

Phase I: Gather and Analyze Data

Introduction

Business, financial, and IH data from ORC member companies was gathered and analyzed during Phase I of the Value of the Industrial Hygiene Profession project. Companies were selected that met criteria for participation in subsequent study phases. Although the survey responses do not represent a statistically significant sample, analyses of a number of program issues are included where the data were thought to be useful.

Those companies providing positive responses to the greatest number of questions and having the most comprehensive programs were included in the group from which participating companies were to be selected. Of particular interest were those that had performed business case analyses or conducted cost or improvement studies of various elements of their IH programs, that had implemented a comprehensive IH exposure monitoring strategy, and that maintained a health monitoring system database that had been used to conduct health studies.

Companies that had performed business case analyses or conducted cost or improvement studies were thought likely to be able to support the development and testing of the *Quantitative* and *Qualitative Approaches*, either by applying the proposed approaches and determining their ability to return meaningful analyses, or by providing insight into the elements that should be included in each strategy.

Those companies that had implemented a comprehensive IH exposure monitoring strategy and maintained a health monitoring system database were thought to be potentially able to provide data to link employee exposure history with health outcomes and ultimately to business impacts.

In providing examples for use in the quantitative strategy portion of this project, companies were asked to use cases of individual IH interventions that could be classified according to type of IH hazard (i.e., biological, chemical, ergonomic, noise, other physical, or radiation), and the level along the hierarchy of controls of the approach that was used to abate the hazard (i.e., administrative/PPE, engineering, or elimination). (See Figure I-1.) This allowed testing on a nearly full range of possible IH exposure scenarios, and added criteria for the ultimate selection of participants. The results of this testing are discussed in the Phase IV section of this report.

Few companies had all of the types of data sought through the surveys. However, in the search for companies to participate, a great deal was learned about the status of IH programs in some of the world's best companies. The data gathered were useful for building the *IH Value Strategy* and for gaining insights into good IH management practice.

Ultimately, the key determining factors in the selection of participants were a company's ability and willingness to share data, to participate in the on-site surveys, to develop case studies of IH risk mitigation projects, and to host subsequent site visits. As a consequence of these factors, the list of companies that initially expressed interest in participating and that met many of the criteria differs somewhat from those that actually contributed case studies.

	Biological Exposure	Chemical Exposure	Ergonomics	Noise	Other Physical: Heat, Cold, Vibration Radiation	Radiation - Ionizing, Non- Ionizing
PPE/ Administrative Controls						
Engineering Controls						
Eliminate Hazard						

Figure I-1. Project Matrix for Quantitative Analysis.

Phase I Survey Results

Survey I for the Value of the Industrial Hygiene Profession project was developed to gather and analyze general data on ORC Worldwide member companies as well as more specific information about their IH programs and practices. Companies were asked to provide responses for two levels of their programs: for the corporation as a whole and for the site that represented their “best” IH program. Identifying the best site was an approach intended to increase the probability of locating programs and projects that would be comprehensive and that would have the highest quality of IH information.

Companies identified their best sites in terms of the quality of IH-related management systems, compliance, and innovation, and the likelihood of having data that could be used to understand how employee health status and business outcomes have been influenced by IH programs.

Survey I was designed to identify ORC member companies that could 1) provide the types of data needed to design, develop, and test the *IH Value Strategy* and its components, and 2) be representative of the wide range of sizes and industry categories in which the *IH Value Strategy* ultimately would be used. The survey polled members regarding company demographics, organization, and industry sector; IH management systems and program elements; IH-related costs and outcome data; and interest in participating in Phase II of the study (see Appendix A: Survey I). In all, 46 ORC member companies responded. (See Appendix B for a list of survey respondents).

Section I—Site Identification, Demographics and Organization

Demographics

Although ORC Worldwide member companies tend to be large, the 46 responding companies exhibited a range of global employee populations from smaller (775 employees), to moderate (4,000 to 10,000 employees), to large (11,250 to 88,853 employees), to very large (219,400 to 259,263 employees) (see Figure I-2). This wide range of company sizes provided the opportunity to see how the *IH Value Strategy* could be applied in small as well as very large organizations. In addition, information about site-level programs and projects allowed the study team to isolate smaller projects that were similar to the conditions likely to be found in smaller companies.

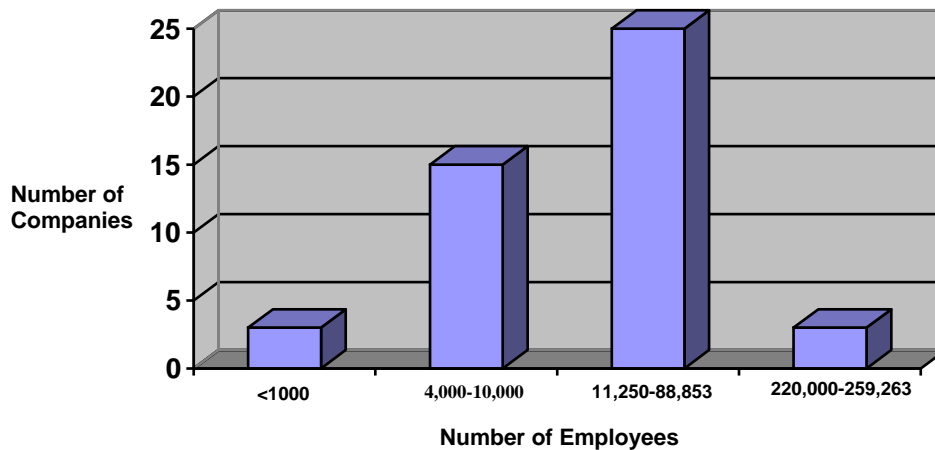


Figure I-2. Range of Employee Populations of Responding Companies.

Companies also were asked to indicate the numbers of employees globally in each functional area of their businesses, according to whether they worked in manufacturing/operations, sales and/or service, corporate or division staff, or research and development (Figure I-3). The large majority of employees fell into the manufacturing/operations group, with an average population across reporting companies of approximately 28,000.

Further categorization of employees by primary North American Industry Classification System (NAICS) code(s) and the NAICS code(s) for the best IH program sites, formed a set of information about the type of exposure to potential risk that employees in each company may have experienced (Figure I-4). This was additional information for identifying companies that may have had examples meeting the criteria for participation discussed earlier, and provided data for further analysis of survey responses.

Within these companies a range of operations exists that includes service functions that are representative of the many types of businesses and activities in which industrial hygienists may find themselves engaged. Warehousing, transportation of goods, and maintenance and repair of equipment and facilities, are a few examples. Laboratory and other research settings are also represented. Missing are major service businesses such as hotel- and restaurant-related industries, package handling and delivery services, construction contractors, and transportation companies.

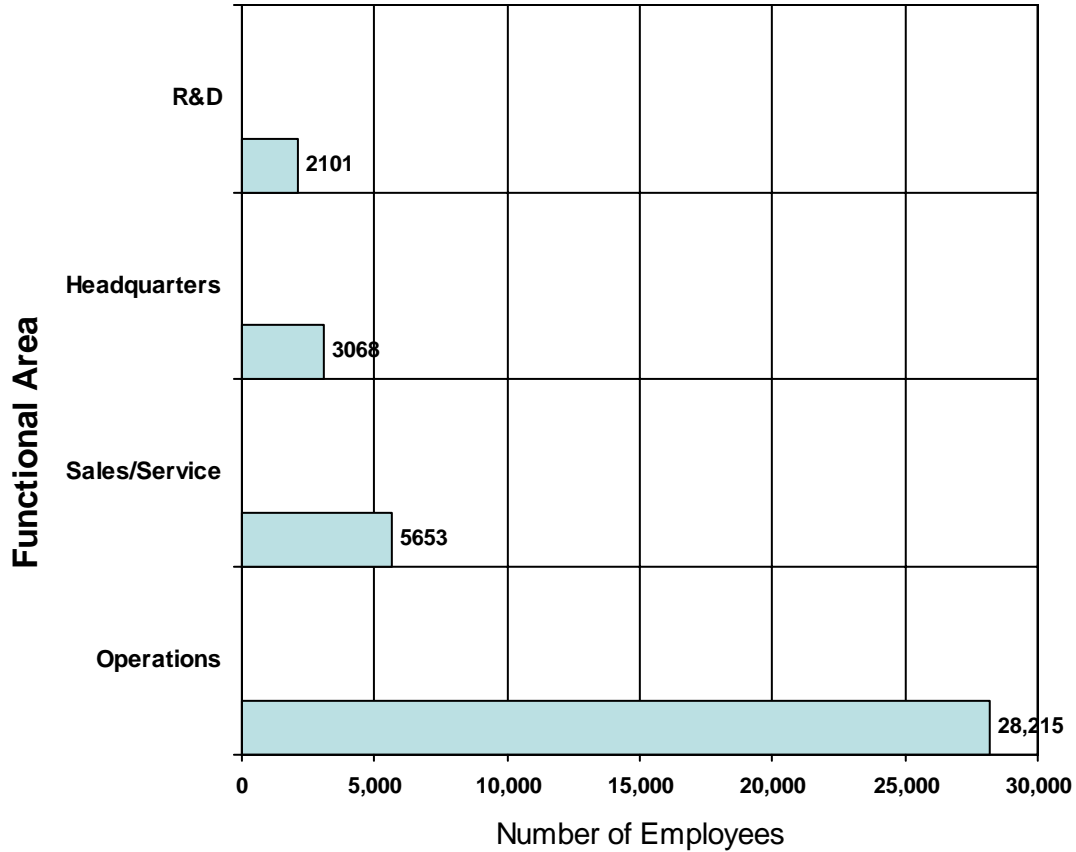


Figure I-3: Number of Employees by Functional Area.

The responding companies represented the following primary industries:

- Aerospace and defense equipment manufacturing
- Automobile manufacturing
- Chemical manufacturing
- Electric power generation
- Electronic products manufacturing
- Food processing
- Glass packaging manufacturing
- Industrial gases production
- Industrial parts distribution
- Industrial products manufacturing
- Medical device manufacturing
- Mining
- Paper manufacturing
- Pharmaceutical preparation manufacturing
- Petroleum processing, research laboratories
- Semiconductor manufacturing
- Specialty glass and ceramic components manufacturing
- Tobacco products manufacturing.

A more in-depth look at the distribution of employees across specific industries within the manufacturing sector revealed that a large majority of the total number of global employees is in automobile manufacturing (635,704), followed by aerospace and defense (158,100), pharmaceutical preparation manufacturing (74,329), chemical manufacturing (71,551), industrial products manufacturing (49,000), food processing (40,000), electric power generation (21,734), petroleum processing (13,885), medical device manufacturing (11,559), and tobacco products manufacturing (6,840).

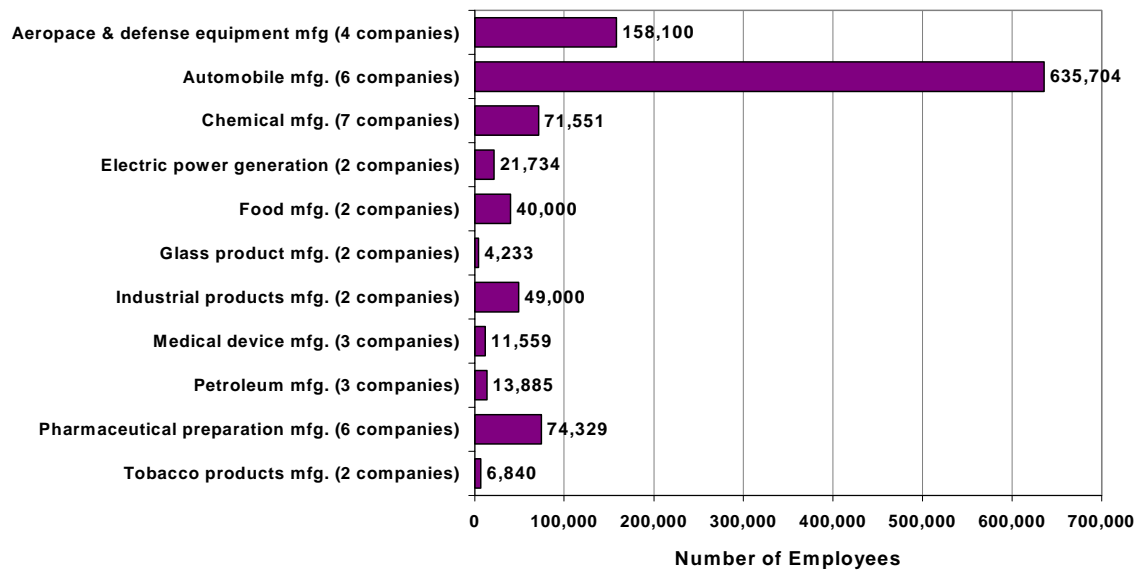


Figure I-4. Total Number of Manufacturing/Operations Employees per Industry Sector

The majority of manufacturing companies that responded to the survey were smaller to medium size in global employee population (Figure I-5).

Organization

In order to understand how companies allocate their IH expertise, and if the level of staffing should be considered as a criterion in the selection of participating companies, the survey asked them to indicate the number of Industrial Hygienists and Certified Industrial Hygienists (CIHs) throughout the corporation and at the best IH program sites. (Certification was defined as being certified in the country of employment and not necessarily by ABIH.) IH staffing was not seen as a significant factor in selection of participants.

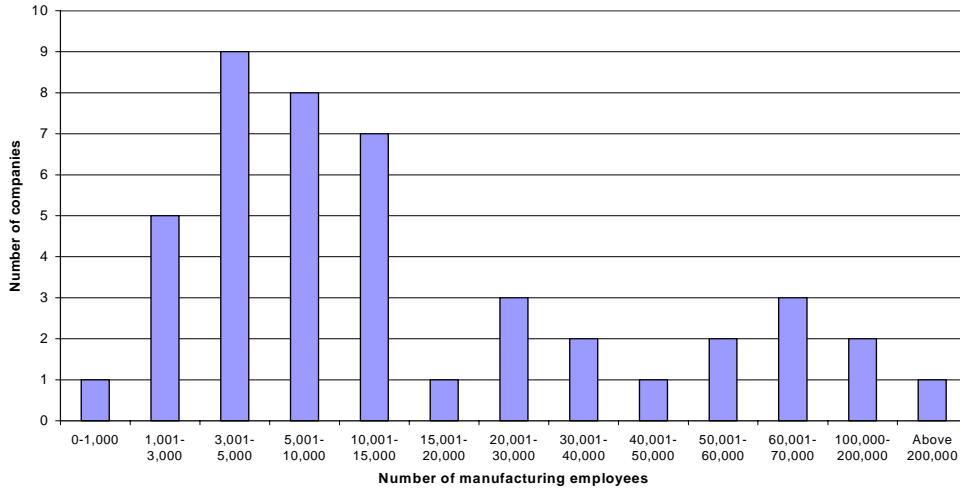


Figure I-5. Distribution of Survey Participants by Total Number of Manufacturing/Operations Employees.

Reporting Structure

Companies were asked to describe the IH reporting structure within their corporate and best IH program site organizations up to three reporting levels. This information was used to determine the relative status of IH throughout each company and at its best IH program site. In addition, information about where IH was placed in an organization gave an indication of how it functioned and how leadership regarded the role of IH in the company. Ideally, companies with a strong reporting relationship to company leadership would be selected because of the support that would likely be given to the IH program for participation and follow-through.

Corporate

At the highest level, the IH function typically reports to a Vice President of Environment, Health and Safety (EHS, or some similar letter combination representing those functions), as was the case with 9 of the 42 companies that answered this question. Also common is to have the highest level into which the IH function reports be a director rather than a vice president. Seven companies reported having this relationship. This position may be a Director or Senior Director of EHS or a Director of Safety and Health (S&H). Other titles included Director, Safety & Workers' Compensation; Director, Chemical Risk Management; and Associate Director, Safety and Environmental Protection.

Three companies indicated that the IH function reported to the Chief Executive Officer (CEO). In these cases, reporting was through a Vice President, either of Human Resources, or Operations. The remaining companies indicated a variety of reporting relationships, including Vice President of Legal, and Vice President of Human Resources.

Best IH Program Site

Most of the 31 companies that responded to this part of the question described three levels of reporting structure for their best IH program sites. Reporting at the site level was typically to the plant manager or a general manager. Seven companies reported this relationship. Equally common is reporting to the operations or manufacturing function through a Vice

President or Director at the site. Other positions included Business Unit or Regional Director or Manager of EHS; Associate Director, Safety and Environmental Protection; and Director, Chemical Risk Management.

The survey asked whether a functional or reporting relationship existed between IH resources at the site level and IH resources at the corporate level. Eighteen member companies maintained they had a functional relationship, three member companies maintained they had a direct reporting relationship, and seventeen member companies stated they had both relationships.

Section II—IH Management Systems and Program Elements

IH Management Systems

To identify well-managed IH programs and to understand the characteristics of IH programs in companies selected to participate in the project, the survey asked about the specific elements of the management systems in use by both the corporation and the best IH program site. The program elements mirrored those outlined in the ANSI Z-10 Occupational Health and Safety Management Systems (OHSMS) Standard:

- IH Policy
- Leadership responsibility and authority
- Employee participation
- Planning
- Hazard identification, assessment, and control
- Incident investigation
- Design review and management of change
- Purchasing review
- Contractor IH policy
- Emergency preparedness
- Education, training, awareness, and competence
- Communication
- Records management
- Auditing
- Management review.

Ten companies reported that they had implemented all 15 OHSMS elements at both the corporation and site levels. Five of these companies were full participants in the project, providing case studies in addition to hosting site visits and responding to both questionnaires. This was extremely helpful because this level of management system implementation indicates that IH programs are likely to be strong, have reliable data upon which to base conclusions, and to have taken appropriate steps to identify and control IH risks.

Member companies generally used more industrial hygiene/occupational health management system elements at the corporation level than at their best IH program sites. The program element used most at the best IH program sites was incident investigation. Of the 39 member companies that used the incident investigation element, 34 of those companies also used the element at the corporation level. The program element used the most at the corporation level was leadership responsibility and authority. Of the 41 companies that used the leadership responsibility and authority element, 33 of those companies also used the element at their best IH program sites.

The program elements used least at the best IH program sites were purchasing review and contractor IH policy (equal numbers of companies used these elements). Of the 28 companies that used the purchasing review policy, only 18 used the element at the corporation level. Of the 28 companies that used the contractor IH policy at their best IH program sites, only 24 used the element at the corporation level. The program element least used at the corporation level was purchasing review. Of the 25 companies that used the purchasing review policy at the corporation level, only 18 used the element at their best IH program sites.

In addition to information about implementation of the management system elements listed previously, the survey collected data regarding the use of recognized management systems and/or processes such as Six Sigma, Lean, Malcolm Baldrige Award, ANSI Z-10, ISO 9000, ISO 14001, OHSAS 18001, OSHA VPP and others. Companies that used these systems, particularly Six Sigma and Lean, were thought likely to have done the kind of systematic analysis of their processes to develop data on IH risks and their possible economic impact.

Of the 42 companies that responded to this question, 24 were engaged in the Six Sigma management system. Of those 24, 19 were engaged in Lean, 7 in Malcolm Baldrige, 15 in ISO 9000, 14 in ISO 14001, 9 in OHSAS 18001, 5 in ANSI-Z-10, 12 in OSHA VPP, and 6 in other management systems. Results show that companies that used Six Sigma also used Lean more than any other approach (Table I-1).

IH Program Element Evaluation

The survey examined how companies address certain specific IH program elements, including risk assessment, risk prioritization, risk control, and others. These elements were then analyzed independently by sub-category. Areas of interest within risk assessment were chemical exposure monitoring, noise assessment, ergonomics, and ionizing and/or non-ionizing radiation. Areas of interest within risk control included risk elimination; substitution of less hazardous materials, operations, processes, or equipment; engineering controls; warnings; administrative controls; respiratory protection; and other personal protective equipment (PPE). We asked member companies what percentage of total program time they spent in these specific areas (Figure I-6).

On average, about 37% of total program time was spent on risk assessment. Twelve percent of total program time was spent on IH risk prioritization. About 42% of total program time was spent on IH risk control. On average, 9% of total program time was spent on other areas.

Through analysis of the time that company IH programs spend on specific risk assessment and control activities, potential areas for improving effectiveness of IH programs were identified (Figure I-7, Figure I-8). In conducting risk assessment, companies indicated that they spent 42% of their IH program time on chemical exposure assessment, 28% on ergonomics, 21% on noise assessment, and 9% on ionizing and non-ionizing radiation. On the risk control side, 24% of IH risk control time was spent on engineering controls, while another 26% was spent on protective equipment and respiratory protection. Twelve percent was given to administrative controls. Only 15% was spent on elimination of risk. Substitution of hazardous materials was given 15%, which, together with risk elimination, is an indication of focus toward more effective programs. Opportunity lies in the area of reducing the amount of time spent on PPE, respiratory protection, and administrative controls applied, and increasing the proportion spent on elimination and substitution. Indeed, these areas have been shown in previous analyses of IH interventions to have great potential to reduce operating costs and increase productivity.

Table I-1: Use of Recognized Management Systems and/or Processes

Company ID Number	Six Sigma	Lean	Malcolm Baldrige Award	ISO 9000	ISO 14001	OHSAS 18001	ANSI Z-10	OSHA VPP	Others
12	N	N	N	N	N	N	N	N	
7	Y	Y	Y	Y	Y	Y	Y	Y	
32	N	N	N	N	Y	N	N	N	
11	N	Y	N	Y	Y	Y	N	Y	
35	N	N	N	Y	N	N	N	N	
40	N	N	N	N	N	N	N	N	Company established Standards
42	N	N	N	N	N	N	N	N	
41	N	N	N	N	Y	N	N	N	
3	Y	Y	N	N	N	N	N	Y	
37	Y	Y	Y	Y	Y	Y	N	N	
6	N	Y	N	Y	N	N	N	N	We take the best of the above and incorporate all of them into our own management system.
9	Y	Y	N	Y	Y	N	N	N	
47	N	N	N	N	N	N	N	N	
39	Y	N	N	Y	Y	Y	Y	Y	
36	Y	Y	Y	Y	Y	N	N	Y	RCMS (American Chemistry Council)
19	Y	Y	Y	N	N	N	N	Y	Responsible Care
23	Y	Y	Y	Y	Y	Y	N	Y	
14	Y	Y	N	N	N	N	N	N	
29	Y	N	N	N	N	N	N	Y	
30	Y	N	N	N	N	N	N	Y	
46	Y	Y	N	N	N	N	N	N	isrs7
44	N	Y	N	Y	Y	N	N	N	
4	Y	Y	N	Y	Y	Y	N	Y	
16	N	N	N	Y	Y	N	N	N	
24	Y	Y	N	Y	Y	Y	N	Y	
25	N	N	N	Y	Y	N	N	Y	
8	Y	Y	N	N	Y	N	N	Y	
5	N	N	N	Y	Y	Y	Y	Y	An internal EMS and HSMS at all sites in addition to programs at the sites under certified management systems. Internal management systems follow ANSI Z10 and ISO 14001 w/out the Environment certification.
18	Y	Y	N	Y	Y	Y	Y	N	
13	Y	Y	Y	Y	Y	Y	Y	N	
33	N	N	Y	N	Y	N	N	N	
21	N	Y	N	Y	Y	Y	Y	N	
28	Y	N	Y	Y	Y	N	N	N	
38	N	Y	N	N	N	N	N	N	
26	N	N	N	Y	Y	Y	N	Y	
34	N	Y	N	Y	N	N	Y	N	
22	Y	Y	N	Y	Y	N	Y	N	
45	Y	Y	N	N	N	N	N	N	
49	N	N	N	Y	Y	N	N	Y	We have a MS that is a consolidation of ISO, RC, etc.
27	Y	Y	N	Y	N	N	N	N	
2	Y	Y	N	N	Y	Y	N	Y	OHSAS is part of MS, not going for external cert

Company ID Number	Six Sigma	Lean	Malcolm Baldrige Award	ISO 9000	ISO 14001	OHSAS 18001	ANSI Z-10	OSHA VPP	Others
43	Y	Y	N	Y	N	N	N	N	
10	N	Y	N	Y	N	N	N	Y	
20	Y	N	N	Y	N	N	N	N	
15	N	N	N	Y	Y	Y	N	N	
17	N	N	N	N	N	N	N	N	

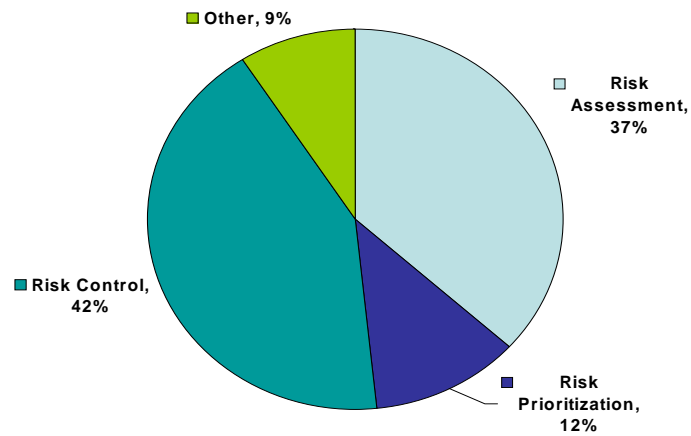


Figure I-6. Total IH Program Time Spent on Risk (Average percentage of all companies)

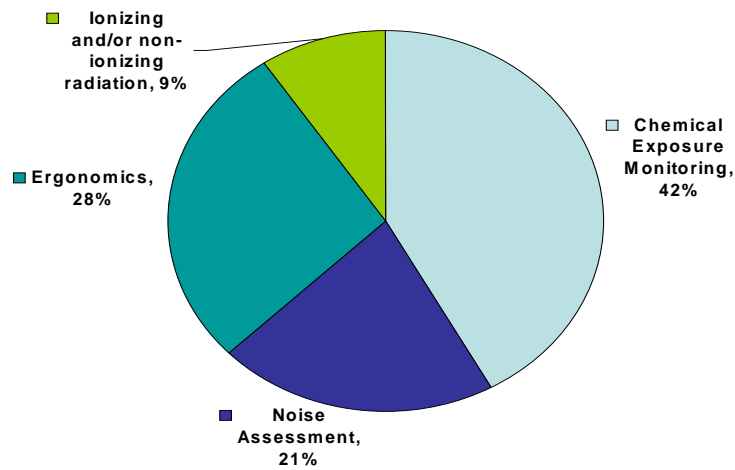


Figure I-7. Percentage of Total Program Time Spent on Specific Risk Assessment Activities

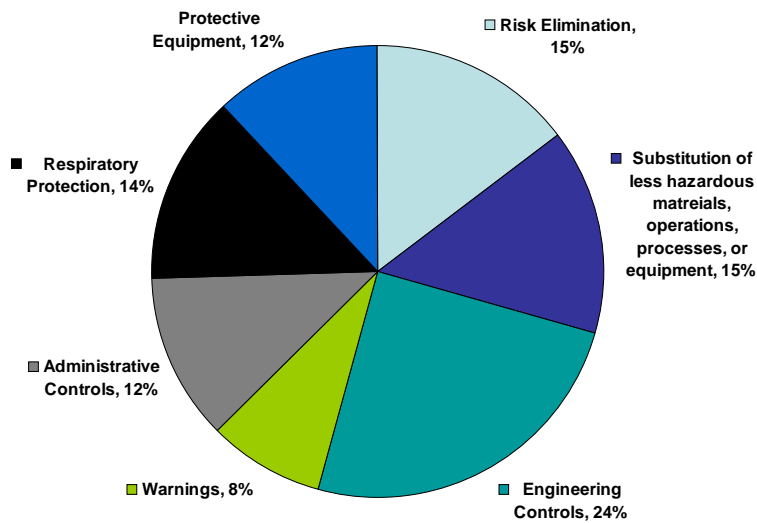


Figure I-8. Percentage of Total Program Time Spent on Specific Risk Control Activities.

Selecting companies that spent more time on proactive activities was thought to increase the likelihood of finding cost-effective, more protective IH programs. It was also thought that these companies would have good test examples and case studies for the *IH Value Strategy*.

Part of this question focused on cost-benefit and process improvement studies, and asked about which IH program elements had undergone them. Eleven companies conducted these studies on risk assessment (Table I-2). Four of the 11 companies also conducted studies on risk prioritization and seven also conducted studies on risk control. Of the 11 companies, ten had conducted cost-benefit and/or process improvement studies on ergonomic risks, eight had conducted studies on chemical exposure monitoring, seven had conducted studies on noise assessment, and five had conducted studies on ionizing and/or non-ionizing radiation. These results suggest that cost or improvement studies on ergonomic risks are completed more often than other type of study.

Cost-benefit or process improvement studies for risk control were conducted by 10 member companies out of the 31 that responded to this question. Of those 10 companies, eight had risk elimination studies; eight had engineering controls studies; six had substitution of less hazardous materials, operations, processes, or equipment studies; four had respiratory protection studies; three had warning studies; three had other PPE studies; and two had administrative control studies.

The following tables illustrate the distribution of cost or improvement studies conducted on various aspects of IH risk assessment and control programs.

Table I-2: Number of Companies with IH Program Cost or Improvement Studies.

IH Sectors		Number of Companies
Risk Assessment		11
	Chemical Exposure Monitoring	10
	Noise Assessment	9
	Ergonomics	13
	Ionizing and/or Non-ionizing Radiation	5
Risk Prioritization		5
Risk Control		10
	Risk Elimination	9
	Substitution of Less Hazardous Materials, Operations, Processes, or Equipment	9
	Engineering Controls	11
	Warnings	3
	Administrative Controls	2
	Respiratory Protection	4
	Other Personal Protective Equipment	3
Other		0

The companies shown in Tables I-3 and I-4 are those that had conducted studies in the greatest number of IH program areas. These companies represented the greatest opportunity for identifying potential projects for development of the micro strategy.

Table I-3: Cost or Improvement Studies on IH Risk Assessment and Control Programs.

Companies Conducting Studies on RISK ASSESSMENT also conducted:	Studies on Chemical Exposure Monitoring	Studies on Noise Assessment	Studies on Ergonomics	Studies on Ionizing and/or Non-ionizing Radiation	Studies on Risk Prioritization	Studies on Risk Control
2	✓	✓	✓	✓	✓	✓
5	✓	✓	✓			✓
12	✓	✓	✓			
14	✓	✓	✓	✓	✓	✓
15	✓	✓	✓	✓	✓	✓
16			✓			
17	✓		✓			✓
34			✓	✓		✓
35	✓	✓		✓	✓	✓
37			✓			
39	✓	✓	✓			

Table I-4: Cost or Improvement Studies in Specific Risk Control Areas.

Cost or Improvement Studies for RISK CONTROL (By Company ID)	Also Conducted Risk Elimination Studies	Substitution	Engineering Controls Studies	Warning Studies	Administrative Controls Studies	Respiratory Protection Studies	Other Personal Protective Equipment Studies
12	✓	✓	✓			✓	
7	✓		✓	✓			
35	✓	✓	✓				
6	✓	✓					
39						✓	✓
19	✓	✓	✓	✓	✓	✓	✓
4	✓		✓				
5			✓				
28	✓	✓	✓				
49	✓	✓	✓	✓	✓	✓	✓

Program Goals

Companies were asked to describe what they believed to be the ultimate goals driving each aspect of their IH program implementation. Those that indicated excellence were regarded as having higher quality IH program implementation overall. It is notable that more companies identified compliance as a program goal than identified excellence (Table I-5). Loss avoidance was less commonly identified than compliance, but was more often cited than excellence.

Table I-5. IH Program Goals.

IH Sector	Number of Companies		
	Compliance	Loss Avoidance	Excellence
Risk Assessment	35	30	24
Chemical Exposure Monitoring	33	28	20
Noise Assessment	33	24	15
Ergonomics	24	27	22
Ionizing and/or non-ionizing radiation	28	20	12
Risk Prioritization	31	28	20
Risk Control	30	27	23
Risk Elimination	29	24	18
Substitution of Less Hazardous Materials, Operations, Processes, or Equipment	26	26	19
Engineering Controls	31	29	19
Warnings	28	25	14
Administrative Controls	29	27	11
Respiratory Protection	30	29	15
Other Personal Protective Equipment	30	29	13
Other	38	41	41

A key element of an IH program is a comprehensive IH exposure monitoring strategy. For the purposes of Survey I, companies that had comprehensive IH exposure monitoring strategies would be able to provide detailed information about IH risk in specific processes, which would enable them to describe the effectiveness of interventions in reducing those risks. Of the 45 companies who responded, 28 (61%) had implemented a comprehensive IH exposure monitoring strategy

If a company maintains a health monitoring system database that collects comprehensive health surveillance data, IH exposure data, and employee personal information, and that can generate specific data elements on specific employee groups, IH exposure groups, and medical surveillance outcomes, it has a powerful tool for linking IH risk with health outcomes. Even more useful would be studies that had been conducted to identify the health outcomes among specific exposed groups of employees. In designing the survey, the study team hoped to identify companies that could provide this type of information, for use in developing both the *Quantitative* and *Qualitative Approaches* of the ***IH Value Strategy***.

Results show that the majority of member companies that had implemented a comprehensive IH exposure monitoring strategy also maintained a health monitoring system database with the capability of linking to comprehensive IH exposure data for all employee exposure groups. These 28 companies also maintained less comprehensive health surveillance data on all employees.

Of the 28 companies that implemented a comprehensive IH monitoring strategy, 18 maintained a health monitoring system database with the capability of comprehensive health surveillance data on exposed employees (Figure I-9). Four companies maintained a health monitoring system database with the capability of comprehensive health surveillance data on all employees. Twenty-two companies maintained a health monitoring system database with the capability of tracking comprehensive IH exposure data for all employee exposure groups. Nine companies maintained a health monitoring system database with the capability of linking complete employee personal information. Thirteen companies maintained a health monitoring system database with the capability of generating specific data elements on specific employee groups. Nineteen companies maintained a health monitoring system database with the capability of generating specific data elements on IH exposure groups. Thirteen companies maintained a health monitoring system database with the capability of generating specific data elements on medical surveillance outcomes.

The survey asked member companies whether their companies had conducted health studies using a health monitoring system. Of the 42 companies that responded to the question, 10 companies conducted the health studies and all 10 had comprehensive IH exposure monitoring strategies (Figure I-9). Eight of the ten companies had comprehensive health surveillance data on exposed employees, two had comprehensive health surveillance data on all employees, eight had comprehensive industrial hygiene exposure data for all employee exposure groups, seven had links to complete employee personal information, six were capable of generating specific data elements on specific employee groups, eight were capable of generating specific data elements on IH exposure groups, and eight were capable of generating specific data elements on medical surveillance outcomes (Table I-6).

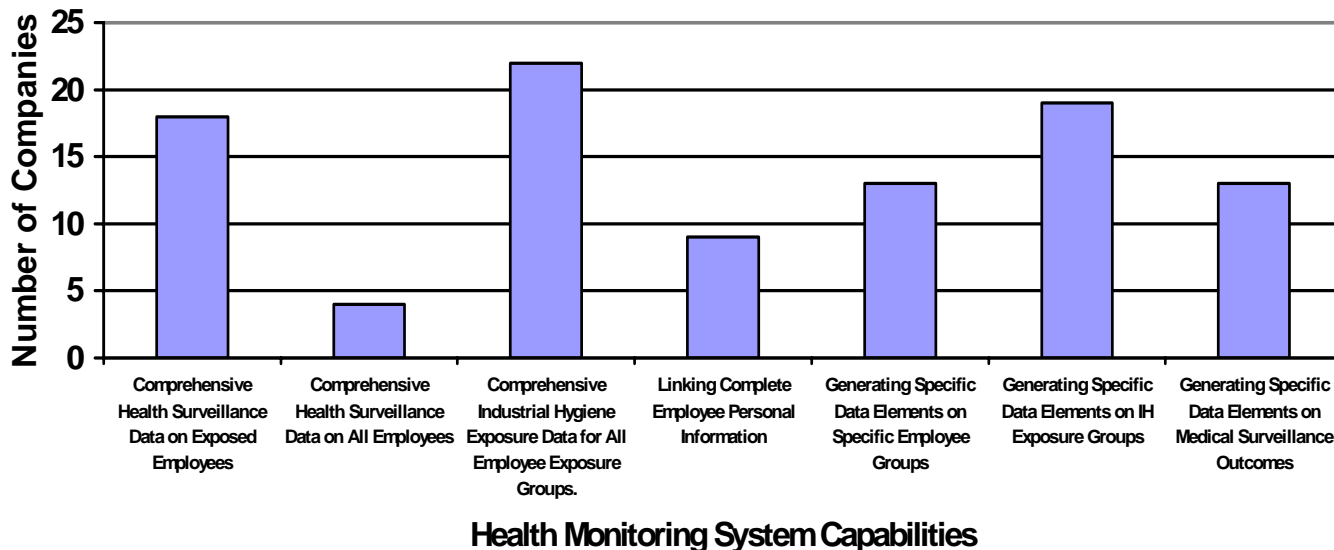


Figure I-9. Companies with Comprehensive Industrial Hygiene Exposure Monitoring Strategies with Health Monitoring System Capabilities.

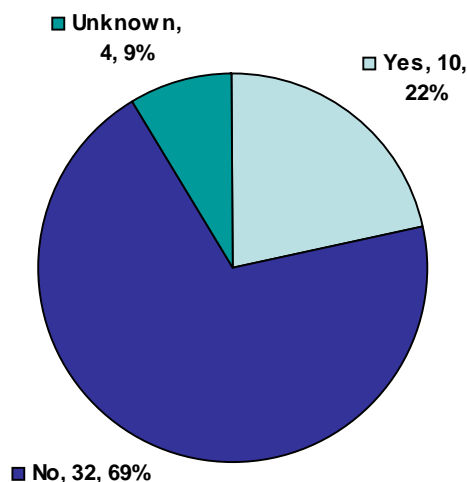


Figure I-10. Companies Conducting Health Studies Using the Health Monitoring System

The relative scarcity of the type of information discussed in the survey indicates that not many companies will be able to make data-driven connections between health outcomes and exposure. In fact, only one company that responded to the survey indicated that it has a fully functional health monitoring system. While it is interesting that there are some companies that currently have the capability to conduct studies based on this type of information, it is unlikely that many, especially smaller organizations, will acquire this resource in the near future. This information has implications for development of the *Qualitative Approach*, since the scope of a health monitoring database is at the enterprise level and can provide insights into company experience with IH risk. The companies that have these systems can serve as resources for learning where to find links between risk and outcome, and provide the guidance for researching them. It also means that in conducting value analyses, companies will have comprehensive IH exposure and health risk data available for determining the impact of IH programs and activities.

Table I-6: Specific Capabilities of Companies that Conduct Health Studies

Comprehensive Industrial Hygiene Monitoring Strategies (By Company ID)	Comprehensive Health Surveillance Data on Exposed Employees	Comprehensive Health Surveillance Data on All Employees	Comprehensive industrial hygiene exposure data for all employee exposure groups	Linking complete employee personal information	Can Generate specific data elements on specific employee groups	Can Generate specific data elements on IH exposure groups	Can Generate specific data elements on medical surveillance outcomes
12	✓	✓	✓		✓	✓	✓
9	✓		✓	✓	✓	✓	✓
39	✓	✓	✓	✓	✓	✓	✓
19			✓	✓	✓	✓	
29	✓		✓	✓		✓	✓
44	✓		✓	✓	✓	✓	✓
24							
33	✓			✓			✓
21	✓		✓	✓		✓	✓
28	✓		✓		✓	✓	✓

Metrics

Understanding the ways in which companies measure progress in key IH program areas is important to making a case for value, because these metrics are often the means of recognizing the impacts of IH on the rest of the business. Survey I asked companies to describe both leading and trailing metrics used to track performance in risk assessment and the IH risk assessment program sub-elements, in risk prioritization, in risk control, in risk elimination and the IH risk elimination program sub elements, and in other areas at the best IH program site and at the corporate level. This resulted in a range of different responses, and some trends were identified. In addition, a number of useful metrics that can be recommended for adoption by other IH programs were found. (See Appendix D).

There was not much difference between the metrics used at the site and corporate levels. By far the most overused metric was OSHA recordable incident rates, which was seen in nearly every category and used as both a leading and trailing indicator by at least one company. It is intriguing that so many companies are dependent on this very limited metric, given that occupational illnesses are more often than not left off the OSHA logs due to long latency and a failure to recognize work-relatedness of disease. In addition, the metric is often used for program areas that it is not sensitive enough to track. An example is use of respiratory protection.

The examples provided in this report may serve to encourage industrial hygienists to experiment with new metrics that can drive continuous improvement in risk-related IH programs more effectively.

Risk Assessment

Frequently-used leading IH metrics for risk assessment at the best IH program sites included percent of IH exposure assessments completed, percent of the IH sampling plan completed, and percent of job and project hazard assessments completed. Leading IH metrics at the corporate level were very similar to those reported at the best sites, adding audit scores to the list. Common trailing IH metrics for risk assessment at the best IH program sites included OSHA injury and illness rates and the number of health-related incidents. Trailing IH metrics at the corporate level were very similar to those reported at the best IH program sites.

Percent of exposure assessments and sampling plans completed is a frequently-used leading metric for chemical exposure monitoring at best IH program sites and at the corporate level. Trailing IH metrics at the best sites and at the corporate level for this program element included illness and injury reporting and the number of samples taken that were within specified limits.

For noise assessment, leading IH metrics at both the best IH program sites and the corporate level included percent of noise surveys completed and the number of people exposed above the 85 and 90 decibel levels. Common trailing IH metrics at best sites and at the corporate level included number of incidents and cases, OSHA recordables, and the number of threshold shifts.

Leading IH metrics for ergonomics at best IH program sites and at the corporate level included assessments/evaluations and reviews of workstations completed. Injury and illness rates and reduction in ergonomically-related incidents were the trailing IH metrics most often cited for ergonomics both at best sites and at the corporate level.

The most frequently cited leading IH metrics for ionizing and/or non-ionizing radiation at best IH program sites and at the corporate level included number of audit findings and planned assessments completed. At best IH program sites and at the corporate level, trailing metrics for ionizing and/or non-ionizing radiation included OSHA injury and illness recordkeeping, results of exposure assessments, and reviews of exposure or release incidents.

Risk Prioritization

Leading IH risk prioritization metrics addressed hazard and risk exposure assessments. Trailing IH metrics for this program element included OSHA injury/illness rates and the results of risk assessments.

Risk Control

Leading risk control metrics focused on completion of plans to minimize risk, and training and communications. Trailing risk control metrics at best IH program sites and at the corporate level included OSHA injury/illness rates and performance on audits.

Risk Elimination

Leading IH risk elimination metrics addressed planning, job hazard analysis, and reviews. A common trailing IH metric at best sites and at the corporate level for risk elimination included OSHA injury/illness rates and results of risk and exposure assessments.

Leading IH metrics to track substitution of less hazardous materials, operations, processes or equipment encouraged analysis and review of processes. Examples included efficiency of

process development routes, hazardous material control program implementation, and workplace exposure improvement score (WEIS). Trailing IH metrics for this program element relied heavily on OSHA injury/illness rates, but some companies focused on reducing the purchase of hazardous materials and the number of chemicals in use.

Leading metrics to track use and effectiveness of engineering controls varied among companies. Measures cited range from percent of recommended controls completed to reduction in exposure potential, to number of design reviews conducted, and ventilation surveys completed. Companies continued to cite OSHA recordable incidents as the main trailing metric, but also mentioned time to complete resolution of hazards, actions taken based on incidents, and number of follow-ups after the fact.

Leading warnings metrics at best IH program sites and at the corporate level measured training implementation and audits. OSHA injury/illness rates were used as the dominant trailing metric, but some companies also used actions based on incident reviews and time to complete resolutions.

Although many companies did not report metrics for administrative controls, a few were cited. Leading indicators included design reviews conducted, preplanning of hazardous operations, and reduction in exposure potential. Besides OSHA recordable rates, some companies used time to complete resolution of hazards, controls implemented due to exposure, and incident review performance.

Respiratory protection leading metrics included percent of fit tests performed versus required, elimination of the need for respiratory protection, and hazardous material control program implementation. Trailing IH metrics at best sites and at the corporate level for respiratory protection included OSHA injury/illness rates, incident reviews to determine program effectiveness, and number of employees wearing respiratory protection.

Some companies listed PPE elimination, tracking of significant threshold shifts (STS), implementation of hazardous material control programs, workplace exposure improvement score, and percent observations of use for leading metrics for other personal protective equipment. Again, for trailing metrics, companies commonly listed OSHA recordable rates, hearing and fall protection monitoring, and hazardous material control program implementation.

In addition to metrics for the risk assessment, prioritization, control, and elimination categories, companies were asked to indicate other metrics they had found useful for managing IH programs. Leading metrics included wellness interventions and health risk assessments (HRAs), management involvement meetings, management systems audit scores, and closure of audit findings. Trailing metrics resembled those mentioned previously.

Section III—IH-Related Cost and Outcome Data

Central to the ability to develop a value case for IH, or any other program for that matter, is the availability and accessibility of data concerning the costs and outcomes of that program's activities. One of the main goals of the Phase I survey was to establish the existence and accessibility of the available data with regards to costs and outcomes of various aspects of IH Programs among participating companies. Existence of health- and exposure-related outcome data also was important to understand the relationship between IH risk and health consequences, to the extent that link could be established. It also was necessary to learn the extent to which companies had this information available to their internal IH organizations for conducting future value studies based on the strategy.

Accessibility of the data under specific terms of release was important to ORC so that a realistic *IH Value Strategy* could be constructed based on the information that a majority of companies had on hand or could collect. This information would allow better understanding of the existing empirical resources available for use in building the strategy. A total of 44 companies responded to this set of questions.

In addition to health outcome data, the survey asked the same existence and availability questions about human resources outcome data and costs, and legal metrics and costs. These two areas can provide information for developing the business case because the “downstream” consequences of IH risk are often seen in the form of absenteeism, workers hired to replace ill or injured employees, and legal fines and penalties.

It was also important to determine companies' experience with business case analysis for IH projects and/or programs. The survey gathered information about the effectiveness of IH business cases as a means to develop guidance for users of the strategy, and with the intent of finding examples for inclusion in the study. As was mentioned earlier, companies' ultimate interest in participating in the subsequent stages of the study was the defining factor in selecting participants.

Many companies regard such data as confidential and are willing to release them only under restricted circumstances, so it was important to determine whether the data existed and were releasable for study with strict confidentiality and blinded, if they existed and were not releasable for study, or if they did not exist. Companies were asked these questions for both the corporate level and for their best IH program sites.

If data regarding IH-related outcomes and costs existed, they were most likely not available for an outside study. However, these numbers varied substantially by a particular question as well as by company. Therefore, it was necessary to examine each question separately in order to compare the availability of different forms of IH-related costs and outcomes data.

Across all categories of questions on IH-related cost and outcome data, the most common answer indicated that, while the data existed, they were not available for release. In other words, approximately 44% and 42 % of all answers to the questions about IH-related costs and outcomes (at the corporate level and the best IH program sites respectively) fell into the “data exist and are not releasable for study” category. At the same time, approximately 18% of the answers at the corporate level and 19% answers at the level of the best IH site indicated that the data “exist and are releasable for study with strict confidentiality and blinded.”

Twenty-four percent and 23%, respectively, of the answers at corporate and best IH site levels indicated that data did not exist, while 14% and 16% of answers (corporate and best IH

site respectively) were left blank. The existence and availability of data were slightly more common at the best IH site level (average of 19% vs. 18%). The same held for the missing answers (16% vs. 14%). The existence and non-availability, and non-existence of data were more common at the corporate level (44% vs. 42% and, 24% vs. 23% respectively), reflecting a more guarded approach to data at the corporate level (Figures I-11 and I-12).

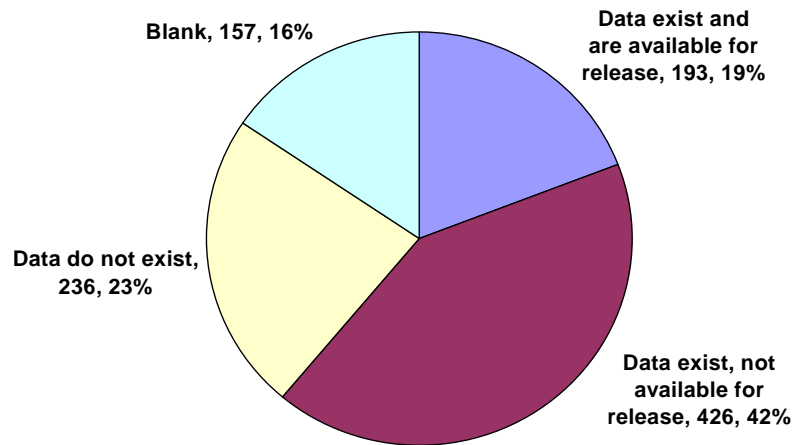


Figure I-11. Availability of Data at the Best IH Site Level

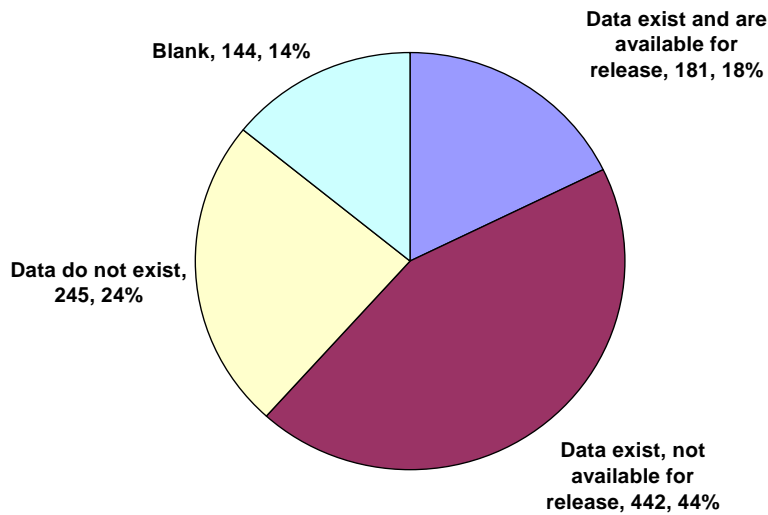


Figure I-12. Availability of Data at the Corporate Level

Cost-Related Outcome Data

Survey respondents were asked about data existence and availability in seven areas related to IH: annual IH program costs, costs by IH program element, workers' compensation loss data, other occupational health-related losses (skin diseases, respiratory diseases, diseases from toxic exposures, diseases from physical agents), non-occupational health-related losses, health and environmental remediation costs, and long-term occupational health liability costs (see Figures I-13 and I-14).

The most common answer across all seven categories was that the data existed but were not releasable for study. Annual IH program costs and costs by IH program element were the exceptions. In these two categories, a majority of the respondents said the data did not exist. With respect to annual IH program costs, 25 companies indicated that such data did not exist at their best IH program sites, while 26 companies indicated that the data did not exist at the corporate level.

Compared to the other four categories, a larger number of companies had cost and outcome data that were available and releasable (when compared among all seven categories) for annual IH program costs (this category was nearly evenly divided between data existed, releasable and data did not exist; 13 and 12 companies had the data at the best IH site and corporate levels respectively); workers' compensation loss data (15 companies at both best IH site and corporate levels); and health and environmental remediation costs (15 at the best IH site level and 11 at the corporate level).

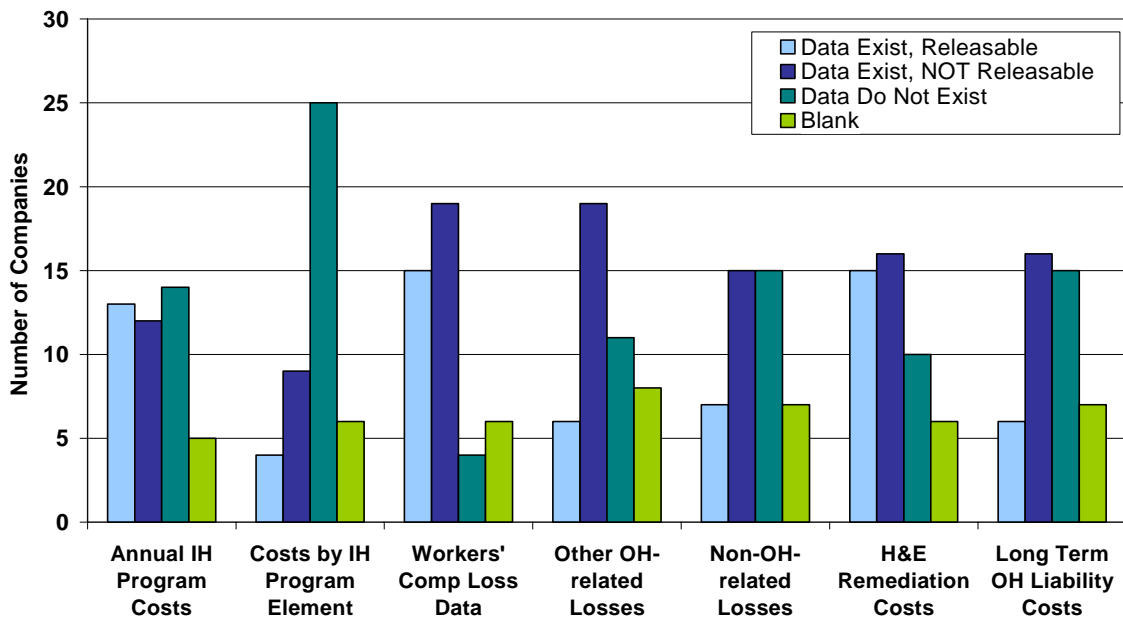


Figure I-13. Cost-related Outcome Data for Best IH Program Sites.

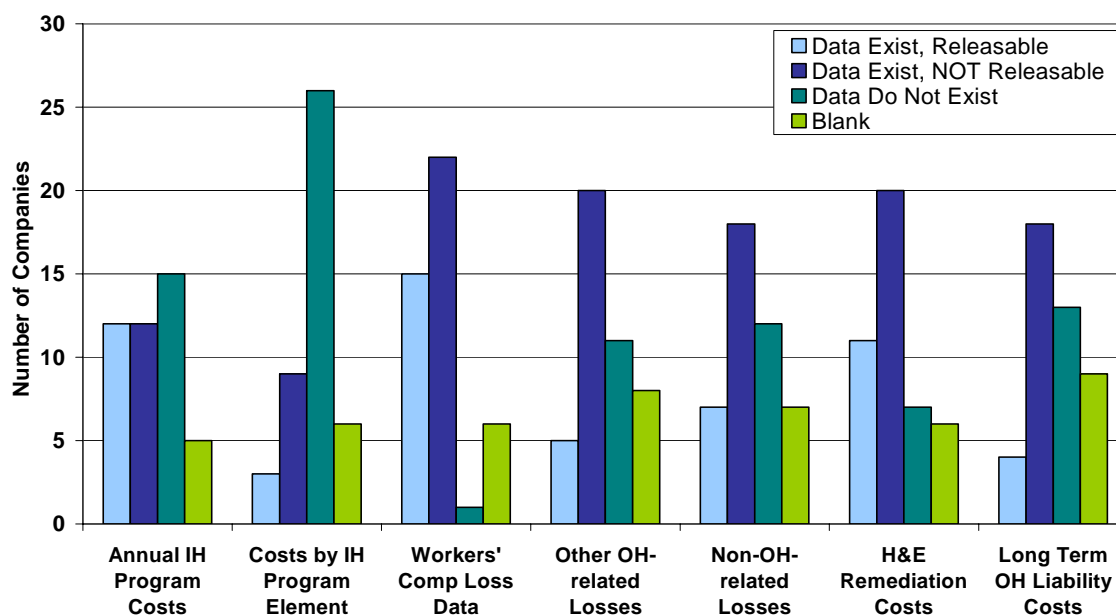


Figure I-14. Cost-related Outcome Data at the Corporate Level

Health and Exposure-related Outcome Data

The questions on health and exposure-related outcome data asked survey respondents about employee exposure monitoring data, medical surveillance data, health monitoring data and workplace injury and illness data. Once again, the answer “data exist and are not releasable for study” was the most common for the categories employee exposure monitoring data (22 companies for both best IH site and corporate levels), medical surveillance data (26 companies), and health monitoring data (21 companies at the best IH site and 23 companies at corporate level).

The single exception was workplace injury and illness data, kept according to OSHA recordkeeping rules. Twenty-six companies had these data available and releasable for study at their best IH sites, and 27 at the corporate level. (Two companies said their OSHA data did not exist!) The category with the next most existing and available data was employee exposure.

Categories for which a larger number of companies had available and releasable data were annual IH program costs (13 and 12 companies had the data at their best IH sites and corporate levels, respectively); workers’ compensation loss data (15 companies at both best IH site and corporate levels); and health and environmental remediation costs (15 at the best IH site level and 11 at the corporate level).

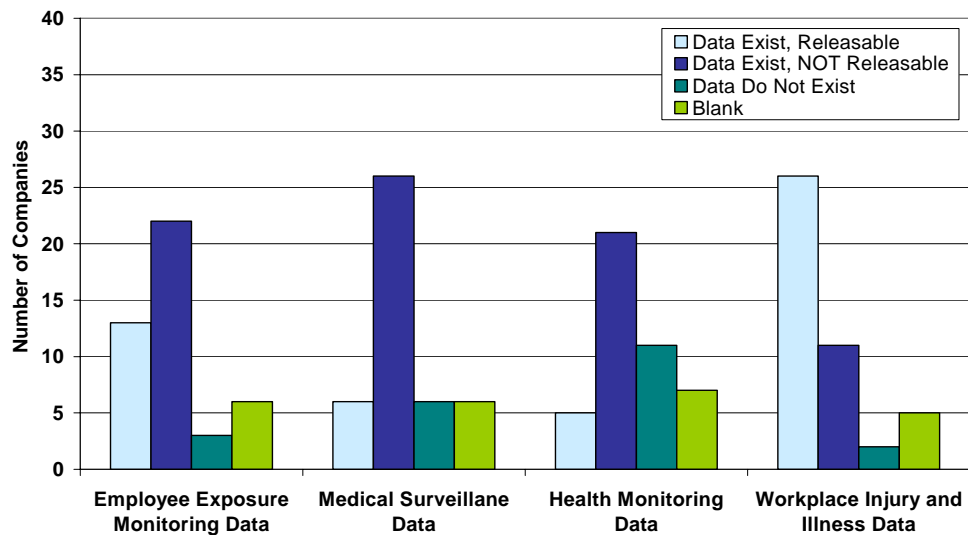


Figure I-15. Health- and Exposure-related Outcome Data for Best IH Sites.

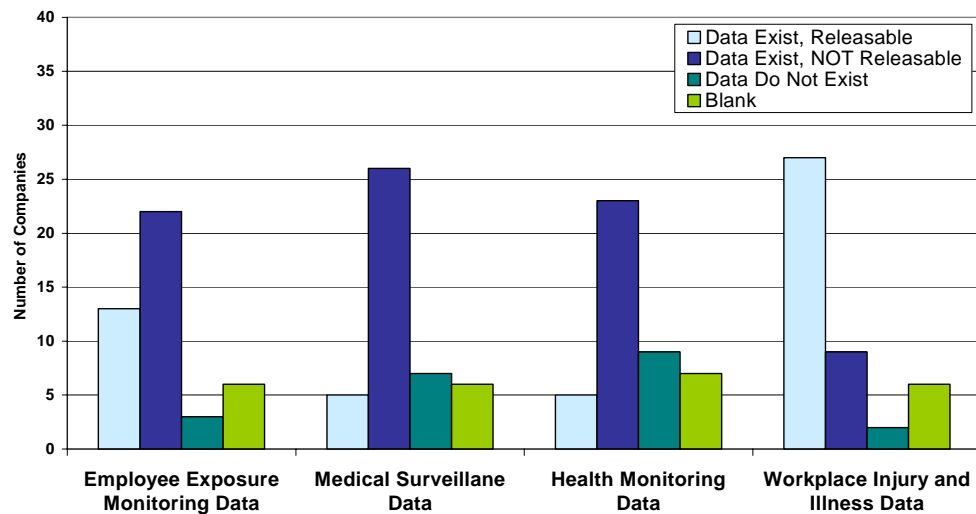


Figure I-16. Health- and Exposure-related Outcome Data at the Corporate Level.

Human Resources Outcome Data and Costs

Questions about human resources outcome data and costs focused on absenteeism data, hiring costs (full-time and replacement workers as well as part-time and temporary replacement workers), and several business and financial metrics including production and material costs, payroll and labor costs, cost of poor quality and other quality metrics, value of process improvements associated with IH programs, and productivity improvements associated with improving IH processes (Figures I-17 to I-20).

Across all questions in this section, absenteeism was the category for which the highest number of companies had existing and available data at their best IH program sites (9 companies). Data for value of process improvements associated with IH programs and productivity improvements associated with improving IH processes did not appear to exist among the majority of companies. Twenty-five and 28 companies chose that answer for value of process improvements (best IH site and corporate level respectively), and 24 and 27 chose the answer for the productivity improvements associated with improving IH processes.

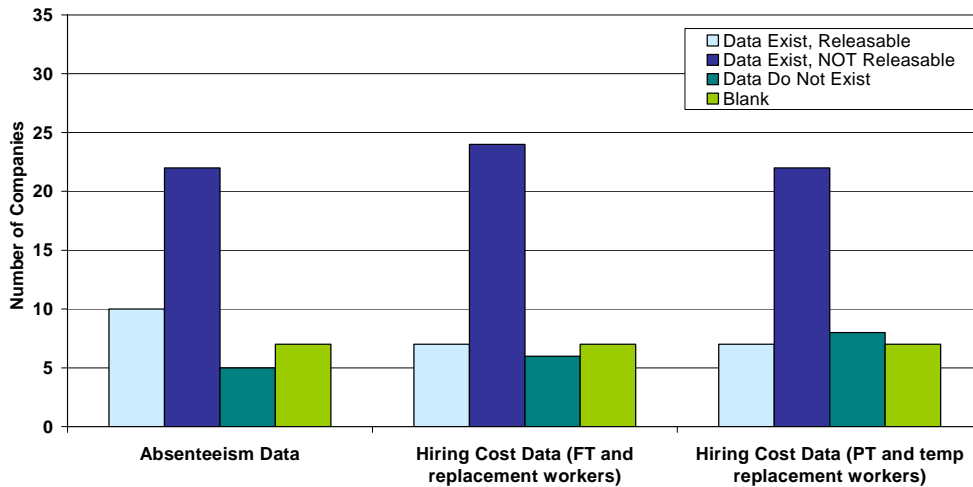


Figure I-17. Human Resources Outcome Data and Costs for Best IH Sites.

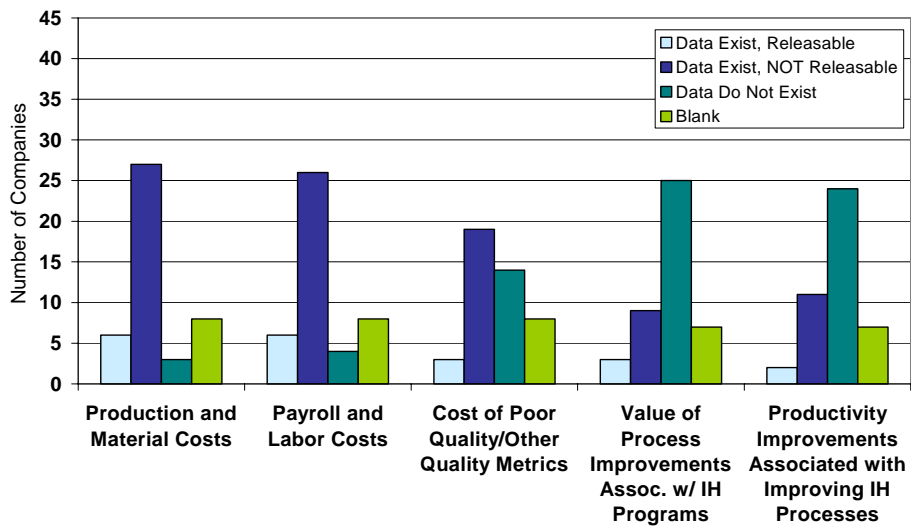


Figure I-18. Human Resources Outcome Data and Costs, Including Business and Financial Metrics, at Best IH Program Sites

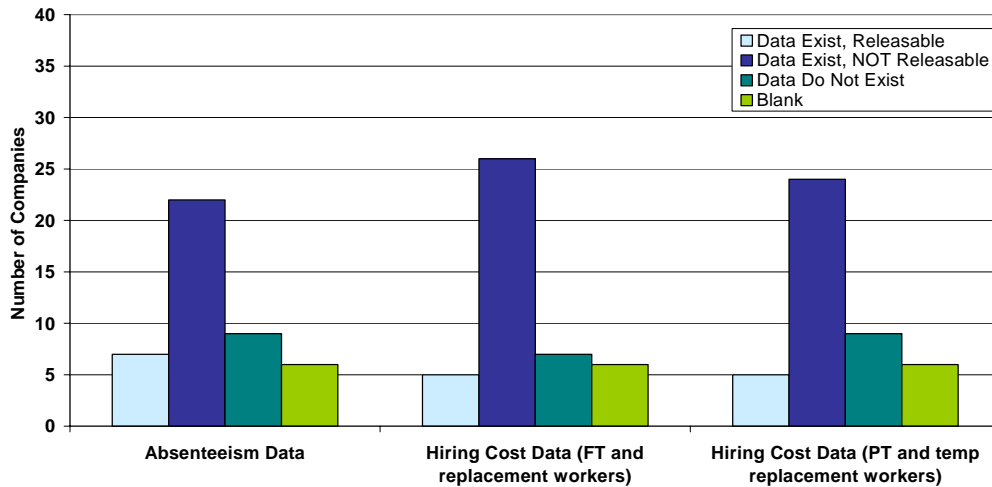


Figure I-19. Human Resources Outcome Data and Costs at the Corporate Level.

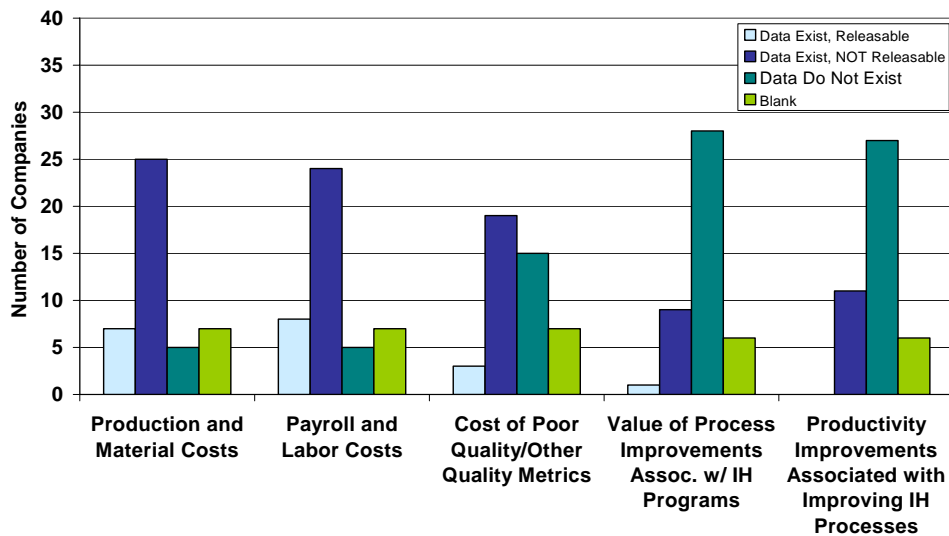


Figure I-20. Human Resources Outcome Data and Costs, Including Business and Financial Metrics, at the Corporate Level

Legal Metrics and Costs Data

Member companies responded to questions about the availability of data on compliance citations, cost of legal judgments, cost of legal settlements and IH-related Sarbanes-Oxley disclosures (See Figures I-21 and I-22). At the level of the best IH sites, 20 companies said that data on compliance citations existed but were unavailable. In contrast, only 14 companies said that such data existed and were available. While eight companies had existing and available data regarding costs of legal judgments, 25 companies said that such data were not releasable for study. Similarly, while the same eight companies had existing and available data on the costs of legal settlements, 24 companies said that such data were not releasable.

At the corporate level, the result was very similar. Fifteen companies had existing and releasable data on compliance citations, nine companies had existing and releasable data on cost of legal judgments, and nine companies had existing and releasable data on costs of legal settlements. On the other hand, 21 companies had non-releasable data on compliance citations, 26 companies had non-releasable data on costs of legal judgments, and 26 companies had non-releasable data on costs of legal settlements.

The IH-related Sarbanes-Oxley disclosures category was different in that the most common answer was that the data did not exist (19 companies at the best IH program site level, and 24 companies at the corporate level). Only five survey respondents said they had such data available for release, and ten companies said that while such data existed, they were non-releasable. The sensitivity of data in this question certainly drove the results.

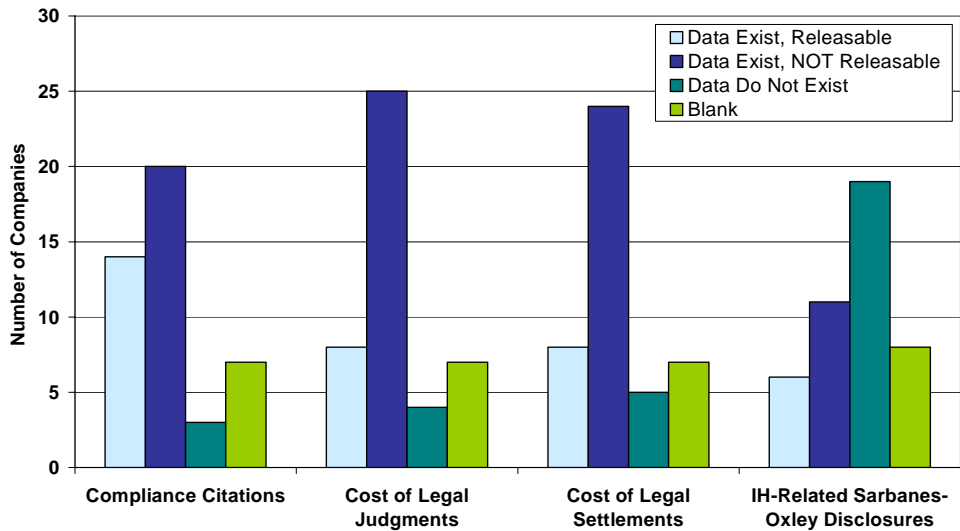


Figure I-21. Legal Metrics and Costs Data at Best IH Sites.

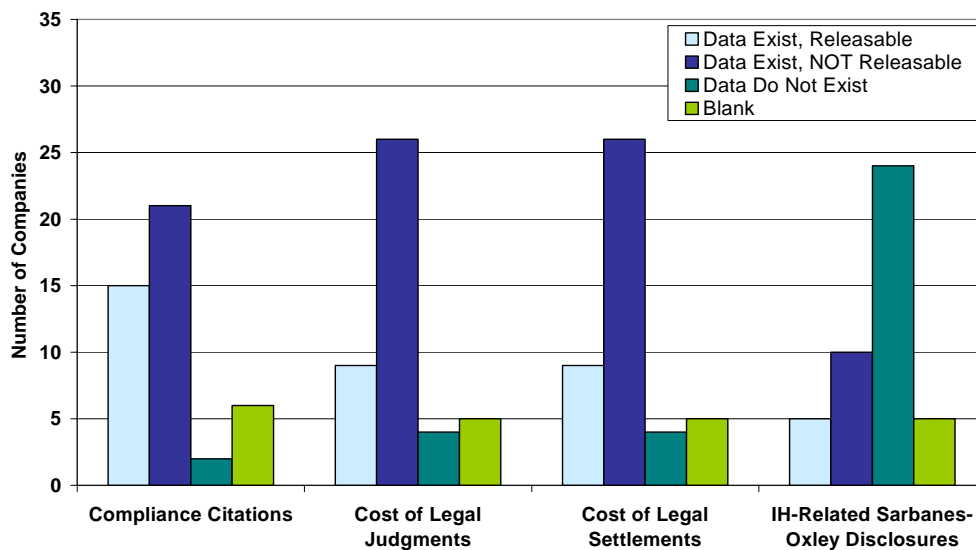


Figure I-22. Legal Metrics and Costs Data at the Corporate Level.

IH Business Case Analysis

Twelve companies indicated that they had conducted business case analyses on IH projects and/or programs; 32 companies answered that they had not (Figure I-23). Companies responding positively were then asked to provide substantive information regarding the types of projects or programs they had analyzed, the financial metrics used in the analysis, the levels of management to whom the analysis was presented, and the degree of effectiveness of the analysis in producing the expected results.

Of this group of 12 companies, three were participants in the latter phases of the study.

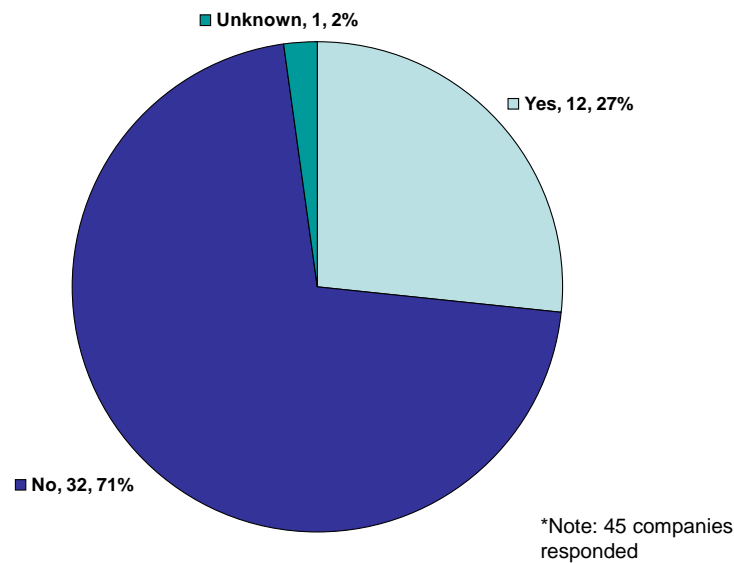


Figure I-23. Business Case Analysis for IH Projects and/or Programs

One company stated that all of its IH projects were subjected to business case analysis. Types of projects/programs for which the responding companies had conducted business case analyses included:

- In-house medical
- Engineering controls
- Types of PPE
- Handling equipment
- Best waste disposal methods
- Exposure reductions
- Internal environmental services
- Lab services
- Asbestos management and abatement
- Lead management and abatement
- Implementation of a new electronic Data Management System
- Post exposure medical surveillance
- Value of internal lab accreditation versus outsourcing to external lab
- Cost to purchase services vs. Internal cost
- Leveraging IH resources across sites/businesses

- Potent drug containment
- Overall value of IH program in order to justify headcount
- Business case justification for engineering controls
- Monitoring equipment upgrades
- Capital requests for ergonomics
- Noise and chemical exposure reductions
- Chromium compliance program element reductions
- IH software
- New product pipeline support/business gains.

Some of the financial metrics that were employed in these business case analyses included:

- Productivity
- Capital costs
- Tax rate
- Reduction per unit cost
- Labor time and level of effort
- Capital and expense dollars
- Cost benefit
- ROI
- Internal Rate of Return (IRR)
- NPV.

All of the companies had presented their business case analyses to the management (Figure I-24), but at different levels (Figure I-25):

- 1 company presented at the Board of Directors level
- 8 companies presented at the Senior Executive management (corporate) level
- 10 companies presented at the middle management (business unit) level
- 5 companies presented at the first-line management (plant or field) level
- 4 companies presented at the supervisory level.

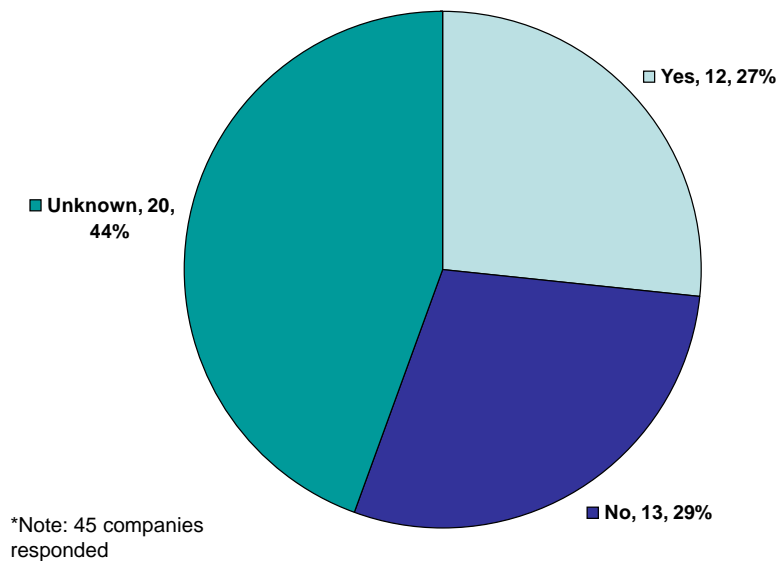


Figure I-24. Business Case Presented to Management.

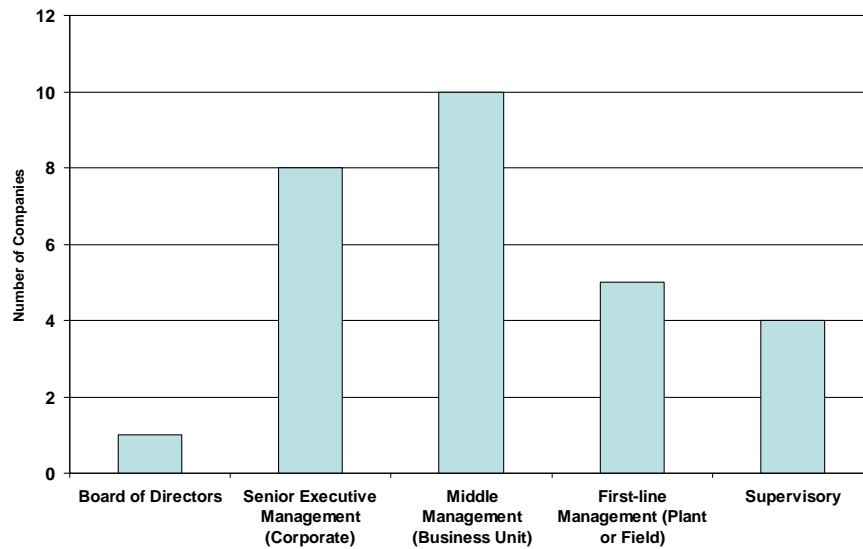


Figure I-25. Business Cases Presented at Various Levels of Management.

Individual company comments regarding the effectiveness of the business case in producing the expected results were as follows:

- Very effective, they were receptive and interested in the process and appreciative that we would put HSE in monetary terms
- Successful
- Excellent
- It was convincing enough that the project was approved and implemented successfully
- This was just developed and is still a 'work in progress'
- Providing the business case was successful in gaining management support.
- Highly effective
- High level of effectiveness due to the importance placed on employee safety
- Business case is successful in attaining funding
- Marginally effective, need to change culture in order to effect substantial change to company
- Little impact.

Interest in Further Participation

Twenty-two out of the 44 companies that completed Section III of the Phase I Survey expressed interest in further participation in the study (Figure I-26). The negative responses to this question (“Company is not interested in further participation in Phase II of the Value of the IH Profession Study”) may have been driven by the unavailability of costs and outcomes data in these companies, as well as the high demands that were placed on the time of the individuals who were to provide responses. However, an affirmative answer to the question about interest in further participation did not signify the existence and/or presence of the costs and outcomes data.

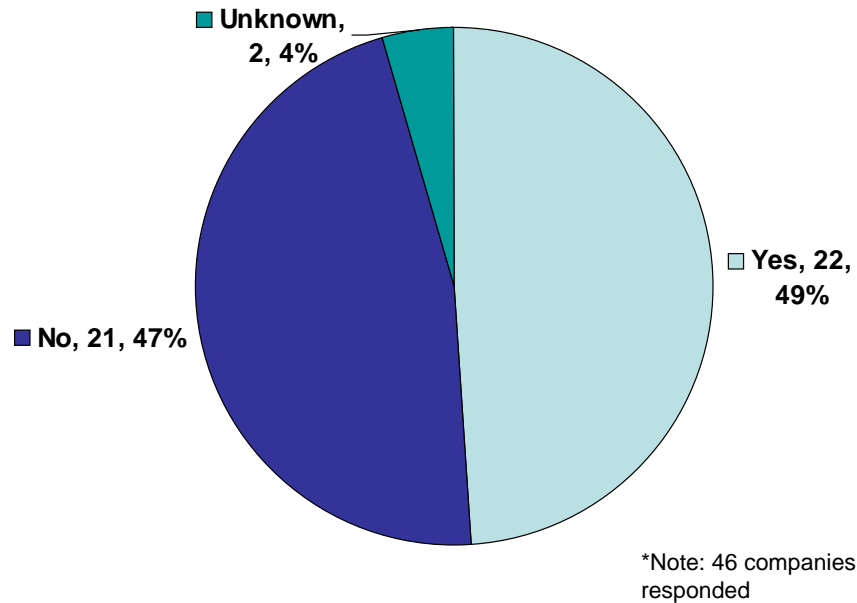


Figure I-26. Interest in Further Participation.

Among the companies interested in participating in subsequent stages of the project, the existence and availability of data at the level of the best IH program site were more common than at the level of corporation. Therefore, for the future phases of the Value of the Industrial Hygiene Profession project, a focus on the best IH program sites appeared to be more promising in terms of the amount of available data.

The categories for which the greatest number of companies has existing and available data (at the level of the best IH program site) were:

1. Annual IH program costs (10 companies)
2. Workers' compensation loss data (10 companies)
3. Health and environmental remediation costs (8 companies)
4. Workplace injury and illness data (17 companies)
5. Absenteeism data (9 companies)
6. OSHA compliance citations (12 companies).

The categories for which the fewest number of companies had existing and available data (at the level of the best IH program site) were:

1. Costs by IH program element (4 companies)
2. Other occupational health related losses (skin diseases, respiratory diseases, diseases from toxic exposures, diseases from physical agents) (4 companies)
3. Long-term occupational health liability costs (4 companies)
4. Health monitoring data (4 companies)
5. Business and financial metrics—Costs of poor quality/other quality metrics (3 companies)
6. Business and financial metrics—Value of process improvements associated with IH Programs (3 companies)
7. Business and financial metrics—Productivity improvements associated with improving IH processes (2 companies)
8. IH-related Sarbanes-Oxley disclosures (4 companies).

Conclusions

Phase I of the project identified companies that met many of the criteria that made them appropriate for further study. The real challenge in selecting companies to participate, however, was the existence of the data and companies' willingness to release it. In addition, many companies found that the time required to answer questionnaires and provide case studies was more than they could spare. A combination of lean staffing and increased scope of coverage has contributed to a decrease in the time that corporate HSE staffs have for activities external to their companies. Therefore, the initial list of companies that responded to Survey I (Appendix B) differs significantly from the final list of participating companies (Appendix C).

Nonetheless, Survey I provided data and information that were useful to the study phases that followed, as well as providing a better understanding of how IH is staffed, managed, and practiced in a number of large, well-respected companies. The distribution of CIHs at the corporate vs. best IH program sites; the implementation of management systems for IH programs; the proportion of time spent on IH program activities; the extent to which companies have completed IH program cost or process improvement studies in specific program areas; the extent to which companies use IH exposure assessment strategies and health monitoring systems; and the metrics industrial hygienists use in managing their risk assessment, prioritization, elimination, and control programs all provided valuable learning that presented opportunities for improvement of IH programs generally.

A second survey was developed to gather further detail regarding program cost-benefit data, which is related to development of both the *Quantitative* and *Qualitative Approaches*. This information is presented in detail in the Phase IV section of this report.