INDUSTRIAL HYGIENE REPORT

COMPREHENSIVE SURVEY OF WOOD PRESERVATIVE TREATMENT FACILITY

AT

INTERNATIONAL PAPER COMPANY

Wiggins, Mississippi

Survey Conducted by

Stewart-Todd Associates, Incorporated
Wayne, Pennsylvania

August 26 & 27, 1980

Contract No. 210-78-0060

Report written by

Alan S. Todd

Report No. 110.22.

Report Date
January 5, 1980

Industrial Hygiene Section
Industrywide Studies Branch
Division of Surveillance, Hazard Evaluations, and Field Studies
National Institute of Occupational Safety and Health
Cincinnati, Ohio

CONTENTS

PURPOSE OF SURVEY:	This walk through survey was conducted as a part of the Phase III study of the INDUSTRIAL HYGIENE ASSESSMENT OF NEW AGENTS - III, NIOSH Contract No. 210-78-0060. Specifically, this survey was for the first agent which includes all wood preserving chemicals. This facility was selected on the criteria set forth in the Study Proposal based on information gathered in PHASE I.
EMPLOYER REPRESENTATIVE CONTACTED:	Ras Davis, Plant Manager William Fiveash, Plant Supervisor (601) 928-3510 Jack Peng, Regional Industrial Hygienist International Paper Mobile, Alabama (205) 476-8010
EMPLOYEE REPRESENTATIVE CONTACTED:	Hershall Ladner United Paper Workers International
ACKNOWLEDGEMENTS:	James L. Oser, NIOSH Harry Gee EAL Environmental Laboratories
STANDARD INDUSTRIAL CLASSIFICATION OF PLANT:	SIC #2491 Wood Preserving

ABSTRACT

A combined preliminary and comprehensive survey was conducted at the International Paper, Wiggins, Mississippi Wood treatment plant as partial fulfillment of obligations to NIOSH under Contract No. 210-78-0060, "Industrial Hygiene Assessment of New Agents III". The field survey was done on August 26 - 27, 1980, both to provide familiarization with current and past methods, and document and quantify routine exposure risk to the treatment chemicals in use. This plant was selected as representative of a large southern wood treating facility with a diversity of pressure treatment systems including the Koppers Company Cellon PCP process. Employee training, work practices, and general occupational educational efforts were reveiwed along with data on process methods and exposure experience.

Personal monitoring was done during the critical exposure periods of concern for those job catergories where routine exposure may occur. The results of the air sampling indicate low airborne concentrations of both PCP and Creosote. The two PCP treatment methods did not result in significantly different concentration levels, even though the time interval for loading and unloading the Cellon Cylinder was generally longer because of tram car wheel lubrication problems.

Creosote airborne levels were low and correlation between the Coal Tar Pitch Volatiles (CTPV) gravimetric method and follow-up analysis by Ultra-violet absorption was poor. Only the second analysis method yielded data consistent with field observations and previous experience. A comparison of the NIOSH PCP sampling method versus the DOW procedure done by area sampling showed levels below the limit of detection by the NIOSH impinger technique. Both methods indicate low air concentrations downwind of the treatment cylinders.

INTRODUCTION

Stewart-Todd Associates, Inc, under NIOSH Contract No. 210-78-0060, "Industrial Hygiene Assessment of New Agents III", conducted a comprehensive field survey of the International Paper Company, Wiggins, Mississippi, wood treatment plant on August 26 and 27, 1980. This plant processes poles, posts, piling, and to a lesser extent, dimension lumber by three pressure treatment processes.

It was selected as representative of a large souther treatment facility with multiple treatment chemicals and processes and specifically, because it uses PCP in the Cellon Process licensed by the Koppers Company. The purpose of the initial phase of the survey was to provide familiarization with current and past process methods and known or potential exposure experience as a function of task or job description. The comprehensive survey sampling strategy was pre-determined but modified to sit conditions and experience. The information obtained through this research effort may be utilized in technical reports of the wood preservative industry.

DESCRIPTION OF THE FACILITY

The wood treatment plant at Wiggins, Mississippi is wholly owned by International Paper Company. The treatment facilities were constructed in 1970 on the present site of just over sixty (60) acres of land. In addition to the administrative offices and treatment building, there is a quality control laboratory, foreman's offices, and drying kilns. Most of the remaining equipment, tanks and cylinders are outside the general wood treatment area. The conventional PCP and creosote pressure cylinders are adjacent to the treatment plant control room along with their bulk mixing and storage tanks. The Cellon PCP process equipment is separate from the other cylinders.

Most of the sixty acres are utilized for limited preparation of wood to be treated, kiln or air drying, and storage of untreated wood. A majority of the plant work force is involved with raw material and finish product transfer and do not have direct exposure to the treatment chemicals. In the wood treating area, there is one basic control room for all three cylinders and processes. The same operators, train crews, and support personnel handle wood for treatment.

The pressure cylinders, storage and mixing tanks, bulk chemical unloading and water treatment facilities are all out-of-doors adjacent to or nearby the treating plant control building. All three treatment cylinders are eight feet in diameter and have hydraulically operated doors. The PCP oil treatment and creosote cylinders adjacent to each other are both ninety-three feet in length. The cylinder dedicated to the PCP Cellon process is 144 feet long. It is separated by a distance of 245 feet from the other two. Adjacent to the cylinder are its tanks for butane, penta solvent and nitrogen. Conventional tram cars are used to move the wood in and out of the pressure cylinders. Locomotives on switching tracks are used to move the loaded tram cars with assistance from other vehicles as needed.

DESCRIPTION OF WORK FORCE

The plant presently has eighty-three full-time employees. Summer help consists of a few college students as production demands permit. There are sixty-nine employees in the wood production and treating process areas. Included in the above are four foremen, one lab technician, and three pole selectors. The remainder of the plant work force are administrative or work in other areas.

The hourly employees are represented by the United Paper Workers International Union. With the exception of the wood treating area, most of the plant employees work on a single shift, five days per week. There is one treatment operator, a trainman and his helper on each shift, who have daily potential direct exposure to both treatment chemicals during the loading or unloading of cylinders. Other personnel operating equipment, who occasionally assist in unloading and/or when transferring treated wood for shipment, have less frequent exposure to airborne or contacted material. Other tasks where exposure may occur, but less frequently, include pump maintenance or leak correction and cylinder entry to remove sludge and/or tram cars with broken cables, etc. The latter are unique situations where the cylinders must be cooled down to permit entry. The remainder of the production force does not work directly with the wood preservatives. There are no females currently in the yard crew, working directly with the preservations.

DESCRIPTION OF PROCESS

Raw logs are selected from company owned timber or purchased as pole stock for utilities or piling. Peeling is followed usually by stacking for limited time periods and kiln drying to the required moisture content for treating purposes.

Most of the timber is southern soft woods, including long leaf, slash and loblolly pines. Dimension lumber is treated to a limited extent on request. Poles and pilings are predominantly forty-five feet or less in length. Most pole and piling wood is stored for limited time periods prior to peeling and drying except during the colder winter months. All wood for treatment is pre-dried to the desired moisture content since boultonizing and other elevated temperature processing methods are not utilized.

Limited steaming of green charges is occasionally done to condition poles and piles so that the wood will accept the preservative. The PCP and the creosote processes are done at 150°and 200°F, respectively and 180 pounds of pressure for good penetration.

Higher concentrations of PCP, up to ten percent in No. 2 diesel oil, are utilized. This reduces quantity of oil solvent needed to carry the treatment chemical into the wood. PCP in flaked form, is supplies from two sources in bulk truck loads. It is mechanically conveyed to a storage site, then to an elevated bin for feed to oil mix tanks as needed.

All oil PCP treated poles are given a final vacuum treatment after draining the cylinder to remove PCP oil solution from the wood surface.

The creosote treating, primarily of piling, is done on a nine hour cycle. The material is received from several sources by tank truck and used directly without dilution or additions. Residual creosotes on poles and piling is minimized by a final vacuum treatment after draining the chemical from the pressure cylinder.

The Cellon Process,which is licensed from the Koppers Company, was installed with their guidance in a separate but adjacent area. This cylinder is primarily used to treat light standards or utility poles where a cleaner surface is desired. In contract to the typical PCP oil process, a propriety solvent mixture is used in place of P-9 or diesel oil. The treatment application of 5% PCP is done at 150^{0}F and 125^{0}- 130 pounds pressure. The treatment cycle time is typically longer than conventional PCP oil processing.

DESCRIPTION OF PAST EXPOSURES

This treatment plant, though relatively new, has been surveyed in more recent years by either regional or corporate staff. There is no staff or equipment on site for industrial hygiene surveys because of the plant size. Previous industrial hygiene survey work has included monitoring for PCP, creosote, total hydrocarbons, diisopropyl ether, and benzene and toluene from diesel oil. Wipe tests have also been done to determine treatment chemical residues on the wood. Analytical and other consulting support was provided by Clayton Associates of Southfield, Michigan on a request basis. The insurance carriers have also been utilized for safety training and guidance. Process assistance for the Cellon treatment is provided by the Koppers Company. There has not been any OSHA or state industrial hygiene surveys conducted at the plant. The company data as dicussed, generally indicated low average exposure to both treatment chemicals. Medical experience reported in the past two years has been limited to a splinter, back, an injury during drilling.

Essentially, processing methods, work practices, and controls to minimize employee exposures to the treatment chemicals, have remained unchanged since the early 1970's. Subjectively, the operators indicate temporary respiratory irritation while working downwind of the open cylinder doors or recharging with wood for treatment.

DESCRIPTION OF MEDICAL, INDUSTRIAL HYGIENE AND SAFETY PROGRAMS

The plant currently has a limited formalized medical program. A local general practitioner, conducts pre-employment examinations which include back x-rays, hearing and visual acuity tests, in addition to general health status. Pulmonary function and specific blood or urinalysis tests are not done either initially or on a periodic basis. The physician also responds to emergency calls if needed. There is a full-time nurse at the plant during the day shift and first-aid trained foremen at the treatment plant during the evening and night shift.

On site safety supervision is provided by the head of employee relations who works with the plant safety committee. Training sessions for employees are conducted with support from the management advisory committee. The last lost-time accident in the plant occurred in March, 1978. Hard hats are required throughout the entire plant. Gloves and goggles are provided in the treatment plant for use when opening doors, loading cylinders, and when working on pumps, etc., where exposure and/or contact might occur. Disposable protective clothing is provided for cylinder entry when desludging or retrieving wood or tram cars. Half-face 3-M Company organic and particulate respirators are used when entering cylinders or cleaning up spills and other infrequent tasks of short duration.

Most plant employees use the lunchroom facilities or eat outside away from the treating area. Some eating is done in the treatment building by the operators because the continuous processing requires some direct control. The treating room is considered by the company to be protected from outside fumes. There are shower facilities in the plant, but no designated change room.

PLANT SURVEY METHODS

An initial familiarization with process and equipment locations and treatment cycles was done following preliminary discussions and queries of the plant management and others. A description of the process flow and equipment, along with details on any new additions, work practices and exposure experience were provided by plant supervisors and staff on site. Information on the Cellon process was presented by the representative from Koppers Company.

The initial sampling strategy was outlined to permit parallel sampling by corporate personnel if so desired. A combination of short- and long-term personal monitoring of the treatment plant operator and the train switchman who assists, was done to quantify peak and average exposures to both creosote and PCP. Since PCP treatment predominates, all of the long-term sampling of four to eight hours duration was limited to this material. Creosote exposures were only sampled during the opening and refilling of the single pressure cylinder. Duplicate area samples were taken approximately fifty to sixty feet downwind of the oil PCP cylinder to provide an index of general airborne levels in the treatment area and compare the NIOSH

impinger and Dow silica gel sampling methods. Bulk samples of the treatment materials were taken for use as analytical standards.

All air sampling was done with Bendix BDX Model 41 pumps pre- and post-calibrated with a Model 302 Universal Calibrator. Air flows of approximately 0.5 - 0.8 liters per minute, were utilized for PCP and 2 liters per minute for creosote. Sample analysis was done by LFE Laboratories, Richmond, California. They are certified by NIOSH-AIHA and participate in the continuing proficiency testing program (PAT). In addition, they are experienced in air sample analysis of all the wood treatment materials.

The sampling train for the NIOSH PCP impinger method included an AA 0.8 micron pre-filter in a 3-piece cassette connected in series with a midget bubbler containing 15 ml of ethylene glycol. A second empty bubbler was utilized as a trap to protect the sampling pump from solvent splash-over or condensation. At the completion of sampling, the AA filter was removed from the cassette and added to the bubbler to preclude sublimation of the PCP. The sample was analyzed by the NIOSH S-297 method which entails high pressure liquid chroma-

tographic separation followed by a UV absorption to quantify concentration. The lower limit of detection by this method is 5 micrograms per sample.

Personal breathing zone (BZ) sampling for PCP was done with large silica gel tubes (520/260) for analysis by a modification of the Dow method. The silica gel tubes and fiberglass plugs were desorbed with methylene chloride derivitized and analyzed by gas chromatography using a flame ionization detector. The lower limit of detection by this method is 0.01 µg of PCP per sample.

Airborne creosote was collected on 0.8 micron silver membrane filters in three-piece cassettes covered with aluminum foil to preclude degradation of the high molecular weight aromatics by direct sunlight. Creosote samples were initially extracted and gravimetrically analyzed for Cyclohexane solubles or coal tar pitch volatiles (CTPV) by the NIOSH P & CAM 217 method. Duplicate 1 ml aliquots of the 5 ml of solvent extract were analyzed for total creosote by ultraviolet (UV) absorption at 252 nanometers on a Beckman DU Spectrophotometer. A bulk sample of the creosote from the plant was used in preparing the UV absorption calibration curves. The lower limits of analytical detection by the two

methods are 5 µg per aliquot for the NIOSH gravimetric determination and 0.2 µg by UV absorption method.

RESULTS AND DISCUSSION

A total of 12 personal and 2 area samples were taken for PCP at both the PCP oil and cellon processes. Four personal short-term breathing zone samples were taken for creosote while unloading and refilling the cylinder. The results are summarized below; detailed data is appended.

PCP Air Concentrations - µg/m^3

	PCP-oil long & short-term sampling	PCP Cellon short-term sampling	Both Processes long-term sampling
Treater	22.8 - 42 min.	12.6 - 64 min.	10.1 - 462 min.
Switchman	16.7 - 43 min.	72.3 - 64 min.	18.6 - 373 min.
Treater	19.5 - 255 min.	142.1 - 54 min.	
Switchman	19.3 - 278 min.	197.2 - 54 min.	
Treater	12.6 - 34 min.		
Switchman	25.9 - 34 min.		

Area Sampling 50-60 feet
Downwind of Oil/PCP $\mu g/m^3$
cylinder

Dow Method	7.0	362 min.
NIOSH Method	<17.5	362 min.

Creosote Air Concentrations
in mg/m^3

	NIOSH Gravimetric Method	UV Absorption Method
Treater (22 min.)	0.110	0.120
Switchman (25 min.)	0.352	0.013
Treater (57 min.)	0.227	<0.002
Switchman (57 min.)	0.045	0.019

The data from monitoring both short-term peak and average exposures to PCP indicates that levels are well below the current occupational limits of 500 $\mu g/m^3$. The highest exposures occurred during one of the Cellon process opening and re-charging cycles, which generally takes longer because of tram car wheel lubrication problems which occur as a result of the solvents in use. In this instance, however, the peak exposure was less than forty percent of the current time-weighted average standard and about thirteen percent less of the short-term exposure limits. Since this cylinder has a long cycle and is in less frequent use, we anticipate it will affect total average exposures, but it probably would not more than double the average eight-hour exposure during any single shift.

In general, it appears that average PCP exposures over the full shift would range from 10 - 25 $\mu g/m^3$ except in unique spill situations and/or when cylinder entry is done for cleaning and repairs, or while retrieving tram cars or treated wood. Other potential sources of exposure occur when replacing door gaskets damaged by poles projecting from tram cars. This type exposure can be essentially eliminated by using door mounted gaskets instead of the cylinder gasket type.

The creosote data which is limited to periods of cylinder opening generally shows significantly different results by the two analytical methods. The gravimetric method indicates two of four exposures of concern while the UV absorption data shows far lower airborne concentrations. Previous work by two independent laboratories indicate a poor correlation between these two methods when given prepared standards for analysis. Satisfactory linear results were only obtained using the UV method of quantifying Creosote. Previous field work with the CTPV gravimetric method indicates wide variability at or below the current occupational limits of 0.2 mg/m^3. The reliability is even more questionable when sampling for intermittent non-continuous exposures. The UV data, however, is acceptable because of the greater analytical sensitivity and linearity at or below the OSHA limit of 0.2 mg/m^3. Summarily, the limited short term exposure data does not suggest excessive exposure from the more routine tasks with creosote. Again, pump leak repairs, spill cleanup or cylinder entry might dramatically affect exposure risk but if respirators are used, then these infrequent events should not affect the overall exposures which appear to be well below current OSHA limits.

RECOMMENDATIONS

While airborne exposures were all well within the current recommended limits, the sustained exposure period due to tram wheel lubrication at the Cellon process could be shortened to further reduce this source of airborne exposure. Additionally, precluding the occasional door gasket damage at the other two cylinders,as already discussed, would further reduce exposures. The monitoring data does not reflect potential exposure from skin contact. While employee personal hygiene generally appears good, a change room and the use of coveralls, or similar work uniforms, with on site change facilities, is recommended to minimize skin contact and adsorption from soiled clothing. It is also preferable to clean PCP and creosote soiled clothing at commerical laundries, rather than at home, where further skin contact or non-occupational exposure to wives, might occur.

SAMPLE DESCRIPTION	PUMP# SAMPLE#	SAMPLING TIME (min)	FLOW RATE TOTAL AIR VOLUME	COMPONENT	CONCENTRATION µg	CONCENTRATION µg/m³
8/26/80						
PCP-oil Switchmen	BDX-89 IP-01	1:14-1:57 43 min.	0.559 lpm 0.024 m³	PCP	0.401	16.7
PCP-oil treator operator	BDX-60 IP-02	1:16-1:58 42 min.	0.609 lpm 0.026 m³	PCP	0.592	22.8
Area sample - 50-60 feet downwind - adjacent to pole pile.	BDX-58 Bubbler & filter IP-03	1:18-7:20 362 min.	0.787 lpm 0.285 m³	PCP	<5	<17.5
PCP-oil Area sample- 50-60 feet downwind - adjacent to pole with silica gel.	BDX-103 IP-04	1:18-7:20 362 min.	0.598 lpm 0.216 m³	PCP	1.510	7.0
PCP-Oil Switchman	BDX-89 IP-05	7:05-11:43 278 min.	0.559 lpm 0.155 m³	PCP	2.989	19.3
PCP-Oil Treater	BDX-60 IP-06	7:07-11:22 255 min.	0.609 lpm 0.155 m³	PCP	3.019	19.5

SAMPLE DESCRIPTION	PUMP# SAMPLE#	SAMPLING TIME (min)	FLOW RATE TOTAL AIR VOLUME	COMPONENT	CONCENTRATION µg	CONCENTRATION µg/m³
8/26/80						
Creosote				Creosote		
Switchman	BDX-99 IP-07	6:16-6:41 25 min.	2.272 lpm 0.057 m³	grav. UV	20 0.75	0.35 0.013
Creosote treater -	BDX-218 IP-08	6:18-6:40 22 min.	2.075 lpm 0.046 m³	Creosote grav. UV	<5 5.5	<0.11 0.12
Cellon PCP Switchman	BDX-83 IP-09	11:47-2:51 64 min.	0.554 lpm 0.035 m³	PCP	2.532	72.3
Cellon PCP 427-19-2685	BDX-66 IP-10	11:48-12:52 64 min.	0.674 lpm 0.043 m³	PCP	0.543	12.6
PCP Oil & Cellon Treater	BDX-33 IP-11	11:48-7:30 462 min.	0.549 lpm 0.254 m³	PCP	2.577	10.1
PCP - oil & cellon	BDX-137 IP-12	11:57 - 7:30 373 min.	0.704 0.263 m³	PCP	4.904	18.6

Wood Treatment Plant

SAMPLE DESCRIPTION	PUMP# SAMPLE#	SAMPLING TIME (min)	FLOW RATE TOTAL AIR VOLUME	COMPONENT	CONCENTRATION µg	CONCENTRATION µg/m³
8/27/80						
Creosote creosote operator - switchman	BDX-143 IP-13	10:15-11:12 57 min.	1.945 lpm 0.111 m^3	Creosote Grav. UV	<5 2.1	0.045 mg/m^3 0.019 mg/m^3
Creosote treater	BDX-116 IP-14	10:15-11:12 57 min.	1.929 lpm 0.110 m^3	Creosote Grav. UV	25 <0.20	0.227 mg/m^3 <0.002 mg/m^3
PCP Oil treater	BDX-83 IP-15	1:17-1:51 34 min.	0.554 lpm 0.019 m^3	PCP	0.239	12.6
PCP - Oil switchman	BDX-103 IP-16	1:15-1:49 34 min.	0.598 lpm 0.020 m^3	PCP	0.518	25.9
PCP-Cellon Treater	BDX-83 IP-17	2:16-3:10 54 min.	0.554 lpm 0.030 m^3	PCP	4.262	142.1
Switchman	BDX-103 IP-18	2:16-3:10 54 min.	0.598 lpm 0.032 m^3	PCP	6.312	197.2
Bulk Sample	IP-19-80	Blank silica gel sample			0.008	