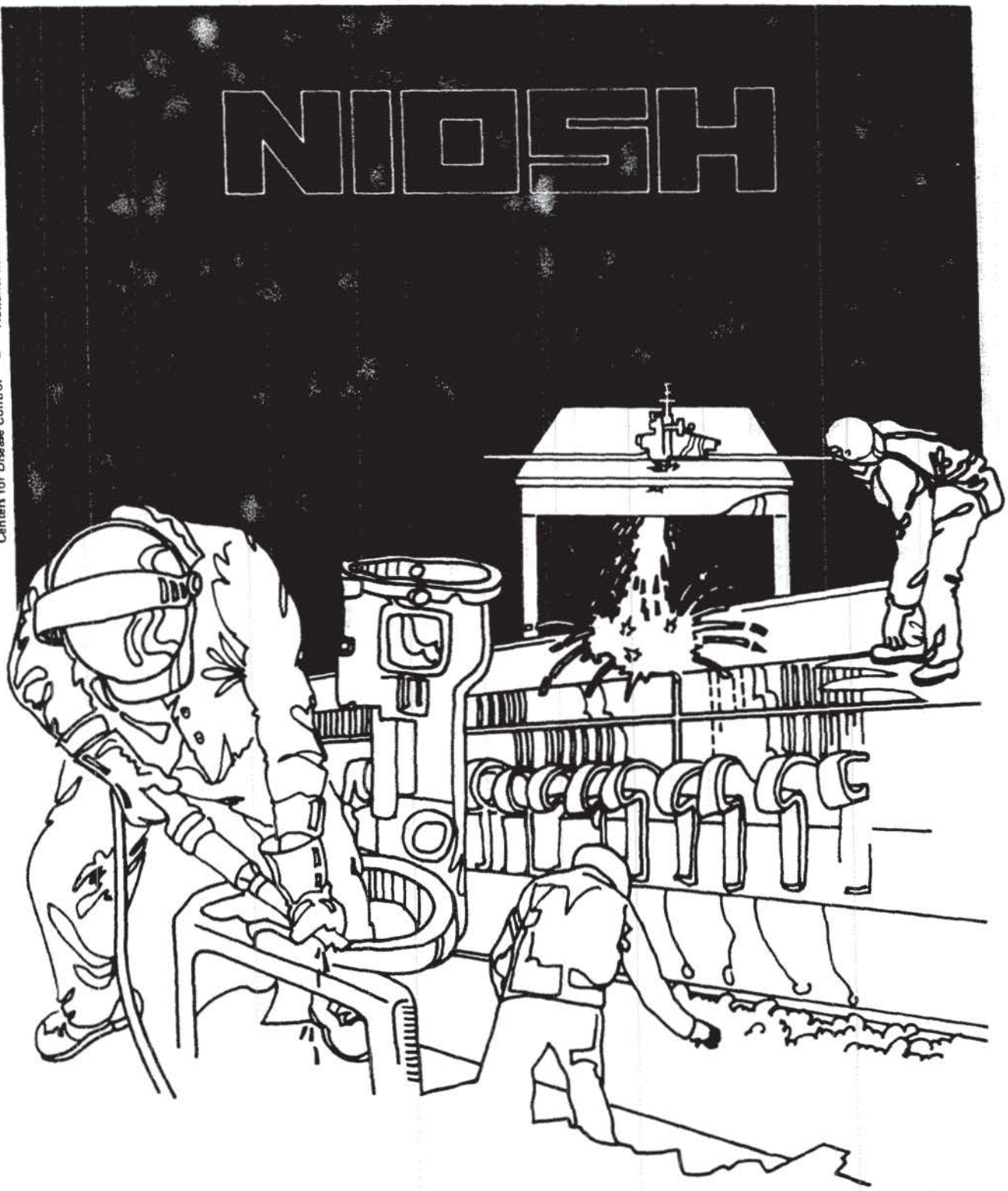
U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES ■ Public Health Service
Centers for Disease Control ■ National Institute for Occupational Safety and Health



Health Hazard Evaluation Report

HETA 81-160-913
CINCINNATI WATER TREATMENT PLANT
CINCINNATI, OHIO

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.

HETA 81-160-918
July 1981
Cincinnati Water Treatment Plant
Cincinnati, Ohio

NIOSH Investigator:
Cheryl Lucas, IH

I. SUMMARY

On January 12, 1981, the National Institute for Occupational Safety and Health (NIOSH) received a request for technical assistance from the Health and Safety Director for the City of Cincinnati to investigate employee exposures at the Cincinnati Water Works Pilot Plant. The area of concern is the activated carbon regeneration process where carbon particles are incinerated to remove absorbed organics. No health problems were reported. Four day-shift operators, and one night-shift operator are exposed in the process.

On March 9-11, 1981 NIOSH conducted a site visit to carry out an industrial hygiene evaluation. Personal breathing-zone and area air sampling for carbon dust and organic vapors, collection of bulk samples, as well as a review of work practices and working conditions were performed. Personal and area noise levels were measured.

Bulk sample analysis of the carbon dust showed no significant amount of any trace metal, organic and/or silica contamination. These negative findings confirmed the assumption that the carbon dust should be classified as a nuisance particulate. Analytical results indicate that worker exposure to respirable carbon dust in air samples ranged from 0.06 to 0.29 milligrams per cubic meter of air (mg/M^3). All concentrations were well below the OSHA respirable dust standard of 5 mg/M^3 for an 8-hour workday. Organic vapor samples, both area and personal taken during the survey, were below the detectable limits of the analytical methods used, therefore their concentrations are negligible. Personal noise exposures ranged from 80.1 to 84.4 dBA, which is below the NIOSH-recommended criteria of 85 dBA and the OSHA standard of 90 dBA for an 8-hour workday.

Based on the data collected in this investigation, NIOSH has determined that no health hazard exists at the Cincinnati Water Treatment Plant Carbon Regeneration facility from exposure to organic vapor, respirable dust, or noise. However, it is recommended that the operators continue to wear a NIOSH-approved dust respirator when cleaning out the drying chamber, or undertaking the gate valve repair procedure - two reported higher exposure tasks which did not occur during the NIOSH survey.

KEYWORDS: SIC 4941 (Water supply); carbon regeneration facility, organic vapor, respirable dust, noise.

II. INTRODUCTION

On January 12, 1981, the National Institute for Occupational Safety and Health received a request for technical assistance from the Health and Safety Director for the City of Cincinnati to investigate employee exposures at the Cincinnati Water Works Pilot Plant. The area of concern is the activated carbon regeneration process where carbon particles are incinerated to remove absorbed organics. No health problems were reported. Four day-shift operators, and one night-shift operator are exposed in the process.

An interim report dated February, 1981 covering the findings of the initial walk-through survey, and future actions needed to complete the evaluation was provided to the company.

Interim environmental sampling results of the initial and follow-up studies were submitted to the company in a letter dated April 28, 1981.

III. BACKGROUND

The Cincinnati Water Works carbon regeneration plant removes organics from activated carbon used to filter trace organic material from drinking water. This is accomplished through an incineration process. First, the wet carbon slurry undergoes a dewatering procedure. Next, the carbon moves into a 300^{o}F drying chamber. Air is circulated out the top of the drying chamber through a cyclone separator into the incineration chamber which interfaces with the drying unit so that there is a continuing circulation of air. The cyclone separator removes fine dust from the carbon because this fine material is useless in filtering drinking water. A double gate valve releases the fine dust by gravity into a receiving barrel for disposal. Meanwhile, the carbon is moving down into the 1525^{o}F incineration chamber where any remaining organics are burned off. The exhaust gas is moved through two wet scrubbers before being exhausted out of the building. Immediately after incineration, water is reintroduced into the carbon so that it can be piped to a storage tank where the material will be held until it is needed. Carbon is regenerated at a rate of 585 lbs./hour, of which 85 lbs. are burned-off organic material. Between 12-25% of the carbon is lost during regeneration due to dewatering, cyclone-separated dust, and burn-off.

There are no local exhaust systems at the plant; only general ventilation is in use.

The workforce consists of 4 operators and one supervisor. Two operators work on the day-shift, one each on the second and third shifts. The operators spend approximately 85% of their time inside an air conditioned control booth. Under normal conditions, operator time spent out in the plant is used to take pressure readings, quality control samples, and emptying the fine barrel and sand separator hopper. The supervisor spends only part of his workday at the plant.

Even though the operators spend the majority of their time in the air conditioned booth, there are potential dust and organic vapor exposures originating at the cyclone separator gate valve and fine dust barrel, when the workers are out in the plant. The dust barrel is manually carted over to a scale where is is weighed, and taken outside to be dumped. Dust respirators (NIOSH approval number TC-21C-132) are used during this task. Since the transfer from the gate valve to the dust barrel, and from the barrel to the outside is the only portion of the process which is not enclosed, it is believed that this is one of three exposure situations which are the major sources of exposure. On the average of twice a week, the incinerator is shut down making it necessary to remove the carbon from the drying chamber to prevent overheating. This is accomplished with a standard shop vacuum. Management indicated that this removal process creates a high dust exposure situation. Also, maintenance procedures necessary to repair the gate valve on the cyclone separator cause excessive dust exposures. However, these maintenance procedures have been necessary only four times since the plant began operation in March, 1980.

IV. EVALUATION DESIGN AND METHODS

The industrial hygiene survey conducted included noise monitoring, personal air sampling, a work practice study, bulk process sample analysis, and an evaluation of control procedures. Personal breathing-zone and area samples were taken for respirable dust and organic vapors. Personal and area monitoring was also conducted for noise. Sampling and analytical methods used for the survey are NIOSH-approved, and are listed in Table I.

Bulk samples of carbon dust from the fine barrel were analyzed for trace metals. Aliquots were weighed, ashed in a low temperature asher to remove most of the carbon and then digested with nitric acid. The residues were dissolved in diluted acid, and the resulting solutions were analyzed by Inductively Coupled Plasma-Atomic Emission Spectroscopy (ICP-AES) for trace metals.

Another carbon dust bulk sample was dissolved with carbon disulfide and analyzed by Gas Chromatography-Flame Ionization Detector (GC-FID) for organic contaminates.

Free silica analysis was done on a carbon dust bulk sample using NIOSH method P & CAM 259 with minor modifications.

V. EVALUATION CRITERIA

OSHA standards and recommended criteria, used to make a health hazard determination statement in this report, are levels of toxic substances which it is believed that nearly all workers may be repeatedly exposed to without adverse effects for a 40-hour work week in an occupational lifetime. Recommended criteria, OSHA standards, and comments on the known health effects for substances evaluated in this study are listed in Table II.

Initial efforts were directed toward gathering information published concerning the health effects of activated carbon dust exposure. Unless the carbon dust was found to contain high concentrations of organics, metals, and/or silica, it is classified as an inert dust.[1,2] Therefore, exposure criteria developed for nuisance particulate will be applicable to the carbon regeneration plant's situation.

VI. RESULTS AND DISCUSSION

Personal noise levels were found to range from 80.1 to 84.4 dBA and are presented in Table IV. This is below the NIOSH-recommended criteria of 85 dBA for an 8-hour workday, as well as the OSHA standard of 90 dBA. Area noise levels ranged from 81.7 to 87.7 dBA, some of which exceeded NIOSH criteria; however, these were located outside the operator's booth, and do not normally relate to employee exposures.

Analytical results from the organic vapor samples showed no appreciable amount of contamination. Only 2 of 13 organic samples submitted for analysis contained levels which were detectable, and they were trace amounts. The two samples containing low level trace amounts were situated where organic concentrations would most likely be at their highest level. Therefore, personal samples were not analyzed.

Organic, trace metal, and free silica analyses revealed that no appreciable amounts of contamination existed in the carbon dust bulk samples taken at the plant. Personal and area respirable dust concentrations ranged from 0.06 to 0.29 mg/M^3 as shown in Table III. The highest level was only 6% of the OSHA respirable dust standard of 5 mg/M^3.

VII. RECOMMENDATIONS

1. Workers, when cleaning out the incinerator drying chamber and making gate valve repairs, should continue to wear NIOSH-approved dust respirators.

2. Workers should be educated on the proper use and care of the respirators that they use.

3. If the Pilot Plant is expanded into a full-scale operation, the enclosed operator's booth should be soundproofed since the noise levels measured at the Pilot Plant were very close to the NIOSH-recommended criteria.

VIII. REFERENCES

1. Gross, P. and C.A. Nau: "Lignits and the Derived Steam-Activated Carbon". Arch. Environ. Health, Vol. 14 (March), pp. 450-60. 1967.

2. Wehi, K.L., W.G. Johnson, J.S. Chapman, and A.K. Pierce: "Pneumoconiosis Among Activated-Carbon Workers". Arch. Environ. Health, Vol. 30 (Dec.), pp. 578-81. 1975.

3. NIOSH Manual of Analytical Methods, 2nd Ed., Vols. 1-5. DHEW (NIOSH) Publication No. 77-157A, April, 1977.

4. Health Hazard Determination Report No. 75-130-484. DHEW (NIOSH).

5. Occupational Safety and Health Standards for General Industry. U.S. Dept. of Labor (OSHA), Section 1910.1000, pp. 545, 100. July, 1980.

IX. AUTHORSHIP AND ACKNOWLEDGEMENTS

Evaluation Conducted and Report Prepared By:	Cheryl Lucas Industrial Hygienist Industrial Hygiene Section
Originating Office:	Hazard Evaluations and Technical Assistance Branch Division of Surveillance, Hazard Evaluations, and Field Studies Cincinnati, Ohio
Report Typed By:	Cheryl Burt Clerk-Typist Industrial Hygiene Section

X. DISTRIBUTION AND AVAILABILITY OF REPORT

Copies of this report are currently available, upon request, from NIOSH, Division of Technical Services, 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), 5285 Port Royal Road, Springfield, Virginia 22161. Information regarding its availability through NTIS can be obtained from the NIOSH Publications Office at the Cincinnati address.

Copies of this report have been sent to:

1. Department of Health, Cincinnati, Ohio
2. Cincinnati Water Works Treatment Plant
3. NIOSH, Region V
4. OSHA, Region V

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

TABLE I

Sampling and Analytical Methodology

Cincinnati Water Works Carbon Regeneration Plant
Cincinnati, Ohio
TA 81-160

Substance	Sampling Method	Analytical Method
Respirable Nuisance Particulate	Preweighted Millipore M-5 PVC filters set in 10mm nylon cyclone separators using MSA personal sampling pumps operating at 1.7 liters/minute.	Standard gravimetric procedures.
Organic Compounds	Charcoal tubes on SKC personal sampling pumps operating at 0.2 liters/minute.	Desorbed with carbon disulfide and injected into a gas chromatograph equipped with a flame ionization detector.
Noise	Metrosonic multifunction dosimeter Model No. 301.	Metrosonic readout unit.

TABLE II

Recommended Exposure Criteria for Hazardous Substances

Cincinnati Water Works Carbon Regeneration Plant
Cincinnati, Ohio
TA 81-160

Substance	Recommended Exposure Limit	OSHA Standard	Health Effects
Activated Carbon Dust (Nuisance	10 mg/M^3 Total 5 mg/M^3 Respirable (ACGIH)	15 mg/M^3 Total 5 mg/M^3 Respirable	Nuisance dusts have been associated with very little adverse health effects on the lungs and do not produce significant organic disease, or toxic effects when exposures are kept under reasonable control. Extremely high concentrations may cause mechanical irritation to the eyes, ears, and nasal passages, and can dangerously reduce visibility. Indirectly, irritation can result from the rigorous skin cleaning procedure necessary for their removal.
Continuous Noise	85 dBA for 8-hr. day (NIOSH)	90 dBA for 8-hr. day	Excessive noise exposure has been associated with temporary and permanent hearing sensitivity losses, physical and psychological disorders. It may cause interference with speech communication or the reception of other wanted sounds, thus causing disruption of job performance.

TABLE III

Cincinnati Water Works Carbon Regeneration Plant
Cincinnati, Ohio
TA 81-160

March 9-11, 1981

Location	Sample Time	Respirable Dust Concentration (mg/M^3)**
Operator #C*	2:05pm-9:30pm	0.06***
Beside gate valve, level 3	2:10pm-9:35pm	0.06
Beside fine barrel, level 3	2:30pm-9:45pm	0.05
Operator #A*	6:10am-12:30pm	0.18
Operator #B*	7:30am-1:55pm	0.29
Beside gate valve, level 3	6:08am-1:45pm	0.09
Beside fine barrel, level 1	6:05am-12:15pm	0.01
	OSHA Standard:	5.00

* Personal breathing-zone samples
** Results are time-weighted average concentrations (TWA's).
*** The average blank weight was subtracted from respirable dust concentrations.

TABLE IV

Personal and Area Noise Levels

Cincinnati Water Works Carbon Regeneration Plant
Cincinnati, Ohio
TA 81-160

March 9-11, 1981

Location	Sample Time	Noise Level (dBA)**
Beside gate valve, level 3	1:45pm-9:45pm	81.7
Operator C* 2nd Shift	2:00pm-9:45pm	84.4
Outside operator's booth; level 1	2:10pm-9:30pm	86.0
Operator B* 1st Shift	7:30am-12:05pm	80.1
Operator A* 1st Shift	6:10am-12:05pm	80.1
Beside gate valve; level 3	6:00am-12:10pm	87.7
Outside operator's booth; level 1	2:15pm-9:35pm	85.9
Beside gate valve; level 3	2:20pm-9:35pm	84.9

* Personal samples
** Results are time-weighted average concentrations (TWA's).