

# **Worksite Inspection and the Control of Occupational Disease**

## **The OSHA Experience**

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Passage of the Occupational Safety and Health Act in 1970 has without doubt had a major impact on occupational health in the United States. The Act and its subsequent implementation made occupational safety and health a national issue in the 1970s and focused a considerable degree of public consciousness on the problems of health in the workplace. It is generally accepted that as activities in occupational health across the country have grown, significant progress in improving workplace conditions has been made. Unfortunately, it is also apparent that significant workplace health issues continue to exist. The historical problems of lead and silica exposure, for example, continue today; recent work indicates that industrial exposures to these materials are still excessive.<sup>1,2</sup> During the past decade new workplace-related diseases resulting from chemical exposure have also been noted. Neurologic disease derived from exposure to dimethylaminopropionitrile or Lucel-7, reproductive impairment from dibromochloropropane (DBCP), and carcinogenesis associated with certain industrial chemicals, such as vinyl chloride, are all examples of disease discovered since passage of the Act.

Thus, examples of both success and failure in the control of occupational disease are numerous. The question before us today is: How effective have OSHA onsite inspections been in achieving control of workplace exposures and thereby reducing occupational disease? A corollary question is: What complementary efforts might be instituted to enhance the efficacy of workplace inspections?

### **A BRIEF REVIEW OF OSHA INSPECTION DATA FROM 1979-1985**

A brief review of OSHA inspection results may be of value in assessing the value of workplace inspections in the control of occupational disease. We used the OSHA Integrated Management Information System (IMIS) to review the results of OSHA compliance activity. This system contains a record of each inspection conducted over the course of OSHA's history.<sup>3</sup> In 1979, OSHA began to include actual exposure measurements in the IMIS. Before 1979, the exposure information was collected and entered as a proportion of the permissible exposure limit (PEL). This paper reviews a data tape covering inspections over the

period 1979–1985. Previously published work<sup>1,3</sup> describes research conducted by the author and colleagues analyzing OSHA inspection data from 1979–1982.

From 1979–1985 OSHA collected samples for 546 different chemicals during the course of inspections. Measurable exposures occurred for 389 substances, and there were overexposures (over the PEL) for 201 chemicals. Fifty-five substances had only one overexposure, and 88 substances had fewer than 10 overexposures. Our analysis of inspection data reveals that OSHA focuses its primary sampling efforts on fewer than 15 substances. Substances with more than 100 test samples having exposures greater than the PEL were silver (109), toluene (142), coke oven emissions (164), styrene (231), arsenic (272), asbestos (275), chromium (275), coal tar pitch volatiles (310), carbon monoxide (373), iron oxide (388), copper (534), nuisance dust (919), silica (1,971), and lead (3,693). Lead and silica had more than 1,000 test samples greater than the PEL. Several of these substances have limited evidence of significant toxicity; only a few of them have adequate OSHA standards. The actual number of overexposures in any given Standard Industrial Classification (SIC) was extremely limited with the exception of those of lead and silica. Overexposures for these 14 substances occurred over a period of years and across a significant number of SIC codes. For example, there were 40 SICs in which 275 overexposures to chromium were detected, an average of one overexposure per SIC per year.

### BREADTH OF COMPLIANCE ACTIVITY

These summary statistics are incomplete, because data from the majority of state-plan states are not included in these numbers, but they do suggest that the breadth of OSHA compliance activity is very limited. OSHA's ability to identify hazardous worksites apparently is inadequate. The limited number of substances studied and overexposures identified derive in part from the use of the 1968 American Conference of Governmental Industrial Hygienists Threshold Limit Values, many of which are clearly outdated. The lack of breadth also appears to result from a failure to identify where agents of concern are actually used and violations of the standards anticipated. OSHA has not developed a successful inspection strategy based on analysis of actual use and predictions about potential worker exposures. In addition, OSHA's inspection pattern of emphasizing complaints may not be entirely appropriate when it comes to identifying overexposures to chronic hazards.

OSHA appears not to have considered how information from EPA's Toxic Substances Control Act (TSCA) or from OSHA's Hazard Communication Standard can be used to identify potential exposures that could broaden the inspection base, and NIOSH Health Hazard Evaluations (HHEs) are not used for scheduling purposes. The newly completed National Occupational Exposure Survey (NOES) conducted by NIOSH may be of particular value in the future. In this regard, OSHA has not had success in applying the National Occupational Hazard Survey (NOHS), but the new survey is undoubtedly more reflective of current use patterns.

A variety of factors may explain the lack of breadth in OSHA inspections including: an inadequate process for selecting inspection sites, systematic failure to develop data on chemical use and exposure, failure of the complaint system to

identify existing health hazards, and standards that are not reflective of current biomedical knowledge. In addition, because there is currently no mechanism for collection of environmental monitoring data mandated in 6(b) standards, OSHA

TABLE 1. Temporal Trends in Lead Exposure (1979–1985)

Year	No. of Inspections	No. of Test Samples	% Samples >0.05 <sup>a</sup>	Median Inspection Severity <sup>b</sup>
SIC = 2816 Pigment Manufacture				
1979	7	82	52	1.2
1980	6	23	65	0.5
1981	4	39	62	3.4
1982	2	5	80	4.9
1983	8	47	45	0.7
1984	7	33	60	1.3
1985	5	26	73	2.0
SIC = 3341 Secondary Lead Smelting				
1979	26	415	69	1.2
1980	20	163	47	0.7
1981	23	193	53	0.5
1982	15	90	73	1.8
1983	24	201	62	1.1
1984	15	110	50	0.2
1985	17	138	39	0.3
SIC = 3362 Brass-Bronze Foundries				
1979	16	142	65	0.9
1980	25	197	49	1.0
1981	28	211	55	0.8
1982	16	146	58	1.6
1983	20	169	32	0.5
1984	26	139	45	0.6
1985	28	198	38	0.7
SIC = 3691 Battery Manufacture				
1979	17	217	62	1.2
1980	26	287	68	1.1
1981	16	155	77	1.9
1982	20	150	67	1.1
1983	15	217	69	1.5
1984	20	141	59	0.9
1985	23	297	38	0.8

<sup>a</sup> mg/m<sup>3</sup>.

<sup>b</sup> Severity levels are levels of lead exposures expressed as a proportion of the PEL, that is, a severity level of 2.0 is twice the PEL. The median severity level is the overall median of inspection median exposure levels expressed as a proportion of the PEL.

cannot use the data to trigger its own inspections. Analytic evaluation of OSHA inspections is beyond the scope of this report, and a more in-depth analysis of OSHA compliance activities will be reported elsewhere.

## EVALUATION OF INDUSTRY COMPLIANCE

From 1979–1985, OSHA conducted 3,934 inspections in which lead was sampled. Of the 14,168 test samples for lead collected, 3,693 (26%) were over the PEL. OSHA adopted a new standard for lead in 1978, and it was implemented during the period of our evaluation. TABLE 1 illustrates the degree of compliance with the standard for industries with high lead exposure over that period. There appears to be improvement in battery manufacture (SIC 3691), and, to a lesser degree, secondary lead smelting (SIC 3341). However, at least 38% of the test samples exceeded the standard for these industries. In the other industries little or no change in exposure levels has occurred. Anecdotal information from both industry and labor also suggests that the battery industry may have made significant strides in implementing controls since the advent of the standard.

Unfortunately, OSHA has no systematic way of measuring the success or failure of its own compliance effort. There is no ongoing evaluation process to determine if the agency's inspections are reducing the hazards associated with chemical exposure. One of the major problems with the OSHA approach to self-evaluation is that the agency measures success on the basis of input variables, such as the number of inspections or the penalties levied, as opposed to an evaluation of compliance, which is the abatement of the hazard through the use of engineering controls. OSHA has no means to assess outcome variables, reductions of exposure through control technology implementation. There is no record on whether controls have been instituted as a result of a compliance process. Anecdotal information suggests that extensions to abatement orders are given repeatedly when engineering controls are mandated. OSHA has little in-house ability to assess claims of technical infeasibility. In addition, follow-up inspections are limited.

## LEAD AND SILICA OVEREXPOSURES

As described earlier, the number of overexposures to lead and silica is significant. In the case of lead, there were more than 3,600 test samples greater than the limit. There were 52 four-digit SICs with at least one third of their inspection medians greater than the PEL. In previously published research we identified 9 two-digit SICs that have evidence of substantial exposure to silica (TABLE 2). In the following three-digit SICs, 325, 326, and 332, more than 60% of the inspections had silica test samples greater than the standard. The data for lead and silica suggest that overexposures are occurring in overwhelming proportions. Respirator use has undoubtedly had an effect in preventing an epidemic in silica- and lead-related disease, but reports from state registries that assess blood lead levels and compliance with the biologic monitoring requirements of the OSHA lead standard suggest that there is significant noncompliance with the standard (Dr. Linda Rudolph, personal communication). Because of overexposures and noncompliance with the biologic monitoring aspects of the lead standard, a special effort should be made to assess the health status of workers in the lead industries as well as workers exposed to silica. In promulgating the lead standard, OSHA suggested that there were five industries with high lead exposure: primary and secondary smelting, battery manufacture, lead pigment manufacture, and brass-bronze foundries. Our analysis of the OSHA data appears to indicate that at least 47 other industries require scrutiny.

TABLE 2. Major Silica Exposures by Industry; OSHA Inspection Data 1979-1982

SIC	Industry	No. of Inspections/ No. of Samples	% of Inspections with Test Sample over PEL	Mean Severity Level <sup>a</sup>	Median Severity Level <sup>b</sup>	Median Exposure over PEL <sup>c</sup>	SICs with Highest Exposure
16,17	Construction: heavy construction and special trades	55/131	51%	4.6	0.9	9.1 (59) <sup>d</sup>	1622,29 1721,99
28	Chemical manufacturing	78/225	30%	1.4	0.3	3.3 (59)	
2816,9	Inorganic chemicals	7/33	57%	1.0	0.3	2.0 (16)	
2821,41,44	Resins, soaps, cosmetics	12/39	50%	6.0	0.1	5.5 (16)	
32	Stone, glass, clay manufacturing	155/636	42%	1.2	0.4	3.2 (187)	
3211,21,29	Glass manufacturing	27/57	22%	1.3	0.2	6.6 (7)	
3251,3,5,9	Structural clay	35/221	66%	1.2	0.9	2.2 (78)	
3261,4,9	Pottery products	26/161	73%	1.7	1.0	2.4 (64)	
3281	Cut stone	5/25	40%	1.0	0.8	1.2 (9)	
33	Primary metal industries	259/2,044	52%	1.1	0.5	2.8 (564)	
3321,2,4,5	Iron and steel	154/1,531	67%	1.3	0.6	2.9 (490)	
3361	Aluminum	29/98	14%	0.4	0.3	1.5 (7)	
3362	Brass, bronze, and copper	34/199	32%	0.5	0.4	1.7 (34)	
34	Metal fabrication	54/161	46%	1.8	0.6	4.1 (44)	3441-3 3471,9 3523,353, 355,3599
35	Machinery (nonelectric)	50/279	56%	2.2	0.7	4.7 (93)	
37	Transportation equipment, manufac- turing	34/84	50%	9.7	0.9	23.2 (37)	3751
39	Miscellaneous, manufacturing industries	11/32	64%	2.1	1.1	3.6 (16)	3959,3996

<sup>a</sup> Severity levels are levels of silica exposures expressed as a proportion of the PEL, that is, a severity level of 2.0 is twice the PEL. The mean severity level is the overall mean of the mean level for each inspection, an average of all test samples taken in that inspection.

<sup>b</sup> The median severity level is the overall median of inspection median exposure levels expressed as a proportion of the PEL.

<sup>c</sup> The mean of median severity levels of overexposures in each inspection.

<sup>d</sup> Number of test samples over the PEL.

Data indicating continuing overexposures to lead and silica raise the important question of why OSHA has no means to assess the reasons behind continuing high exposures. Analysis using OSHA IMIS data for lead indicates that when the data are analyzed by job title, consistently high exposures are demonstrated for certain jobs in the battery manufacturing industry. Unfortunately, there are no data to assess whether the continuing high exposures are a result of economic or technological factors or simply employer recalcitrance. OSHA inspection and evaluation strategy apparently fails to ask for—or answer—the following questions: Why were there more than 3,600 overexposures to lead during 1979–1985 (even without including data from most state plan states)? Why are these exposures ongoing, and why does OSHA not have a means to evaluate the temporal trends in its data, to establish a means to ascertain the basis for the trends, and to devise strategies that will result in reduced exposures?

The problems just reviewed can be summarized as follows:

1. OSHA's inspection effort lacks breadth. The agency focuses on a few substances, there is limited application of data on chemical use that would broaden the inspection base, and the current system results in continual reinspection of industries and substances previously identified.

2. A positive aspect of the reinspection of industries with known exposures to certain highly toxic agents is that it identifies real problems. It also shows, however, that OSHA has not been successful in implementing control technology to reduce exposures. Moreover, there is no evaluation mechanism in place that would facilitate an assessment of why high exposures continue to occur.

3. OSHA's evaluation process focuses on input variables (e.g., number of inspections) instead of actual compliance through implementation of control technology.

### **NEW APPROACHES TO FACILITATE OSHA'S INSPECTION EFFORTS**

The key issue is how OSHA, with its limited resources, can achieve compliance with its standards. A program of inspection, citation, penalty, and abatement is never going to work for those industries with significant continuing exposures unless OSHA can determine a means to identify reasons for the ongoing problems, with appropriate follow-up to ensure that positive changes have occurred.

It is essential that OSHA, in cooperation with NIOSH, create a means for ongoing surveillance of industrial exposures. Relying solely on data from inspections overly narrows the scope of the data available. What is required is an expansion of efforts in the area of hazard and medical surveillance including biologic monitoring. An appropriate surveillance strategy would be to require industry to collect data on inplant exposures for selected substances. The data would then be collected by OSHA, computerized, and used as a basis for developing intervention activities. The data collected would be exposure measurements, biologic monitoring results, and, possibly, certain medical surveillance information. To avoid an overburdensome requirement, the data could be collected over time intervals from selected industries chosen at random. The 6(b) standards promulgated by OSHA already contain monitoring requirements, but these provisions were not envisioned to be used for surveillance purposes and may require modification. The 6(b) standards, however, form the basis for beginning such a surveillance effort. An effective surveillance strategy can prompt subsequent intervention when controls are nonexistent or inadequate. The OSHA inspection

program would review industry-gathered data to assure that it is being effectively collected. An example of this approach is the required monitoring of dust levels in the coal mines by operators and subsequent follow-up by MSHA.

### HAZARD SURVEILLANCE RECOMMENDATIONS FOR OSHA

1. Collect, analyze, and use data currently required to be collected under existing 6(b) standards: acrylonitrile, arsenic, asbestos, benzene, coke oven emissions, cotton dust, formaldehyde, ethylene oxide, lead, and vinyl chloride. Set up an appropriate surveillance strategy for subsequent follow-up.

2. Promulgate a generic standard that requires industry to conduct environmental monitoring for a wider range of substances. Biologic monitoring data need to be collected also, but within that context the complex issues of rate retention and medical removal protection would need to be addressed. Data collected in this generic standard would be collected by OSHA, analyzed, and used as a basis for intervention.

3. Consider how data from the Hazard Communication Standard can be collected, evaluated, and used as a basis for setting inspection priorities. Up to now that information has been considered as data for workers, but there is no reason it could not be used more extensively. The use of the data from the Hazard Communication Standard would enable OSHA to expand the breadth of compliance activities especially when coupled with data from NOES and TSCA.

4. Some states have enacted laws that require reporting of occupational disease such as silicosis or excessive blood lead levels. Additional consideration should be given to how these data can become incorporated into the overall surveillance strategy. It would be appropriate for the data to become included in the OSHA IMIS and used as a basis for setting inspection priorities.

5. OSHA needs to establish an evaluative mechanism to determine the effectiveness of its compliance effort. In particular, when certain jobs or processes in industry continually demonstrate overexposure, the basis of those violations must be evaluated. This should include engineering review as well as other factors that might influence employer compliance.

6. Focused enforcement activities are entirely appropriate when continuing overexposures are occurring, but they do not represent a valuable effort unless effective evaluative efforts are simultaneously conducted. These and other surveillance activities need to be considered if the limited resources of OSHA can better be used to identify and ultimately control workplace disease.

### REFERENCES

1. FROINES, J. R. & D. H. WEGMAN. 1986. An approach to the characterization of silica exposure. *Am. J. Ind. Med.* **10**: 348-361.
2. FROINES, J. R., S. L. BARON, D. H. WEGMAN & S. O'ROURKE. 1989. Characterization of the airborne concentrations of lead in U.S. industry. *J. Occup. Med.* Submitted for publication.
3. FROINES, J. R., C. A. DELLENBAUGH & D. H. WEGMAN. 1986. Occupational hazard surveillance: A means to identify work related risks. *Am. J. Pub. Health* **76**: 1089-1096.