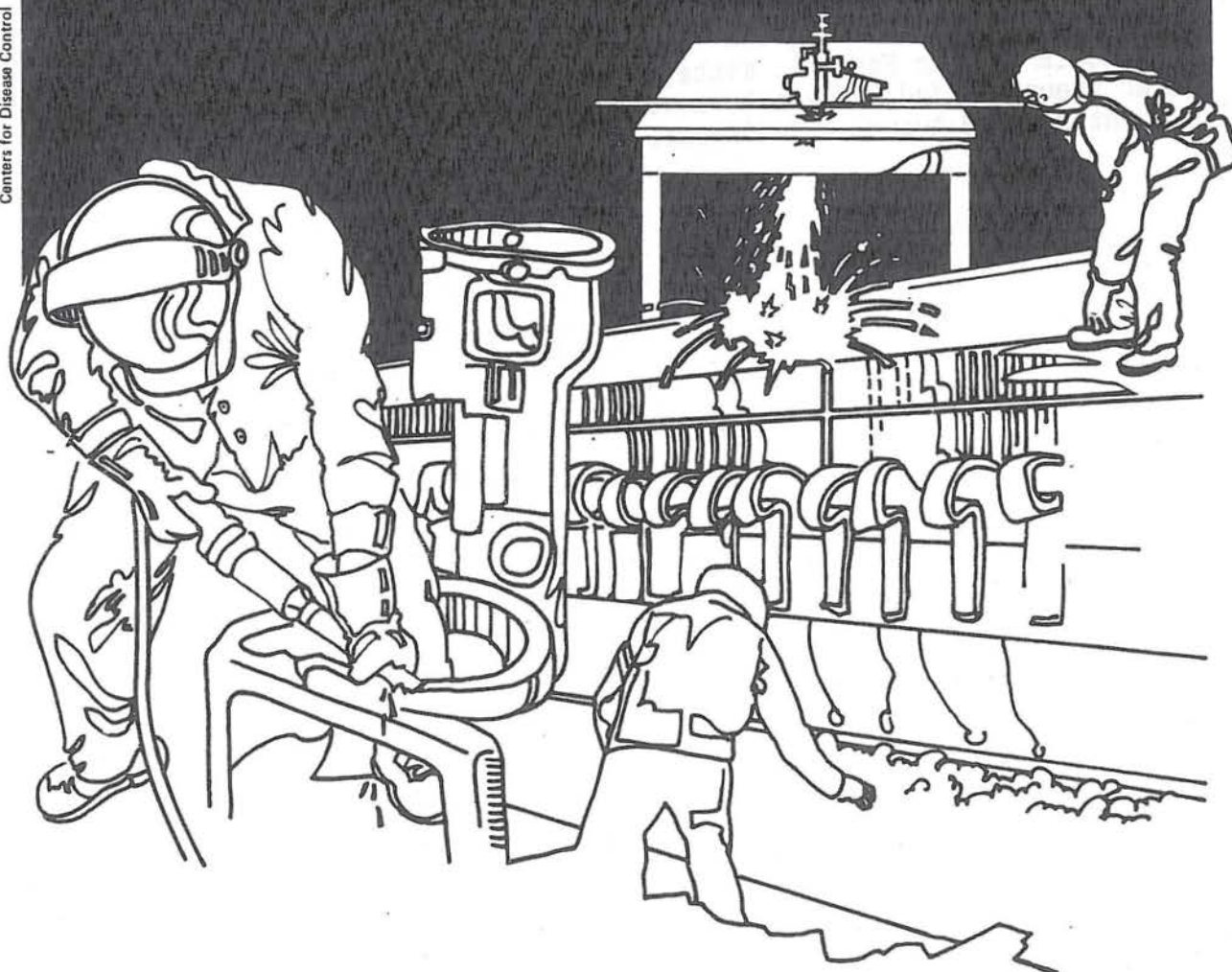


# NIOSH



## Health Hazard Evaluation Report

HETA 82-082-1064  
GEOSOURCE, INC.  
DENVER, COLORADO

## PREFACE

The Hazard Evaluations and Technical Assistance Branch of NIOSH conducts field investigations of possible health hazards in the workplace. These investigations are conducted under the authority of Section 20(a)(6) of the Occupational Safety and Health Act of 1970, 29 U.S.C. 669(a)(6) which authorizes the Secretary of Health and Human Services, following a written request from any employer or authorized representative of employees, to determine whether any substance normally found in the place of employment has potentially toxic effects in such concentrations as used or found.

The Hazard Evaluations and Technical Assistance Branch also provides, upon request, medical, nursing, and industrial hygiene technical and consultative assistance (TA) to Federal, state, and local agencies; labor; industry and other groups or individuals to control occupational health hazards and to prevent related trauma and disease.

Mention of company names or products does not constitute endorsement by the National Institute for Occupational Safety and Health.

HETA 82-082-1064  
GEOSOURCE, INC.  
DENVER, COLORADO  
MARCH 1982

NIOSH INVESTIGATOR:  
Theodore W. Thoburn, M.D.

## I. SUMMARY

On December 28, 1981, the National Institute for Occupational Safety and Health (NIOSH) received a request from the plant manager at Geosource, Inc., Denver, Colorado, to investigate an odor in the offices thought to be a gas leak. The problem started in October 1981, about a year after Geosource moved into the building. Previous investigations by the Fire Department, Public Service Company, and Denver City Health Department had noted the odor, felt there were no hazardous levels, explosive or otherwise, and failed to identify a source. The company had gas heaters checked without finding the problem.

On February 8, 1982, the NIOSH investigator visited the plant, toured the offices and production area, and inspected the ventilation units on the roof. The odor of "gas" was obvious in the office area, but not the production area. The odor was also noted about the roof units. Visits to all other tenants of the building showed that only the office immediately next to Geosource offices had any problem, lesser than Geosource, and again only in the office area. Mercaptan (the added odorant for natural gas) levels were judged to be annoying but not to pose a health risk.

The production area was basically clean, with the only potentials for health problems relating to burning off cable sheathing in the fitting and repair areas and to the use of solvent on the varnish coating on the wire. At current production levels, good work practices should probably be sufficient to prevent problems. If production increases, mechanical ventilation may become necessary.

On the basis of personal observation, NIOSH concluded that a health hazard did not exist, although a gas leak as indicated by the odor of mercaptan was definitely present. Production areas with a potential for health problems are pointed out in this report.

KEYWORDS: SIC 3357 (Drawing and Insulating of Nonferrous Wire), insulating wire, natural gas, mercaptan, methylene chloride, phenol, polyurethane, polyethylene.

## II. INTRODUCTION

On December 28, 1981, the National Institute for Occupational Safety and Health (NIOSH) received a request from the plant manager at Geosource, Inc., Denver, Colorado, to investigate an odor in the offices thought to be a gas leak. The problem started in October 1981, about a year after Geosource moved into the building. Previous investigations by the Fire Department, Public Service Company, and Denver City Health Department had noted the odor, felt there were no hazardous levels, and failed to identify a source. The company had gas heaters checked without finding the problem. An investigation was conducted by the NIOSH investigator on February 8, 1982.

## III. BACKGROUND

Geosource, Inc., occupies a little over one-sixth of the building in the northeast corner of this office/warehouse complex. There are 2,000 square feet of office space with normal height ceilings and a forced air ventilation system working off roof mounted units which heat with natural gas and cool with electric refrigeration. There are 19,216 square feet of "warehouse" space with about 22 feet high ceilings. Heat is supplied by individual gas heaters with blowers mounted a bit below ceiling level and vented through the roof. There is no cooling system for the "warehouse" area. Natural gas use is confined to the heating units, as all other energy needs use electricity with the exception of one propane forklift.

The warehouse area is used for storage of material, production of the seismic cable, and repair of used cable. varnish-coated copper wire, plastic pellets, and fittings serve as raw material. The wire is coated with variously colored polyethylene as it is run through an extruder head. This machine was not running at the time of the NIOSH visit. Wires are then twisted into pairs, then multistranded cables. These are wrapped with nylon cords and then dried in a hot box. The dried cable is then run through another extruder which applies a polyurethane outer sheath.

Following this the wire goes to an area where the fittings are added. This involves cutting the cable with shears, burning off some of the cable sheath and insulation with a hot soldering iron, and cleaning off the varnish with a solution containing methylene chloride and phenol. Connections were then soldered without flux. An identification "sleeve" is then molded on using a compatible plastic and the cable tested. Completed cables are usually shipped promptly.

The repair section is somewhat smaller than the section adding fittings and uses the same techniques and materials. It is a separate section although in the same end of the warehouse.

The finishing section works two shifts. The fabricating sections work one shift with a very limited second shift. In all there are 67 workers on both shifts.



#### IV. INVESTIGATION

On February 8, 1982, the NIOSH investigator visited the plant and met with the plant manager. The odor of "natural gas" was quite evident in the office area. After obtaining background information, the investigator walked through the production area. Generally the area was clean and the air clear and odorless. The cable sheath extruder was operating but produced no noticeable fumes nor were fumes noted where the identification was being applied. There was a faint, slightly sweetish odor of solvents noted when approaching the area where fittings were being added to the cables. The investigator then walked around the building in the company of the maintenance man and inspected the ventilation units on the roof. The building has separate gas service to the east and west sides of the building, the reduction valves being located against the outside wall about one-third of the distance from the north end. The gas service for the east side of the building was fairly close to the doors into the Geosource offices; however, no odor of "gas" was noted in the vicinity.

The building has a flat roof surrounded by a knee high rim. Ventilation units for the various offices were located fairly close to the east or west edge. Only the units on the east side were inspected. The gas lines come up through the roof further in than the units. They are then set above roof level as they run over to the units. Those to the units serving Geosource appeared weathered and rusted. Those to the offices further south in the building were smooth with a green coating. A distinct "gas" odor was detected about the units serving Geosource, more distinct by the larger unit. This was despite a fair breeze. No odor was detectable by the other units. Although the plant manager did not know the percentage of fresh air introduced by the roof units, it appeared that they were set for close to 100% recirculation. The odor of gas was quite strong by the intake vent of the large unit.

As a final part of the study the NIOSH investigator stopped by every office/warehouse in the building to ask if any other of the building's tenants had had a similar problem (see Figure 1). The proprietor in the furniture warehouse (Scanfurn) immediately south of Geosource had noted the odor in the office in the morning, particularly Mondays, but not in the warehouse section. He had been in the building since December 1981. None of the other occupants of the building had noted this "gas" odor. Several mentioned the odor of "rotten eggs" or stockyards as occasionally being a problem. The occupants of the Brandt Warehouse in the northwest end of the building mentioned they had had a gas leak two months ago, but had fixed it.

After the plant visit the NIOSH investigator had a discussion with the investigator from Denver City Health Department who had recommended NIOSH be asked in. Besides the "gas" she expressed concern about health effects of fumes produced when the cable sheaths are burned off.

## V. DISCUSSION

### A. "Gas"

By history, the "gas" odor is strongest in the office, particularly in the morning or when there is an inversion. The evening shift has not had problems. Sometimes the odor is noticeable outside as well as in the office area. There have been some complaints of headaches in addition to the odor, but no other health complaints. By observation the odor is that of the mercaptan added to natural gas by the gas company so that leaks will be noticed. Apparently the leak is in the vicinity of the ventilation units. Either by cross connections in the ventilating systems or by diffusion along the roof, enough gas gets into the next ventilating system down the roof to be noticeable in the office immediately down-roof from Geosource. The warehouses are spared because they do not intake air from roof level. Several stacks were identified as air intakes, but they stood higher than the ventilating units and appeared to be exhausting a low flow of heated air. The west side of the building is spared because there is sufficient open roof area that almost any breeze would dissipate gas coming from the Geosource units before it reached the other side of the roof. Because the units are run with nearly 100% recirculation any "gas" getting into the system is retained. With daytime activity and increase in wind during the day less "gas" gets into the system and more fresh air gets into the building through doors, gradually dissipating the gas. There may also be some measure of adaptation on the part of the occupants.

Mercaptans have a very strong, unpleasant odor so only very low levels are needed to allow gas leaks to be noticeable by the odor. At levels likely to be encountered from a gas leak the strong, offensive smell may cause headaches and nausea. Much higher levels would be necessary before any other ill effects could be produced. (For example, the odor threshold of ethyl mercaptan for 50% response is 0.00047 parts per million (ppm) and for 100% response is 0.001 ppm. The environmental criteria (ACGIH) is 0.5 ppm.<sup>1</sup>

### B. Other Potential Exposures

As the polyethylene and polyurethane are supplied in fully reacted pellet form it is unlikely there will be any health problems associated with their use except when they are heated, particularly in an uncontrolled manner. The polyurethane extruder and the identification molding areas appeared to be functioning properly and were not emitting any noticeable fumes. Although the process of burning off cable sheath was not observed, it could be expected to produce a puff of decomposition products fairly close to the operator's face. Polyurethanes decompose to carbon monoxide, carbon dioxide, hydrogen cyanide, oxides of nitrogen, and acrolein.<sup>2</sup> The latter two would be irritating, particularly to persons with greater susceptibility to respiratory irritants. Polyethylene on thermal decomposition could be expected to give off an indeterminate mixture containing hydrocarbons, oxides of carbon and aldehydes, the latter being irritating. At current production levels it appears

release of these fumes into the general room air should not be a problem as long as individual workers are protected from them while burning off the sheath.

The unnecessary exposure to the solvent used to strip the varnish should be avoided because methylene chloride when absorbed into the body is metabolized to carbon monoxide which binds to red cells to form carboxyhemoglobin reducing the blood's oxygen carrying capacity. This effect would be additive with other carbon monoxide exposures such as smoking and auto exhaust, as well as the small amounts generated when heat stripping the cables and by the fork-lift.

#### VI. CONCLUSION

There is a gas leak in the vicinity of the roof top ventilating units for Geosource. The leaked gas with odorant (mercaptan) is being circulated in the ventilating system. The levels detected are probably not dangerous to health, although they can be annoying. Previous investigations concluded there was no explosive hazard.

With the current level of activity the only exposure in the work area likely to cause health problems is the fumes given off when heat stripping cable (irritating to the respiratory tract). The varnish stripper, if misused, could also cause problems. If operations are scaled up, it may be necessary to install a ventilating system to handle these fumes.

#### VII. RECOMMENDATIONS

1. Locate and fix the gas leak(s) in the ventilating units.
2. As an aid in locating the leak (inside or outside the ventilating unit) one could seal off the intake and see if that made a difference after allowing time for any entrapped "gas" to dissipate.
3. As increase evidence that the gas is to blame, one could shut down the gas at the meters on a Friday and not reopen it until Monday and observe. If no leak can be found, this may be a necessary step before tearing out enclosed or buried pipe. Such a test would not be practical until warmer weather or an alternate heat source was established.
4. Workers in the fitting and repair areas should avoid breathing fumes given off when heat stripping and solvent stripping cables. If this proves difficult to accomplish by work practice, some mechanical device to move the fumes away from the worker's face might be useful.

#### VIII. REFERENCES

1. American Conference of Governmental Industrial Hygienists, Documentation of Threshold Limit Values, 4th Ed., Cincinnati, Ohio, (1980), p. 189.

2. International Labour Office, Encyclopaedia of Occupational Health and Safety, McGraw-Hill Book Company, New York (1972), p. 1099.

IX. AUTHORSHIP AND ACKNOWLEDGMENTS

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X. DISTRIBUTION AND AVAILABILITY

Copies of this report are currently available upon request from NIOSH, Division of Standards Development and Technology Transfer, Information Resources and Dissemination Section, 4676 Columbia Parkway, Cincinnati, Ohio 45226. After 90 days the report will be available through the National Technical Information Service (NTIS), Springfield, Virginia. Information regarding its availability through NTIS can be obtained from NIOSH, Publications Office, at the Cincinnati address.

Copies of this report have been sent to:

1. Geosource, Inc..
2. U.S. Department of Labor/OSHA - Region VIII.
3. NIOSH - Region VIII.
4. Colorado Department of Health.
5. State Designated Agency.

For the purpose of informing affected employees, a copy of this report shall be posted in a prominent place accessible to the employees for a period of 30 calendar days.



FIGURE I

Geosource, Inc.  
Denver, Colorado

Warehouse/Office Building Containing Geosource, Inc.  
(not to scale)

