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IN-DEPTH SURVEY REPORT

CONTROL TECHNOLOGY FOR REMOVING LEAD-BASED PAINT FROM STEEL STRUCTURES CHEMICAL STRIPPING USING CAUSTIC (PEEL AWAY ST-1)

AT

Williams Pipeline Terminal and Station
Marshall, Minnesota

REPORT WRITTEN BY
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U S DEPARTMENT OF HEALTH AND HUMAN SERVICES
Public Health Service
Centers for Disease Control and Prevention
National Institute for Occupational Safety and Health
4676 Columbia Parkway, Mailstop R-5
Cincinnati, Ohio 45226

FACILITY SURVEYED	Williams Pipe Line Company Terminal and Station Marshall, MN
SIC CODE	4613
SURVEY DATES	September 8-11, 1992
SURVEY CONDUCTED BY	R Leroy Mickelsen Phillip A Froehlich
FACILITY REPRESENTATIVE	Jim Rodkey Williams Pipeline Company P O Box 3448 Tulsa, OK 74101 918-588-3243
CONTRACTOR	Barsness Painting Company Sparta, Wisconsin 608-269-2307
EMPLOYEE REPRESENTATIVE	No Union
PAINTING INSPECTOR	Bill Dellis Bates Coating Consultants P O Box 54796 Tulsa, OK 74155-0796 918-252-7294
ANALYTICAL WORK PERFORMED BY	DataChem Laboratories 960 West LeVoy Drive Salt Lake City, UT 84123-2547 (801) 266-7700 Mark Millson NIOSH Division of Physical Sciences and Engineering 4676 Columbia Parkway Cincinnati, OH 45226
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Mention of company names or products does not constitute endorsement by the Centers for Disease Control and Prevention

INTRODUCTION

Because of increased reports of lead poisoning and silicosis among workers in the steel structures painting industry, researchers from the National Institute for Occupational Safety and Health (NIOSH) developed a research project to evaluate engineering controls in this industry [1,2] As a part of this project, NIOSH researchers attempted an in-depth study of chemical stripping of a storage tank at the Williams Pipeline Company Terminal and Station, Marshall, Minnesota The stripping was performed by the Barsness Painting Company, Sparta, Wisconsin, September 8-11, 1992, Mr William Dellis of Bates Coating Inspectors and Consultants, Tulsa, Oklahoma, was contracted by Williams Pipeline to oversee and inspect the paint removal process

The Marshall Terminal and Station was built circa 1946, occupies about 40 acres, and contains a pumping station, tank truck loading facilities, and nine storage tanks Each storage tank is surrounded by earthen dikes about 4-feet high Two tanks are 73 feet in diameter and 41 feet tall, six are 60 feet in diameter and 40 feet tall, and one is 36 feet in diameter and 24 feet tall The latter tank, having a surface area of about 3700 ft^2, was the subject of this study It was last painted in 1968 with a chalking white alkyd top coat over a lead-based primer

Paint removal was done using Peel Away ST-1 manufactured by Dumond Chemicals, Inc , New York, New York According to the Material Safety Data Sheet, it contains 21 percent calcium hydroxide, 16 percent magnesium hydroxide, 9 percent sodium hydroxide and the balance water and non-hazardous chemicals It is a light blue paste having a specific gravity of 1 33 and a pH of 13

The removal method consists of spraying Peel Away on the painted surface, allowing it to set several hours or overnight, then washing the decomposed paint and excess caustic from the tank At this site, washing was to be followed by a brush-off, abrasive blast to remove traces of remaining paint and to establish an anchor pattern for repainting Liquid runoff was collected using caustic resistant, reinforced plastic tarps placed on the ground surrounding the tank The specially designed, 15' x 50' tarps were somewhat curved to conform to the tank diameter and had inflatable pillows to form a curb at the outside edges to contain the runoff The lateral edges of the tarps were held together with clamps made from polyvinyl pipe to create a continuous ring around the base of the tank The interior edges were gathered together, pulled a foot or so up along the bottom of the tank, and held in place with a cable clamp, the edges were sealed to the tank using duct tape and caulk This provided a catch basin about 12 feet wide

A spiral stairway encompassing about a third of the tank circumference provided access to the top Personnel security lines were attached to the vent at the center of the roof, as were cables to support two "spiders" (one man platforms with motorized winches to raise and lower the platforms) used to access the side of the tank for spraying and scraping

The intended schedule for the paint removal and repainting was to construct the catch basin on Tuesday, continue preparation and spray the Peel Away onto the tank on Wednesday, scrape, flush, rinse, and cleanup on Thursday, and then abrasive blast and paint on Friday Although the catch basin was prepared on schedule, further work was delayed until Friday morning because of adverse weather conditions (winds averaging 10 to 20 knots per hour with gusts to 30 knots per hour) As a result, the Peel Away was sprayed on in the morning and allowed to set only a few hours before scraping and flushing

The Peel Away was applied using a Binks Model 7 spray nozzle (Binks Manufacturing Company, Franklin Park, Illinois) modified so that the slurry and air supply valves were independently operated The workers wore work pants and shirts, protected by Tyvek® coveralls with hoods, and alkali-resistant boots and gauntlet gloves to protect their feet, hands, and forearms They also wore hard hats with face shield visors (some workers wore safety glasses under the visor) and half mask respirators with organic vapor cartridges and dust and mist prefilters

A light coat of Peel Away was applied beginning at the top and continuing to the bottom of the side of the tank in a swath about 8 to 10 feet wide, depending on the reach of the man in the spider The spider was shifted to a position such that a new swath could be applied that overlapped the previous one by a foot or so The spray was applied in this manner except for the area where the stairway prevented use of the spider This light coat provided a base on which a thicker coat was then sprayed After the side was completed, the top of the tank was then treated in the same manner, i e , a thin coat followed by a thick coat As the caustic reacted with the paint, the color of the Peel Away, light blue at the start, turned a pink red The spraying was done by one man and was completed in about four hours The Tyvek coveralls, in good condition, were carefully removed and discarded

After about two hours, the workers cleaned the surface after donning waterproof coveralls closed at the collar, wrists, and ankles with duct tape Starting with the top of the tank, the coating and decomposed paint were removed by hand scraping, followed by a high pressure water rinse After the top was rinsed, two spiders were used to provide worker access to rinse the side of the tank The three workers and the foreman scraped, rinsed, and assisted in positioning the spiders, although two men in the spiders did most of the scraping and rinsing of the sides The debris retained by the ground tarps was mostly a sludge which was subsequently shoveled into 55-gallon drums

The ambient air was warm and fairly calm at the start of the spraying, but wind gusts developed and increased in velocity as the job progressed This caused the caustic coating to dry out in some areas before paint decomposition was complete and made removal from these areas more difficult Where conditions were ideal, the paint was removed to the bare metal, however, in areas where removal was difficult, reddish patches (thin coats of lead-based primer) and even some traces of white finish coating remained on the tank

Because of time constraints, the NIOSH research team was unable to observe the completion of the work, i e, tarp and equipment cleanup, brush-off blasting, and painting

Personal breathing zone (PBZ) and area samples for lead were collected on 37-millimeter (mm), 0 8-micrometer (μm) pore size, cellulose ester membrane filters in closed-face cassettes The cassettes were connected via Tygon® tubing to SKC Model 224-PCXR3 (SKC Inc , Eighty Four, Pennsylvania) battery-operated sampling pumps adjusted to a flow rate of approximately 2 0 liters/minute (L/m), the pumps were calibrated prior to and after use For alkaline dusts, similar sampling equipment was used except the collection media were 37-mm, 1 0-μm pore size polytetrafluoroethylene (PTFE) membrane filters supported by a cellulose backup pad Bulk samples of the old paint on the tank and samples of the used Peel Away were also obtained for analysis of metals

Analyses for lead and major metals were done according to NIOSH Method 7300 *for bulk samples and NIOSH Method 7082 for filter samples, using* inductively coupled argon plasma, atomic emission spectrometry, when the lead results were below the limit of detection, samples were then analyzed using flame atomic absorption spectroscopy (NIOSH Method 7105) [3,4,5] Alkaline dust analyses were done in accordance with NIOSH Method 7401 using an acid-base titration [6] The method was modified by using 0 02N sulfuric acid in place of 0 01N hydrochloric acid The results are reported as sodium hydroxide Sound levels were measured and recorded using a Quest M-27 Noise Logging Dosimeter (Quest Electronics, Oconomowoc, Wisconsin)

For PBZ samples, the cassettes were attached to the lapel of the workers' coveralls Area samples were collected on the spiders, at the top of the dikes, approximately 25 feet upwind and 25 feet downwind of the tank and also atop a more remote dike about 75 feet downwind from the tank Bulk samples of the existing paint were taken by scraping approximately 1-inch square areas with a chisel from the top and sides of the tank

RESULTS

One sample of the existing paint, taken from the top of the tank, indicated a lead content of about 6 percent by weight Two samples scraped from opposite sides of the tank contained 0 9 percent and 1 5 percent lead On an area where the paint was peeling on the side of the tank, an attempt was made to separately sample the top coat and the primer coat, these samples indicated 0 25 percent and 11 percent lead, respectively Two samples of sludge on the tarps were found to contain 1 percent and 0 6 percent lead, and a sample of waste water from the tarp contained 0 03 percent lead All of these determinations were grab samples which indicate the presence of lead, but may not represent the average lead concentrations for the substances tested

Area sampling results for lead and alkaline dust

	During Application of ST-1			During Scraping and Rinsing		
		Lead			Alkaline Dust	
	Sampling	Concentration		Sampling	Concentration	
Sampling Location	Time (min)	Sample ($\mu g/M^3$)	8-hr TWA ($\mu g/M^3$)	Time (min)	Sample (mg/M^3)	8-hr TWA (mg/M^3)
Spider	263	1 18	0 64	397	0 86	0 71
25 ft Downwind	243	0	0	385	0 52	0 42
75 ft Downwind	224	0	0	366	0 15	0 11
25 ft Upwind	233	0	0	382	0 07	0 05

Personal sampling results for lead exposure during scraping and rinsing

	Sampling	Lead Concentration	
Person Sampled	Time (min)	Sample ($\mu g/M^3$)	8-hr TWA ($\mu g/M^3$)
Scraper in Spider	219	3 88	1 77

Personal sampling results for alkaline dust

	During Application of ST-1			During Scraping and Rinsing		
	Sampling	Concentration		Sampling	Concentration	
Person Sampled	Time (min)	Sample (mg/M^3)	8-hr TWA (mg/M^3)	Time (min)	Sample (mg/M^3)	8-hr TWA (mg/M^3)
Sprayer in Spider	245	0 29	0 15	-	-	-
Scraper in Spider	-	-	-	396	0 16	0 10
Ground Help	222	0 23	0 10	283	0 32	0 19
Ground Help	241	0 21	0 10	162	0 67	0 23
Ground Help	-	-	-	228	0 66	0 31

CONCLUSIONS

These results indicate that exposures to lead and alkaline dust were well below the OSHA PELs of 50 $\mu g/m^3$ for lead and 2 mg/m^3 for sodium hydroxide during application of the stripping agent and wet removal of the decomposed paint Unfortunately, the NIOSH research team was unable to observe the completion of the work It may be assumed that brush-off blasting of the tank would have produced some lead exposure because areas of lead primer and top coat that had not been removed by the caustic stripping were observed on the tank Cleanup of equipment and dismantling and removal of the tarp are other potential sources of lead exposure to the employees which were not documented

It is impossible to surmise what these exposures would be Therefore, the results of this study must be labelled inconclusive

At a subsequent survey of a highway bridge renovation, the same caustic stripper was used to remove the bulk of the lead-based paint, and abrasive blasting with coal slag was used to complete the removal During application of the stripper and removal of the decomposed paint by scraping and rinsing, airborne concentrations of lead and caustic were well below the OSHA PELs During blasting, lead concentrations in the 5000 $\mu g/m^3$ range (100 times the PEL), were measured by personal sampling Caustic concentrations were well below the PEL where rinsing and scraping were done, but marginally above the PEL in zones where the decomposed paint was not rinsed before blasting This work was performed in a containment using 85 percent screening on the outside of the bridge and solid flooring suspended about 4 feet below the bridge girders Because the blasting was performed under the bridge between the girders and bulkheads, the airborne debris during blasting was confined in volumes much smaller than the overall containment structure, thereby increasing exposure to the blasters The concentration of lead in the bridge coating was 24 percent by weight, much greater than the 1 percent to 6 percent found on the tank

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