INFORMATION PROFILES ON POTENTIAL OCCUPATIONAL HAZARDS

VOLUME III. INDUSTRIAL PROCESSES

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Final Report
Contract No. 210-78-0019

July 1980

Prepared for:

National Institute for Occupational Safety and Health
5600 Fishers Lane
Rockville, Maryland 20857

PB81 147688

PAGE	1. Rec... NA
4. Title and Subtitle: Potential Occupational ... Volume III. Industrial Processes, The Wrecking and Demolition Industry	5. Report Date: July 1980
	6. NA
7. Author(s): Anonymous	8. Performing Organization Rept. No. NA
9. Performing Organization Name and Address: Center for Chemical Hazard Assessment, Syracuse Research Corporation, Syracuse, New York	10. Project/Task/Work Unit No. NA
	11. Contract(C) or Grant(G) No. (C) 210-78-0019 (G)
12. Sponsoring Organization Name and Address: National Institute for Occupational Safety and Health, Rockville, Maryland	13. Type of Report & Period Covered: Contract Final Report
	14. NA

15. Supplementary Notes

NA

16. Abstract (Limit: 200 words)

ABSTRACT: This information profile on the wrecking and demolitions industry (SIC-1795) is part of a group of 46 such profiles that provide information about chemicals or industrial processes considered to be potential occupational hazards. Each profile contains summary data on known and suspected health effects, the extent of worker exposure and the industrial importance of either a single chemical, class of chemicals, or a particular industrial process. The report was developed for use by occupational safety and health professionals in industry, and labor and other areas, to provide them with a synopsis of information in their workplaces.

17. Document Analysis a. Descriptors

Toxicology
Physiological-effects
Chemical-properties
Physical-properties
Occupations
Industrial-processes
Work-environment
Safety-research

b. Identifiers/Open-Ended Terms

c. COSATI Field/Group

18. Availability Statement: Available to the public	19. Security Class (This Report): NA	21. No. of Pages: 12
1<	20. Security Class (This Page)	22. Price

(See ANSI-Z39.18) See Instructions on Reverse OPTIONAL FORM 272 (4-77) (Formerly NTIS-35) Department of Commerce

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INTRODUCTION

An information profile is a working paper used by the National Institute for Occupational Safety and Health (NIOSH) to assist in establishing Institute priorities. It is an initial step in determining the need to develop comprehensive documents or to initiate research. Each profile summarizes data on known and suspected health effects, the extent of worker exposure, physical and chemical properties, and the industrial importance of individual chemicals and classes of chemicals. The profile may also be used by industry, labor, and the occupational health community as a synopsis of information on each subject and to identify possible health hazards associated with their workplaces.

Although detailed literature searches are conducted using computerized and manual searching techniques to identify pertinent and recent information, not all the literature obtained is incorporated in the report due to the summary nature of the profiles. Further, literature published after 1978 may not be included in these profiles because it was generally unavailable at the time the search was completed.

THE WRECKING AND DEMOLITION INDUSTRY

I. SCOPE OF PROFILE

This profile outlines the typical operations performed in the wrecking and demolition industry for the purpose of identifying associated potential occupational hazards.

Wrecking and demolition operations are categorized under Standard Industrial Classification (SIC) code 1795. The work involves removal of buildings, structures and equipment for site clearance, replacement, or extensive modification. The removed material may be salvaged for reuse or sale, or disposed of as waste. A complete description of SIC category 1795 is presented in Appendix A.

II. SUMMARY

Wrecking and demolition involve the following operations, which are performed sequentially:

1. Preparation of the structure and the adjacent area for the dismantling operation.
2. Breaking up the structural parts to moveable sizes and shapes.
3. Collecting and loading the broken-up materials for removal and site clearance.
4. Transporting and disposing of the waste products.

The occupational hazards associated with the wrecking and demolition industry are in large part related to the inherently unsafe operating environment and work practices employed. Asbestos fibers resulting from the demolition of buildings containing friable asbestos fireproofing or insulation are particularly hazardous. Dangerous lead oxide and iron oxide fumes may be associated with oxyacetylene flame cuttings.

III. STATISTICAL INFORMATION

The principal statistical factors regarding employment, payroll, growth, etc. in the wrecking and demolition industry (SIC 1795) for 1976 are presented in the following table.

Table 1. Principal Statistics for the Wrecking and Demolition Industry (Anon., 1978a)

Employment	7272
Number of Establishments*	839
Annual payroll total	$82.54 x 10^6
Annual payroll % of SIC 179	2%
Annual growth (Anon., 1978b)	1.5% since 1972
Size of operation	
Less than 5 employees	54%
Less than 10 employees	76%
Less than 20 employees	90%
Less than 50 employees	98%
over 50 employees	2%

* Data submitted to OSHA by the National Association of Demolition Contractors (NADC) indicate that nationally there are approximately 2300 firms which perform demolition work. (Written Communication, 1979a). It is explained that the census estimates of the size of the industry (Anon., 1978a) are lower due to discrepancies in the classification of the data.

Approximately fifty percent of the employment in demolition work was in the eight following states, as extrapolated from the SIC 179 distribution of employment (Anon., 1978a):

California	10%
Texas	8%
New York	7%
Pennsylvania	6%
Illinois	5%
Florida	5%
Ohio	5%
Michigan	3%

Inquiries to representatives of the Department of Labor (DOL), National Association of Demolition Contractors (NADC), National Safety Council, and labor organizations have disclosed no specific published information on rates

of injuries and illnesses for SIC 1795. As an approximation, the compensation cases for SIC 1795 for New York and for a number of other states collected by JACA Corporation, and the NIOSH office at Morgantown, W.Va., have been used (Written Communications, 1979a,b). The rate for New York, with 150 compensation cases per year for the period 1973-76 and an annual employment judged to have averaged 2000 man-days, was 7.5 cases per 100 man-days for SIC 1795 (Written Communication, 1979c). This is nearly four times the rate for compensation cases for all industry in New York State, about two cases per 100 (Anon., 1978c). The other 14 states on which compensation data for SIC 1795 were available appear to approximate these rates (Written Communications, 1979a;b).

The injury and illness rates for SIC 179 Miscellaneous Special Construction, are as follows (Anon., 1979a; Data on SIC 1795 are not given separately):

Total cases reported for injuries and illnesses	= 16.6 cases/100
Incidence rates for injuries only	= 16.1 cases/100
Incidence rates for illnesses only	= 0.5 cases/100
Incidence rates for lost time cases	= 6.3 cases/100
Incidence rates for lost work days	= 122.1 days/100

Information gaps concerning injury and illness data are being filled by the IACA Corporation study for the NADC (Written Communication, 1979a).

IV. CHARACTERIZATION OF DEMOLITION AND WRECKING OPERATIONS

Wrecking and demolition of buildings, bridges, other structures, and large equipment consist of several stepwise operating procedures (Anon., 1979b):

1. Preparation of the structure and adjacent area for the dismantling operation.
2. Breaking up the structural parts to movable sizes and shapes.
3. Collecting and loading the broken-up materials for removal and site clearance.
4. Transporting and disposing of the waste products to an acceptable dump area.

Preparation of the building or structure involves a number of individual operations such as (OSHA, 1974):

> The initial disconnection of all utility services (electric, gas, water) and sewer and drainage systems. Shoring and the erection of temporary supports to adjacent structures may be required.
>
> The removal of reusable and other fixtures and equipment; including lighting, heating, plumbing, and salvageable material, as well as the removal of accessible piping, ducts, stairs, platforms, tanks, etc. These steps involve manual, mechanical, and oxyacetylene cutting operations, as well as lifting, hoisting and related procedures for removal and transportation.
>
> The installation of protective and temporary operating provisions such as covers for walkways and stairwells, refuse chutes, handrails, toe boards, platforms, scaffolds, floor reinforcing and coverings on inside and often on adjacent outside areas.
>
> Miscellaneous provisions for the protection of adjacent buildings, other installations and their personnel. These include shoring, temporary supports, curtains, fences, covered walkways, railings, etc.

Breaking-up steps of the wrecking operation use manual methods, and equipment such as air drills and hammers, sledges, bars, oxyacetylene flame cutters, and heavier mechanical methods with crane operated wrecking balls and buckets, bulldozers, and scrapers. Blasting may be necessary for foundations, footings, and supports. In collecting and loading operations, the broken-up material is usually chuted and shovelled into trucks using hand shovels, scrapers, hoists, crane buckets, wheelbarrows, etc.

Final disposal of the refuse material is usually by truck to a waste dump. Because only a small part of the material may be combustible, little can usually be incinerated. In many cases, the refuse is used for landfill. Broken concrete is sometimes recycled and scrap metals are collected. The trucks and dumps require protection from dusting; tarpaulin covers, bagging, and wetting may be used.

V. PROCESS CONTROLS

Effective control of conditions which may lead to hazardous exposures in wrecking and demolition work largely involves the identification of unsafe working conditions associated with the various operations (accident prevention). Safety precautions for wrecking and demolition work are detailed in OSHA's Construction Safety and Health Regulation (OSHA, 1974) and the revised OSHA General Industry Standards (OSHA, 1976).

Dust control is an important concern in wrecking and demolition operations, particularly if hazardous asbestos dust is formed. Both OSHA (OSHA, 1976) and EPA (EPA, 1978) currently regulate the demolition and renovation of asbestos containing structures. However, since there is no way to measure the total amount of asbestos fiber dust that might be released, regulation has typically required the implementation of certain work practices. EPA requires the removal and proper disposal of friable asbestos prior to demolition, and OSHA standards specify precautionary steps such as wetting, bagging, and the use of appropriate respirators and protective clothing.

The control of lead oxide and iron oxide dusts, and fumes which may result from the use of oxyacetylene flame cutting equipment similarly requires the use of respirators and the implementation of prudent work practices.

The use of personal protective devices may be required during other demolition operations as well (e.g., wearing hearing protection during the use of high explosives). Storage tanks or areas having combustible or toxic residues may require other special provisions.

VI. POTENTIAL HEALTH HAZARDS

A. Safety Hazards

The principal and obvious sources of potentially hazardous conditions that prevail in the wrecking and demolition industry are accidental in nature,

and related to the inherently unsafe work environments and conditions. Specifically, the operations conducted are often performed from elevated positions with minimum and make-shift supports, and with exposure to weather extremes, falling material, and unknown hazards from previous occupancy. Many potentially hazardous occupational practices are also employed, such as the use of crane operated wrecking balls, air drills and hammers, flame cutting torches, blasting, and shoring, as well as the dismantling of electric power lines and equipment, water, gas, sewer, and other services. Collecting, moving, loading, and transporting the rubble, scrap and other forms of dismantling refuse also have potential hazards.

As indicated in Section III, no DOL or National Safety Council incidence rates for accidents in the industry have been derived. However, indications from state data on compensation cases are that they would be high. Preliminary data from the JACA Corporation study from the NADC show the following distributions for types and sources of accidents for 185 compensation cases in 14 states, where separate records for SIC 1795 cases were kept in 1976 (Written Communication, 1979a):

Type of Accident		Source of Injury	
Struck by or against	40	Working surfaces	23%
Falls	25	Metal items	23%
Strains	15	Vehicles	8%
Caught between	6	Hand tools	7%
Nonclassifiable	7	Containers	5%
Others*	7	Nonclassifiable	26%
		Others**	8%
			100%

*Includes temperature extremes, radiation, chemicals.
**Includes chemicals, machines, wood objects.

The JACA study, largely based on data from the Department of Labor Supplementary Data System (Root and McCaffry, 1978), indicates other factors that aggravate the tendencies for injuries and illnesses in demolition work. These pertain to the short term each job involves, and the large proportion of temporary and unskilled employees. Training is difficult and working conditions vary widely. The effects of these conditions are that high accident rates tend to occur within the first few days of employment.

B. Chemical Hazards

Wrecking and demolition are frequently dusty operations which may, depending upon the character and amount of respirable (>5 μm) dust inhaled, be potentially injurious. Dust particles and fumes, especially those composed of asbestos, lead oxide and iron oxide, are particularly hazardous.

The demolition of buildings containing asbestos fireproofing or insulation, and other types of friable asbestos materials, especially the explosive demolition of large structures, is a major source and perhaps the most significant potential future source of asbestos emissions (EPA, 1974; 1978). Numerous studies provide conclusive evidence that exposure to asbestos fibers causes asbestosis (a debilitating scarring of the lungs), lung cancers, and cancer of the lining of the stomach and the lung (mesothelioma) in man (NIOSH, 1977a). However, although NIOSH recognizes the occupational hazard of asbestos, their recommended exposure standard (100,000 fibers >5 μm in length/m^3) appears directed towards exposures associated with the processing, manufacturing, and use of asbestos and asbestos-containing products (NIOSH, 1976). Both OSHA (OSHA, 1976) and EPA (EPA, 1978) currently regulate the demolition and renovation of asbestos-containing structures. The amount of asbestos that might be released by a structure is presently unknown, but it would appear to be potentially large and in need of quantitation.

Hazardous lead emissions commonly occur through the generation of lead oxide fumes and dust when heat is applied to a lead surface. Welding and cutting metal structures containing lead, or covered with red lead (Pb_3O_4) paint, have been widely recognized sources of lead poisoning since the 1920's, especially in connection with the dismantling of ships and in structural steel work such as bridge repair (Hamilton and Hardy, 1974; NIOSH, 1977a). Recently, oxyacetylene flame cutting has been associated with considerable lead exposure in bridge demolition workers (Feldman et al., 1977; Campbell and Baird, 1977; Fischbein et al., 1978). These workers experienced symptoms and biochemical changes consistent with serious lead exposure (increased blood-lead levels, depressed urinary delta-aminolevulinic acid and erythrocyte delta-aminolevulinic acid dehydratase, increased urinary coproporphyrins and erythrocyte protoporphyrins), apparently resulting from malfunctioning, inadequate or improperly used respirators. In one group of oxyacetylene metal burners, average lead exposures of as high as 15 mg/m^3 were reported, a level over 100 times the NIOSH recommended limit (<100 $\mu g/m^3$) and 10 times the level for which the usual respirators are considered adequate (Feldman et al., 1977).

The inhalation of iron oxide dust or fumes resulting from high temperature operations may cause a benign pneumoconiosis (siderosis). Workers using oxyacetylene equipment in cutting are at risk, especially when working in closed spaces. It appears that the nodules of siderosis are collections of iron particles and that the inhalation of pure iron oxide does not cause fibrotic pulmonary changes (Hamilton and Hardy, 1974; NIOSH, 1977a). However, the inhalation of iron oxide plus certain other substances may cause injury. Well-studied series of workers with siderosis show no increase in morbidity or mortality from respiratory disease (Hamilton and Hardy, 1974).

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VII. PERTINENT NIOSH PUBLICATIONS

A. Criteria Documents

Subject	NIOSH Publication No.
Asbestos	72-10267
Asbestos (revised)	77-169
Noise	73-11001

B. Health Hazard Evaluations (HHE's)

No relevant health hazard evaluations were encountered.

C. Other NIOSH Publications

Title	NIOSH Publication No.
Abrasive Blasting Respiratory Protective Practices	74-104
Abrasive Blasting Operations: Engineering Control and Work Practices Manual	76-179
Engineering Control of Welding Fumes	75-115
Relationships Between Whole-Body Vibration and Morbidity Patterns Among Heavy Equipment Operators	74-131
Morbidity Patterns Among Heavy Equipment Operators Exposed to Whole-Body Vibration	77-120
Scrap Processors	76-125

VIII. EXISTING STANDARDS

A tabulation of ACGIH Threshold Limit Values (TLVs), OSHA promulgated standards, and NIOSH recommended exposure limits for selected deleterious agents associated with wrecking and demolition processes are presented in Table 2.

IX. EXPOSURE ESTIMATES

As indicated in Section III, the wrecking and demolition industry employed approximately 7000 workers in 1976.

X. ONGOING STUDIES

The NADC is currently developing a Demolition Safety Program for OSHA (Written Communication, 1979a). This study is being prepared for the NADC by the JACA Corporation.

Table 2. Threshold Limit Values, OSHA Standards, NIOSH Recommended Standards*

	TLV (ACGIH, 1977)	OSHA (OSHA, 1976)	NIOSH (NIOSH, 1977b)
Asbestos, all forms	5 fibers/cc, >5 μm in length	2 fibers/cc, >5 μm in length 10 fibers/cc, ceiling	100,000 fibers/m^3, >5 μm in length 500,000 fibers/m^3, 15-minute ceiling
Lead, inorganic fumes and dusts (as Pb)	0.15 mg/m^3 0.45 mg/m^3, 15-minute ceiling	0.2 mg/m^3	>100 μg/m^3
Iron oxide, fume	5 mg/m^3 10 mg/m^3, 15-minute ceiling	10 mg/m^3	---
Nuisance Particulates	10 mg/m^3 total dust <1% quartz 5 mg/m^3 respirable dust	---	---
Welding Fumes - total particulates	5 mg/m^3	---	---

*All values are 8-hour time weighted concentrations except as indicated.

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APPENDIX A

Standard Industrial Classification: Wrecking and Demolition Work
(Anon., 1972)

Group No.	Industry No.	Description
179	1795	Special trade contractors primarily engaged in the wrecking and demolition of buildings and other structures, and who may or may not sell material derived from demolishing operations.
		Concrete breaking for streets and highways - contractors
		Demolition of buildings or other structures (except marine) - contractors
		Dismantling steel oil tanks, except oil field work - contractors
		Wrecking of buildings or other structures (other than marine) - contractors