposure summary data; (6) area concentration summary data; (7) personal exposure detail data; (8) area concentration detail data; (9) non-NIOSH personal exposure summary data; (10) non-NIOSH area concentration summary data; (11) non-NIOSH personal exposure detail data; and (12) non-NIOSH area concentration detail data.

Figure 1 shows the overall flow dia-

SAM DATE	# OF SAM	SAM TYPE	SAM UNIT	MEAS	MIN	MAX	ARITH MEAN	GEO MEAN
08/11/81	3	AIR	PPM	TWA	0.04	0.1	0.08	0.08
08/11/81	2	AIR	PPM	TWA	0.09	0.25	0.17	0.15
08/11/81	2	AIR	PPM	TWA	0.08	0.13	0.1	0.1
08/11/81	5	AIR	PPM	TWA	0.27	0.35	0.31	0.3

FIGURE 2. NIOSH personal sample summary: formaldehyde. Job title: assembler; SIC code: 2321; IHS report No: 125.17.

each plant and/or job title that matched the parameters specified in the data search step. This type of information can be useful to NIOSH and NCI researchers wanting to identify suitable locations for study of a given chemical or job group.

What Type of Software Is Used for IHIS?

We are currently using FOXPRO for Windows 2.6A in writing the IHIS system software. This package has several advantages, including flexibility and ability to create large database files. However, the biggest advantage may be its ability to create executable files for IHIS. This means that the user does not need to have FOXPRO stored on his or her computer to use IHIS.

How Is IHIS Managed?

We believe that formal management of a database is critical to ensure continued reliability, functionality, and enhancement. We use the team approach to management. Overall management of IHIS is vested in a database manager whose duties include management of data entry and staying abreast of the information needs of database users. Responsibility for enhancement of database software and development of IHIS access methods is vested in a computer programmer specifically assigned to IHIS.

What Is the Strategy for Quality Assurance?

A critical feature of any database is the reliability and accuracy of the data contained therein. For IHIS, it is important that data be extracted from each report completely and accurately, and then entered into the system completely and accurately.

Data entry into IHIS proceeds in four phases. In the first phase, the database manager identifies the appropriate report(s) from each IHS file for which useful data can be extracted. The reports are photocopied. After logging the report(s) into the report tracking spreadsheet, the photocopies are delivered to the data entry contractor. During phase two, an individual with an industrial hygiene background reads each report and marks data in the report to be coded. During phase three, the identified data are entered into IHIS by clerical personnel. Quality control checks by contractor personnel to ascertain completeness and accuracy of extraction and entry are incorporated into these two phases. The database manager performs a final QA check of data entry during phase four. Each marked-up report is first reviewed to determine completeness and accuracy of data extraction. Data marked for entry into the IHIS are then compared with those that appear on a printout of the IHIS data file for that report.

As part of QA, the database manager holds biweekly meetings with contractor personnel to discuss coding issues and to resolve coding questions. In addition, the database manager remains on call to resolve report and coding questions as they arise.

SAM DATE	SAM TYPE	SAM VALUE	UNITS	TIME (min)	MEAS TYPE	COMMENTS
03/30/81	AIR	0.117	PPM	553	TWA	SPOT WELD
03/30/81	AIR	0.237	PPM	445	TWA	FUSE STAY
03/30/81	AIR	0.191	PPM	361	TWA	TOP STITCH
03/30/81	AIR	0.114	PPM	424	TWA	BUTTONHOLE

FIGURE 3. NIOSH Personal Sample Detail: SIC Code 2321. Chemical name: formaldehyde; Job title: Assembler; IHS report No: 125.12.

How Is IHIS Accessed?

When completed, IHIS will be available to NIOSH and NCI users via local area network systems currently in place at NIOSH and NCI. External users will have access via a 1.44M disk. We expect to have a completed version of IHIS available to occupational health and safety professionals working in other government agencies–national and international–and in the private sector in the latter part of 1997.

What Are Future Plans for IHIS?

Our future plans for IHIS include developing data search strategies for the qualitative information extracted from IHS survey reports–most notably the medical, industrial hygiene, and safety information. To broaden access to IHIS, we will explore methods for on-line access.

Summary

IHIS has been designed to provide industrial hygiene data directly and expeditiously to the user. The user can retrieve data and then download to an ASCII file for customized analysis. The database we have developed will provide an invaluable resource for exposure assessment.

EDITORIAL NOTE: Tom Bloom is a senior industrial hygienist with the Industrywide Studies Branch, DSHEFS, NIOSH, Cincinnati, Ohio. He is a current member of the ACGIH Computer Committee. Janet Graydon is a programmer/analyst with the Support Services Branch, DSHEFS, NIOSH, Cincinnati, Ohio. Mustafa Dosemeci is an industrial hygienist with the Occupational Studies Section, Environmental Epidemiology Branch, National Cancer Institute, Bethesda, Maryland.