Applied Occupational and Environmental Hygiene

ISSN: 1047-322X (Print) 1521-0898 (Online) Journal homepage: https://www.tandfonline.com/loi/uaoh20

Development and Implementation of an Exposure Assessment Program in a Research-Based Facility: Phase I

Raeanna Sharp-Geiger , Thomas Keefe , Philip Bigelow , Roben Rudy-Hinker , Lisa Pugh & Lisa Woodrow

To cite this article: Raeanna Sharp-Geiger , Thomas Keefe , Philip Bigelow , Roben Rudy-Hinker , Lisa Pugh & Lisa Woodrow (1998) Development and Implementation of an Exposure Assessment Program in a Research-Based Facility: Phase I, Applied Occupational and Environmental Hygiene, 13:12, 839-846, DOI: 10.1080/1047322X.1998.10389164

To link to this article: https://doi.org/10.1080/1047322X.1998.10389164

Development and Implementation of an Exposure Assessment Program in a Research-Based Facility: Phase I

Raeanna Sharp-Geiger,[A,B] *Thomas Keefe,*[A] *Philip Bigelow,*[A] *Roben Rudy-Hinker,*[B] *Lisa Pugh,*[C] *and Lisa Woodrow*[B]

[A]Department of Environmental Health, Colorado State University, Fort Collins, Colorado 80523-1676; [B]Material Science and Technology Division, Los Alamos National Laboratory, MST Division, P.O. Box 1663, MSG752, Los Alamos, New Mexico 87545; [C]Department of Computer Information Systems, Colorado State University, Fort Collins, Colorado 80523-1676

Exposure assessment programs and related databases are of increasing importance in the field of industrial hygiene. The ability to systematically evaluate potential health risks to workers, to establish and document exposure levels, and to ensure compliance with regulations in an efficient and effective manner is a necessity in every type of industry. Moreover, once this information is collected, its organization and storage in a format that facilitates retrieval and use by a variety of end users must also be addressed. While the need for programs that meet these needs is apparent, the development and implementation of such programs poses great challenges, not only to industrial hygienists, but to all individuals responsible for the protection of worker health and safety. In a research-based setting, these individuals face the additional challenge of managing facilities that contain a large number of operations that are generally dynamic in nature, contain a wide spectrum of associated hazards (i.e., chemical, physical, biological, and radiological), and can be both small in scale and frequently changed in scope. This article describes a three-phased approach to the development and implementation of an exposure assessment program and the associated database in a research-based environment. Although the different phases of the development and implementation are outlined, the focus of this article is the first phase—basic characterization—which involves clearly defining the goals of the program, identifying required information, developing comprehensive data-gathering instruments, training data gatherers, carefully designing the database, and ensuring quality control in both the collection and computer entry of the data. This first phase is critical because the information obtained in phase I will be used in subsequent phases to determine sampling priorities and frequency of control verification/maintenance. SHARP-GEIGER, R.; BIGELOW, P.; KEEFE, T.; RUDY-HINKER, R.; PUGH, L.; WOODROW, L.: DEVELOPMENT AND IMPLEMENTATION OF AN EXPOSURE ASSESSMENT PROGRAM IN A RESEARCH-BASED FACILITY: PHASE I. APPL. OCCUP. ENVIRON. HYG. 13(12):839–846; 1998. © 1998 AIH.

The need to implement systematic exposure assessment strategies to evaluate potential risks to workers' health, to establish and document exposure levels, and to ensure and demonstrate compliance with regulations in an efficient and effective manner has been well established.[1] Additionally, the process of collecting, organizing, and maintaining such information in a database has received much attention.[2–6] Although several approaches to exposure assessment have been published, only a few programs have been described in the literature, and none of these have dealt specifically with the unique challenges faced by research-based facilities.[7–10] Furthermore, to date, implementation of such a program has not been published.

Industrial hygienists in research-based facilities face unique challenges in striving to implement systematic exposure assessment strategies. Research-based facilities typically contain dynamic operations that are both small in scale and frequently changed in scope. The operations involve a wide spectrum of hazards (i.e., chemical, biological, physical, and radiological) with potential exposures to varying quantities of chemical and physical stressors that are short in duration and vary in frequency. Additionally, the ability to categorize exposures by job titles and form similar exposure groups is difficult due to the use of generic job titles (e.g., technician 1-8) and a lack of consistency in hazards and exposures across operations.

A systematic basic characterization and assessment of operational hazards and controls to prioritize operations is necessary in research-based settings. This approach, in conjunction with a well-organized, flexible, and comprehensive database system, is the first step in attaining effective exposure assessment programs. Once operations are prioritized, quantitative exposure assessment decisions can be made. As has been pointed out previously, and may be especially true in some research settings, qualitative assessments may be appropriate for some operations.[11]

The Material Science and Technology (MST) Division at Los Alamos National Laboratory (LANL) is a research-based facility currently implementing systematic collection, documentation, and compilation of exposure information as part of their task-based exposure assessment program. This division, composed of over 400 operations, is involved in a broad spectrum of materials science research, including materials synthesis, processing, fabrication, testing, characterization, and modeling, resulting in an equally broad spectrum of physical, chemical, and radiological hazards. This exposure assessment program and its accompanying database system are being developed and implemented in three phases: basic characteriza-

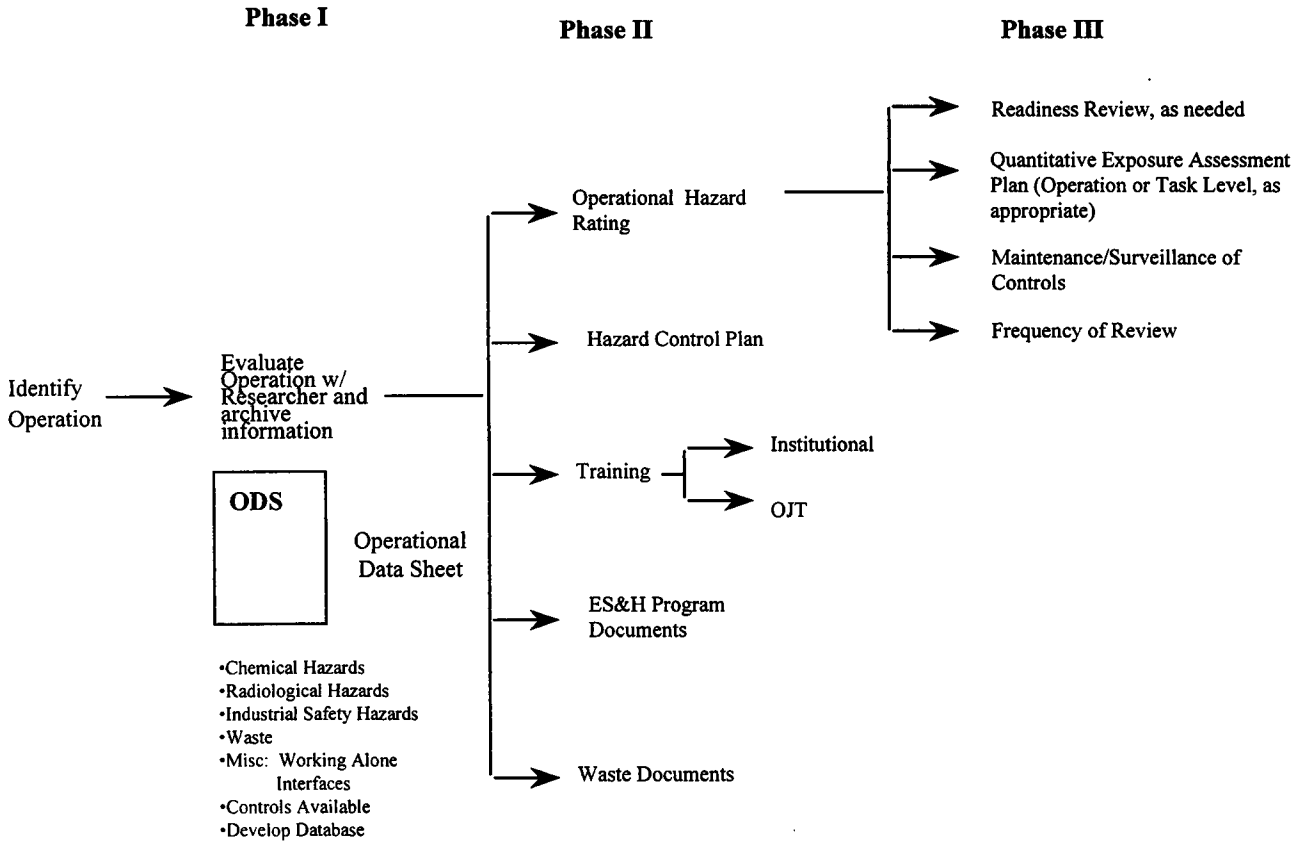


FIGURE 1. Flow diagram of operational assessment program.

tion, qualitative hazard assessment, and quantitative exposure assessment.

Phase I: basic characterization of division operations, which is currently underway, has included the following elements: clearly defining the goal of the data collection and management process; developing data collection forms; training environmental safety and health (ESH) personnel to collect the necessary data; developing the first tier of the database; collecting data; and quality control and computer entry of the data. In addition to collecting information on each operation for traditional exposure assessment purposes, the goal of this phase is to provide information that will also serve as the foundation for the following: personal protective equipment hazard evaluations, as required by 29 CFR 1910.132;[12] inventory of operations, hazards, and controls for operation, line, facility, and division level management; hazard control plans (commonly referred to as safe operating procedures); validation of medical monitoring enrollment; identification and validation of training and waste management and disposal requirements; future studies of occupational health; and an operations tracking and trending system. This first phase is critical to ensuring the success of the overall program by providing the information on which decisions in subsequent phases are based.

This article outlines the goals, scope, and approach currently being taken by the MST Division in the basic characterization phase (phase I) of the exposure assessment process. Phase II and phase III, development of a construct to prioritize operations or tasks based on their hazards and controls and quantitative exposure assessment, are currently under development and will be briefly outlined. A diagram of how the three phases are linked is illustrated in Figure 1.

This is a practical implementation of an exposure assessment and database program for research-based facilities with an emphasis on identifying and prioritizing operations based on their hazards and level of reliance on controls. The data elements used in the exposure assessment program and included in the database closely parallel those outlined recently by the Joint American Conference of Governmental Industrial Hygienists–American Industrial Hygiene Association (ACGIH-AIHA) Task Group.[2] The information obtained by this program will be used for a variety of compliance and management functions in addition to traditional exposure assessment, and will allow for centralization of the information. This approach, and the accompanying tools, may have utility in other occupational settings.

Definitions of terms follow. These definitions are provided to clarify the breakdown of activities, from an ESH standpoint, conducted within the MST Division at LANL.

Definitions

Knowledgeable persons	Personnel who are very familiar with the planned or existing operation. They are able to define and discuss each task involved in the operation in detail.

Task	Subset of an operation that can be defined by different chemical, physical, or radiological hazards or by differences in the processing of the materials involved. Tasks are defined to ensure that similar hazards and controls are present throughout the task. Tasks can be defined as distinct steps in an operation.
Operation	Activity or group of activities contained within one room which result in a product or modification of a product. Examples of products include data, and parts. Owning organizations aid in the definition of operations. More than one operation may be contained within one room.
Process	A group of operations that are linked together as part of an overall project. Related operations, when combined, become processes. Processes can involve several rooms located in different facilities.
Research-based operations	Operations where the object of the work is to develop, design, refine, or test materials or processes. The end goal is not production of materials on a routine basis.

Phase I: Basic Characterization

Phase I has involved the following steps: clear definition of the goals of the data collection and management systems; development of an appropriate form for collecting data; training ESH technicians; development of a centralized database; data gathering; and quality control of the data elements entered into the database. The goal of this first phase was to gather sufficient information on new and existing operations to allow for the following: inventorying of operations and hazards, qualitative hazard assessments, personal protective equipment hazard evaluations, development of hazard control plans, verification of training plans and waste documentation, identification of applicable ESH program documents (e.g., X ray generating devices, electrical safety), and development of a method for prioritizing operations. To ensure that these goals were met, systematic data collection on a well-designed data collection form was imperative.

In June 1996 the existing Operational Data Sheets (ODSs), used to gather information on operations conducted by the division, were redesigned to provide a more systematic and detailed approach. To characterize operations consistently, detailed directions on completing the form were written. The final version of the data collection form is shown in Figure 2. Information was divided into two levels—operational and task—with the ability to group related operations into a third level (i.e., processes). For example, pouring of molten metal would be one task in a furnace operation, which would make up one part of a foundry process. This approach was taken to ensure that the characterization of an operation would occur at a task level. Similar approaches have been used elsewhere.[4,13]

Data gathered at the operation level include information that is consistent throughout the operation and thus does not vary according to task. Task-level data include information that is consistent throughout the task. The data elements collected at these two levels are listed in Table 1.

Once the ODS form was developed and the directions on filling out the form were completed, field tests were conducted to ensure that the form contained sufficient information for thorough characterization without being cumbersome. One interesting observation made in this process was the need to identify that a hazard had been evaluated, even if it is not present. For example, some operations do not involve lasers or other nonionizing radiation (NIR) sources; this must be recorded in the physical hazards section to show that the presence of NIR sources was evaluated. This was needed not only to ensure consistency in approach, but also to increase the reliability of the information gathered. This feature is significant for the MST Division in that outside entities, such as the Department of Energy, periodically conduct audits, and the ability to demonstrate that a thorough hazard evaluation was conducted is critical.

After modifications, the form, directions for completing the form, and formal training were provided to the ESH technicians responsible for data collection. The first step in the training involved an overview of the program—all three phases—including an outline of the purpose and scope of the data collection and an introduction of the data collection forms. Next, a series of three operational walk-throughs were conducted with the technicians. The first walk-through consisted of a trainer–technician team accompanied by a knowledgeable person. The trainer took the lead, demonstrating to the technician how to structure the data collection and solicit information effectively. After the first walk-through, both the trainer and the technician completed the ODSs together so that the importance of maintaining consistency when filling out the form was conveyed. The second operational walk-through was a group walk-through with four technicians, two trainers, and a knowledgeable employee. This time, the ESH technician responsible for the operation took the lead, with other group members soliciting information as needed. Once the walk-through was completed, the group determined the best way to divide the operation into tasks and to complete the forms. The last set of operational walk-throughs consisted of a trainer–technician team and a knowledgeable person, with the technicians taking the lead on collecting the data and completing the form. Each form was reviewed for completeness by the trainer, who then provided the technician with an evaluation of the data collection technique.

Development of the database system began concurrently with training. The first step was to ensure identification and integration of the needs of the three worlds as defined by Rawls[3] (data users, data owners, and data borrowers). Once this was done, the focus turned to ensuring ease of data entry and retrieval and to incorporating data verification and quality assurance checks within the system. This was accomplished by constructing the database so that queries can be easily executed to extract required information and by limiting the number and length of text fields in the database. Lastly, it was determined that the data needed to be controlled at a division level but be accessible to both affected employees and management. To this end an initial database has been developed using Microsoft Access software with plans for a read-only version to be placed on a LANL MST server for view by employees with authorized access. The underlying entity relationship diagram for the database is depicted in Figure 3. The architecture of this database was driven by the additional need to transfer information into a statistical computer package for analysis in phase II of this process.

Reviewer _____

Date _____

☐ Classified/SensitiveInfo.

Related ODSs _____

1. Location: TA-	BLDG-	RM-	Owning Org.-	Operation Start Date -
2. Description of Operation and Process Flow Diagram				

				No
3b. Task Name	4b. Frequency	5b. Duration	6b. Attended? Yes	No
3c. Task Name	4c. Frequency	5c. Duration	6c. Attended? Yes	No
3d. Task Name	4d. Frequency	5d. Duration	6d. Attended? Yes	No
3e. Task Name	4e. Frequency	5e. Duration	6e. Attended? Yes	No

II. AFFECTED WORKER(s) INFORMATION

1i. Primary Contact	2i. Z-Number	3i. Org.	4i. Phone #:	5i. e-mail	6i. Task a b c d e
1ii. Affected Worker	2ii. Z-Number	3ii. Org.	4ii. Phone #:	5ii. e-mail	6ii. Task a b c d e
1iii. Affected Worker	2iii. Z-Number	3iii. Org.	4iii. Phone #:	5iii. e-mail	6iii. Task a b c d e
1iv. Affected Worker	2iv. Z-Number	3iv. Org.	4iv. Phone #:	5iv. e-mail	6iv. Task a b c d e
1v. Affected Worker	2v. Z-Number	3v. Org.	4v. Phone #:	5v. e-mail	6v. Task a b c d e

III. OPERATIONAL HAZARDS

IIIa. Chem/Mat Hazard Info.	Task						FU
1. Are Chemicals Used?	No	a	b	c	d	e	
2. Are Carcinogens Used?	No	a	b	c	d	e	
3. Is Beryllium Used?	NO	a	b	c	d	e	
4. Is Asbestos involved?	NO	a	b	c	d	e	
5. Are PCBs Used?	NO	a	b	c	d	e	

6i. MOST FREQUENTLY USED HAZARDOUS CHEMICALS AND FORM	6ii. Task	6iii. Carc?	6iv. Exp. Pot.	6v. Quantity per Frequency

IIIb. Physical Hazard Info.	Task						FU	
1. Cold /HeatStress?	NO	a	b	c	d	e		
2. Crane/Hoist Use?	NO	a	b	c	d	e		
3. Cryogen Use?	NO	a	b	c	d	e		
4. Electrical Hazards?	NO	a	b	c	d	e		
4i. Stored Energy?	NO	a	b	c	d	e		
5. Forklift Use?	NO	a	b	c	d	e		
6. Thermal Issues?	NO	a	b	c	d	e		
7. Hydrogen System(s)?	NO	a	b	c	d	e		
8. Biological?	NO	a	b	c	d	e		
9. Noise?	NO	a	b	c	d	e		
10. Non-Ionizing Radiation?	NO	a	b	c	d	e		
10i. Laser(s)?	NO	a	b	c	d	e	Type:	λ= Class:
11. Magnetic Fields?	NO	a	b	c	d	e		
12. Confined Space?	NO	a	b	c	d	e		
13. Oxygen System?	NO	a	b	c	d	e		
14. Mechanical?	NO	a	b	c	d	e	Type:	
15. Pressure System?	NO	a	b	c	d	e		
15i. Stored Energy?	NO	a	b	c	d	e		
16. Vacuum System?	NO	a	b	c	d	e		
16i. Stored Energy?	NO	a	b	c	d	e		
17. Pyro/Explosives?	NO	a	b	c	d	e	Permit Required?	
18. Spark/Flame?	NO	a	b	c	d	e		
19. Ergonomics?	NO	a	b	c	d	e		
20. Other?	NO	a	b	c	d	e		

IIIc. Radiation Hazard Info.	Task						FU	Material and Form	Quantity
1. Radioactive Materials?	NO	a	b	c	d	e			
2. Fissile?	NO	a	b	c	d	e			
3. Radioactive Sources?	NO	a	b	c	d	e			
4. Radiation Generating Devices?	NO	a	b	c	d	e		SEM TEM Diffractometer Other:	
5. Criticality Issues?	NO	a	b	c	d	e			

MST-OSH-ODS-0011.1 (3/97)
Page 1

MST OPERATIONAL DATA SHEET

OWP _____

IV. OPERATIONAL CONTROLS

IVa. Engineering	Task						Eff.		FU	
1. Isolation/Shielding?	NO	a	b	c	d	e	Y	N		
1i. Glovebox?	NO	a	b	c	d	e	Y	N		
1ii. Hot Cell?	NO	a	b	c	d	e	Y	N		
1iii. Other Isolat/Shield?	NO	a	b	c	d	e	Y	N		
2. Local Ventilation?	NO	a	b	c	d	e	Y	N		
2i. Lab. Fume Hood? Hood Number:	NO	a	b	c	d	e	Y	N		Last Test Date: Status:
2ii. Other Ventilation?	NO	a	b	c	d	e	Y	N		
3. Audio/Visual?	NO	a	b	c	d	e	Y	N		
4. Interlocks?	NO	a	b	c	d	e	Y	N		
5. Automated Controls?	NO	a	b	c	d	e	Y	N		
6. Other?	NO	a	b	c	d	e	Y	N		

IVb. Per. Prot. Equip.	Task						Eff.		FU	
1. Gloves?	NO	a	b	c	d	e	Y	N		Type:
2. Lab Coats/ Coveralls?	NO	a	b	c	d	e	Y	N		
2i. Anti-C's/booties?	NO	a	b	c	d	e	Y	N		
3. Respirator?	NO	a	b	c	d	e	Y	N		
4. Safety Glasses/Shield?	NO	a	b	c	d	e	Y	N		
4i. Laser Goggles?	NO	a	b	c	d	e	Y	N		
5. Hearing Protection?	NO	a	b	c	d	e	Y	N		Type:
6. Other?	NO	a	b	c	d	e	Y	N		

IVc. Administrative	Task						Eff.		FU	
1. Controlled Area? (Rad)	NO	a	b	c	d	e	Y	N		
2. Proper Housekeeping?	NO	a	b	c	d	e	Y	N		
2i. General Laboratory	NO	a	b	c	d	e	Y	N		
2ii. Operation Specific	NO	a	b	c	d	e	Y	N		
2iii. HEPA Vac?	NO	a	b	c	d	e	Y	N		
2iv. Reg. Scheduled?	NO	a	b	c	d	e	Y	N		
3. Job Rotation/ Limit Exp.?	NO	a	b	c	d	e	Y	N		
4. Spark/Flame Permit?	NO	a	b	c	d	e	Y	N		
5. LO/TO Required?	NO	a	b	c	d	e	Y	N		
6. Regulated Area?	NO	a	b	c	d	e	Y	N		
6i. Beryllium?	NO	a	b	c	d	e	Y	N		
6ii. Carcinogen?	NO	a	b	c	d	e	Y	N		
7. Signs?	NO	a	b	c	d	e	Y	N		
8. Training?	NO	a	b	c	d	e	Y	N		
9. Work Authorization	NO	a	b	c	d	e	Y	N		
9i. ESH ID/NEPA	NO	a	b	c	d	e	Y	N		ESH ID #: NEPA#:
9ii.CAA (1990)	NO	a	b	c	d	e	Y	N		
9iii. SOP	NO	a	b	c	d	e	Y	N		

MST-OSH-ODS-0011.1 (3/97)
Page 3

MST OPERATIONAL DATA SHEET

OWP _____

Administrative Controls (con'd)

	Task						Eff		FU
9iv.SWP and/or RWP	NO	a	b	c	d	e	Y	N	
9v. USQD Required?	NO	a	b	c	d	e	Y	N	
10. Sole Attendant?	NO	a	b	c	d	e	Y	N	
11. Other: (SME Required?)	NO	a	b	c	d	e	Y	N	

2. Bioassay (Rad)?				
3. Carcinogen?				
4. Dosimetry?				
5. Noise?				
6. Monitoring Devices? Type:				
7. Surveys performed?				
8. Other?				

V. EMERGENCY EQUIPMENT (In Room)

EQUIPMENT	None	Yes	FU
1. Eyewash?			
2. Fire Extinguisher?			
3. Shower?			
4. Spill Kits?			

			FU	
1. Waste Generated?	None	Yes		Type
2. Satellite Storage Area?	None	Yes		

V. PACKAGING AND TRANSPORTATION (of Hazardous Materials)

P & T REQUIRED...	ALWAYS	SOMETIMES	NEVER	FU
1. Before Operation?				
2. During Operation?				
3. After Operation?				

FIGURE 2. Operational data sheet.

TABLE 1. Data Elements Collected at the Operation and Task Levels

Operational-level data elements:
- name of reviewer
- date of review
- owning organization (who is responsible for the operation)
- the assignment of a unique operational work plan number (based on the operation location)
- operation location (technical area, building, and room)
- operational flow diagram
- the delineation of the operation into tasks (task codes are currently under development)
- medical monitoring involvement
- emergency equipment present in the room
- whether or not waste is generated
- other facility-specific information

Task-level data elements:
- name of the task (later to be a task code identifier)
- duration
- frequency
- whether the task is attended (i.e., whether someone is present)
- affected employees and their ID numbers, the organizations for which they work, their phone numbers, and e-mail addresses
- hazard information:
  - chemical hazards, their physical state, quantities per frequency, and the potential for exposure given with controls present
  - physical hazards (list of 18 specific hazards with additional information requirements delineated in the instructions)
  - radiation hazards (type, physical state, materials, amounts)
- control information:
  - engineering controls used and their effectiveness
  - personal protective equipment, its type and effectiveness
  - administrative controls delineated by type and effectiveness
- areas where follow-up is required (column labeled FU)

In January 1997 a graded approach to data collection with weekly quotas for each technician was implemented. This approach has allowed the technicians to complete ODSs concurrently with their existing duties, while ensuring that all operations would be reviewed. Priority has been given to operations coming on line and those operations the technicians believe to be in the greatest need for basic characterization. Each walk-through is coordinated and completed with a knowledgeable person involved in the operation. A visit to the operation area is scheduled in advance, and a memo explaining the goal of the walk-through is forwarded to the knowledgeable employee prior to the visit. Once the walk-through is complete, an ODS is completed for the operation and forwarded to the ESH team leader. The ESH team leader first reviews each ODS to ensure consistency and comprehensiveness of the information and forwards any questions/concerns back to the technician supporting the operation for clarification. The ODS data are then entered into the database, with hard copies of the ODS maintained in a centralized location.

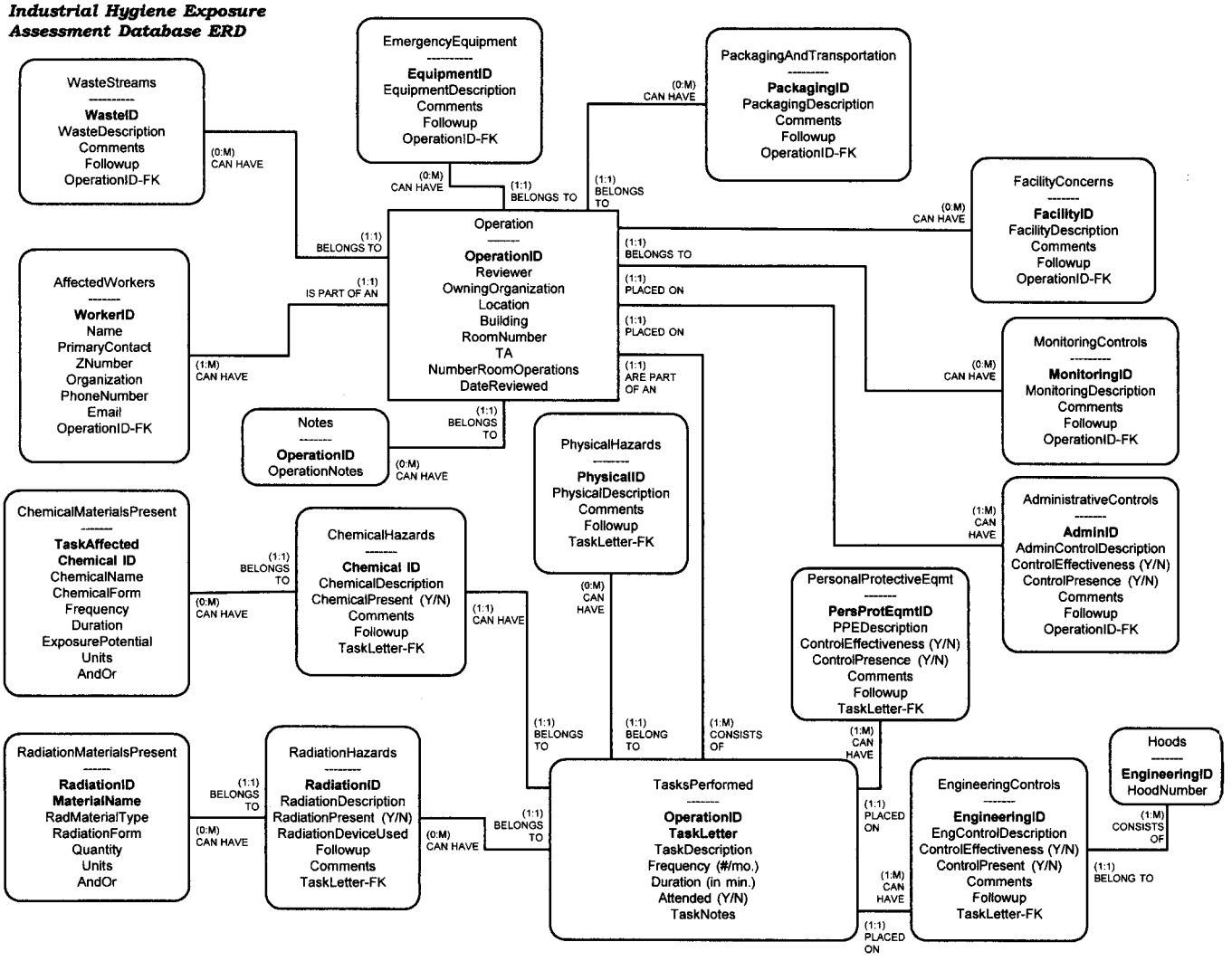
Following entry of the ODS data into the system, a summary report (Figure 4) is generated and forwarded to the knowledgeable person and the ESH technician for their review with respect to both completeness and accuracy. Any necessary changes are returned for data entry, after which finalized reports are signed off by the knowledgeable person and then archived. A copy of the final signed summary is then both filed in the ESH operations area with the original ODS and forwarded to the knowledgeable employee for his/her records. The data validation steps are important because they ensure participation and input from individuals closest to the operation, thereby increasing the reliability of the data. When changes in existing operations occur or when new operations are being planned, knowledgeable employees involved in the operation contact the ESH technician supporting the area. A decision is then made to either update the existing ODS or to complete a new ODS for the operation.

Phase II

Once sufficient data have been compiled, a paradigm to rate the operations with respect to hazard will be developed (phase II). This rating, tentatively on a scale of 0 to 3 for each hazard classification (chemical, physical, and radiological), is expected to facilitate prioritizing operations for quantitative exposure assessments, determining the frequency of control maintenance and verification, determining the level of operational readiness reviews, and determining frequency and level of operational reviews. The approach to the paradigm development will involve a combination of statistical approaches (e.g., multiple linear regression analysis and discriminant analysis). Development of the paradigm is scheduled to begin in December 1997, with validation to follow.

Phase III

Phase III will involve the implementation of a quantitative exposure assessment program. Prioritization of operations for inclusion in phase III will be driven by the hazard ratings assigned to operations in phase II, as well as by the professional judgment of the ESH team. The quantitative exposure assess-



ment program will involve the collection of the following information in a format similar to that used in phase I: the reason for sampling (baseline, diagnostic, etc.); exposure conditions; exposure pattern on day sampled; potential routes of exposures; type of samples collected (grab, area, breathing zone, etc.); duration of sample; analytical method; sample device type; serial number of instruments; date of last calibration; sample media; precalibration and postcalibration for pumps, dosimeters, etc.; and calculations performed. This information is similar to that described by the Joint ACGIH®-AIHA Task Group.[2]

As noted previously, because of the large number of operations at the MST Division, it is not feasible to complete a quantitative exposure assessment of every operation. Justification will be required and documented whenever the determination is made not to conduct sampling.

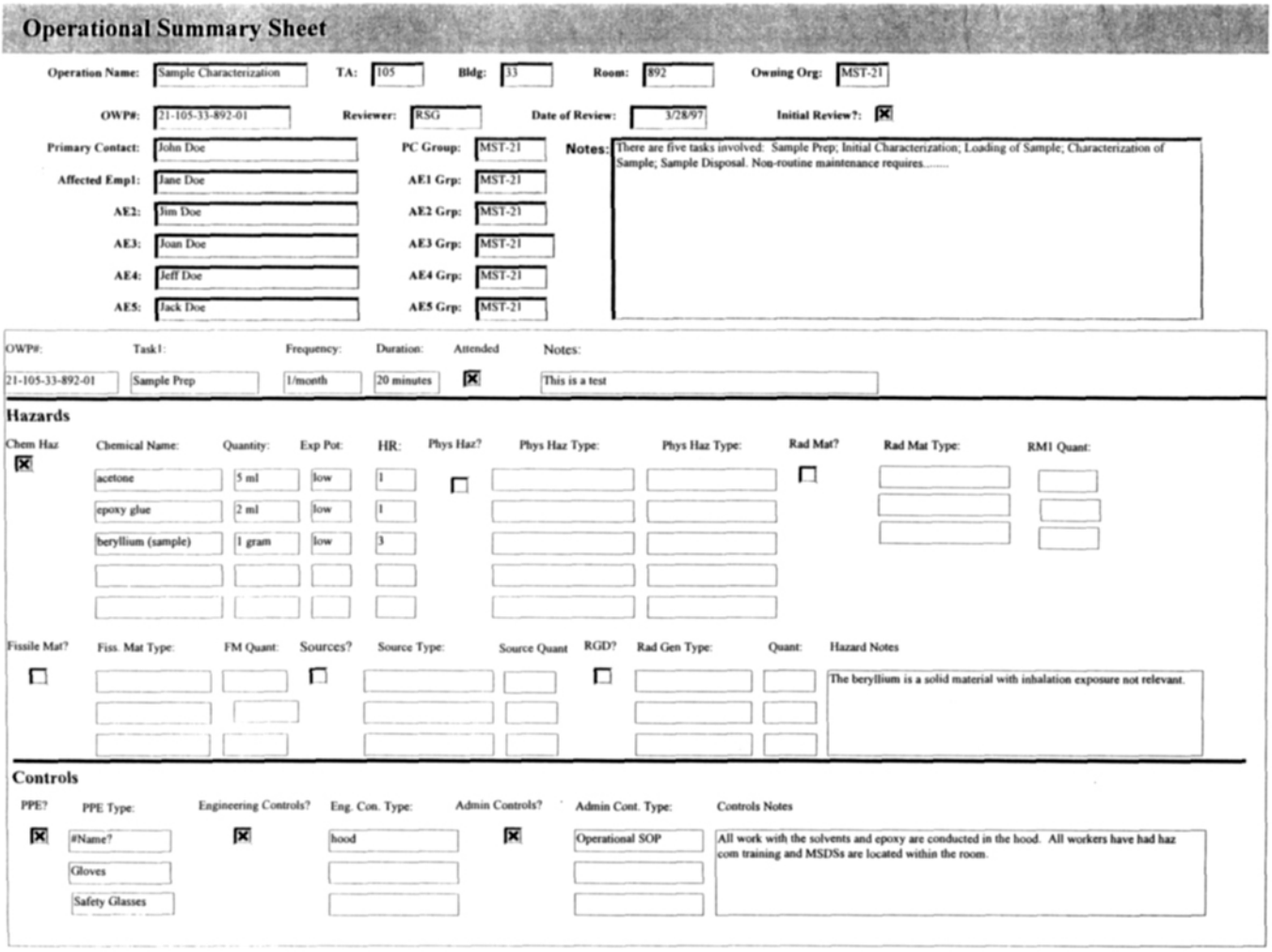
Limitations

As with any program, there are limitations associated with the proposed approach. In the case of the MST Division program, the largest limitation may lie with the strict definitions of tasks, operations, and processes. Some areas, such as machine shops, pose unique situations even though, like research-based operations, they are dynamic in nature. As a result, characterizing the activities conducted within the room—as tasks or operations—can be confusing. Much of this can be overcome by identifying those situations that do not fit neatly into the defined paradigm and by determining and communicating the desired approach to individuals involved in the data collection.

The decision to limit the definition of an operation to only one room was made because a room is a manageable, stable unit. This approach also allows for a room-by-room inventory of hazards, which can then be used to define the hazard and control parameters, not only for each operation, but also for facilities as a whole. This approach also facilitates the tracking of historical exposures/operations within facilities and identifies safety/health concerns for co-located workers.

Discussion

The need for a systematic approach to occupational exposure assessment and database development has been seen as a necessity for quite some time. The recent paper by the Joint



Operational Summary Sheet

Operation Name: Sample Characterization TA: 105 Bldg: 33 Room: 892 Owning Org: MST-21

OWP#: 21-105-33-892-01 Reviewer: RSG Date of Review: 3/28/97 Initial Review?: ☒

Primary Contact: John Doe PC Group: MST-21 Notes: There are five tasks involved: Sample Prep; Initial Characterization; Loading of Sample; Characterization of Sample; Sample Disposal. Non-routine maintenance requires.....

Affected Empl: Jane Doe AE1 Grp: MST-21

AE2: Jim Doe AE2 Grp: MST-21

AE3: Joan Doe AE3 Grp: MST-21

AE4: Jeff Doe AE4 Grp: MST-21

AE5: Jack Doe AE5 Grp: MST-21

OWP#	Task1:	Frequency:	Duration:	Attended	Notes:
21-105-33-892-01	Sample Prep	1/month	20 minutes	☒	This is a test

Hazards

Chem Haz	Chemical Name:	Quantity:	Exp Pot:	HR:	Phys Haz?	Phys Haz Type:	Phys Haz Type:	Rad Mat?	Rad Mat Type:	RMI Quant:
☒	acetone	5 ml	low	1	☐			☐		
	epoxy glue	2 ml	low	1						
	beryllium (sample)	1 gram	low	3						

Fissile Mat?	Fiss. Mat Type:	FM Quant:	Sources?	Source Type:	Source Quant	RGD?	Rad Gen Type:	Quant:	Hazard Notes
☐			☐			☐			The beryllium is a solid material with inhalation exposure not relevant.

Controls

PPE?	PPE Type:	Engineering Controls?	Eng. Con. Type:	Admin Controls?	Admin Cont. Type:	Controls Notes
☒	#Name?	☒	hood	☒	Operational SOP	All work with the solvents and epoxy are conducted in the hood. All workers have had haz com training and MSDSs are located within the room.
	Gloves					
	Safety Glasses					

FIGURE 4. Operational summary sheet.

ACGIH-AIHA Task Group provides guidance on the data elements to be included in developing a program and stresses the need for consistency in approach across organizations.[2] As pointed out by Holzner *et al.*,[5] two important aspects of a quality industrial hygiene program are the collection and management of workplace exposure information. The MST Division at LANL is in the process of implementing a standardized, systematic approach to collecting, storing, utilizing, and managing exposure assessment information. The approach closely parallels the guidance provided by the Joint ACGIH-AIHA Task Group paper in order to ensure a quality industrial hygiene exposure assessment program.

Clearly defining the goals of an exposure assessment program, identifying required information and end users of the information, developing comprehensive data-gathering instruments, training data gatherers, carefully designing the database, and ensuring quality control in the data collection and entry process are paramount to developing a flexible, effective program.

This first phase of the program provides a more consistent, comprehensive, and centralized approach to ESH than has been available in the past to the MST Division. Additionally, the information gathered lends itself to a variety of uses by all three worlds described by Rawls—the data collectors, the data owners, and the data borrowers—not just for exposure assessment purposes.[3] For example, project managers can use the information to aid in the development of safe operating procedures; line managers can use the information to inventory hazards and controls by operation, room, building, or facility, as well as track/trend changes that occur over time; facility managers can use the information to prioritize operations for routine maintenance/surveillance of controls and to determine efficient resource allocations for different types of operations; and occupational medicine personnel can use the information to validate medical monitoring enrollment. However, without consistency in the information gathered and entered into the system, the utility of the system is diminished.

Training, which is necessary for both data collection and validation of the information once it has been entered into the database, also poses the greatest challenge. Specifically, obtaining consensus among the ESH professionals on the definitions of tasks conducted within operations was initially quite difficult. However, with time, additional training, and group walkthroughs, consistency in the identification and definition of

tasks greatly improved. Furthermore, this additional training proved valuable when communicating the end goals for the processes to researchers and affected workers. As a result, the training greatly improved the reliability of the data. Without such processes, conclusions based on the data would be suspect.

Research-based facilities can benefit from a systematic and comprehensive approach to the exposure assessment process. However, due to the limited resources and wide variety of operations, they must implement systems that are flexible enough to allow for many uses of the data by multiple users once the data are collected. In the implementation of phase I: basic characterization, which is currently underway, careful consideration has been given to the design and development of both the data collection instrument and the database. Phase II, development of a prioritization paradigm, will be initiated in early winter, with the development and implementation of phase III scheduled for the following winter. Once complete, this process will result in a comprehensive, systematic exposure assessment program, as well as a tool for use by management in prioritizing operations based on the presence of hazards and control and may find utility in other occupational settings.

Acknowledgments

The authors thank LANL for funding this research, the MST Division for cooperation in the acquisition of information, and the MST ESH team for assisting in the development of forms and collection of the operation information. Special thanks to Paul Wiemann, MST ESH team leader, for his assistance in overseeing the implementation of phase I and his thoughtful review of this manuscript.

References

1. Hawkins, N.C.; Norwood, S.K.; Rock, J.C. (Eds.): A Strategy for Occupational Exposure Assessment. American Industrial Hygiene Association, Fairfax, VA (1991).
2. Joint ACGIH-AIHA Task Group on Occupational Exposure Databases: Data Elements for Occupational Exposure Databases: Guidelines and Recommendations for Airborne Hazards and Noise. Appl. Occup. Environ. Hyg. 11(11):1294–1311 (1996).
3. Rawls, G.: The Worlds of Occupational Exposure Databases. Appl. Occup. Environ. Hyg. 10(4):237 (1995).
4. Gomez, M.R.; Rawls, G.: Conference on Occupational Exposure Databases: A Report and Look at the Future. Appl. Occup. Environ. Hyg. 10(4):238–243 (1995).
5. Holzner, C.L.; Hirsh, R.B.; Perper, J.B.: Managing Workplace Exposure Information. Am. Ind. Hyg. Assoc. J. 54(1):15–21 (1993).
6. Ott, M.G.; Norwood, S.K.; Cook, R.R.: The Collection and Management of Occupational Exposure Data. The American Statistician 39(4):432–436 (1985).
7. Tait, K.: The Workplace Exposure Assessment Workbook (WORKBOOK). Appl. Occup. Environ. Hyg. 8(1):55–68 (1993).
8. Tait, K.: The Workplace Exposure Assessment Expert System (Workspert). Am. Ind. Hyg. Assoc. J. 53(2):84–98 (1992).
9. Damiano, J.: Quantitative Exposure Assessment Strategies and Data in the Aluminum Company of America. Appl. Occup. Environ. Hyg. 10(4):289–298 (1995).
10. AIHA Board of Directors: American Industrial Hygiene Association White Paper: A Generic Exposure Assessment Standard. Am. Ind. Hyg. Assoc. J. 55(11):1009–1013 (1994).
11. Tait, K.: Commentary on the AIHA White Paper: A Generic Exposure Assessment Standard. Am. Ind. Hyg. Assoc. J. 55(10): 1014–1018 (1994).
12. U.S. Department of Labor: 29 CFR 1910.132 Subpart I—Personal Protective Equipment. U.S. Department of Labor, Washington, DC (1995).
13. Susi, P.; Schneider, S.: Database Needs for a Task-Based Exposure Assessment Model for Construction. Appl. Occup. Environ. Hyg. 10(4):394–399 (1995).