

INDUSTRIAL HYGIENE REPORT
COMPREHENSIVE SURVEY OF WOOD PRESERVATIVE
TREATMENT FACILITY

SANTA FE CENTRALIZED TIE PLANT
Somerville, Texas

Survey Conducted by
Stewart-Todd Associates, Incorporated

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Report written by

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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 group which includes all agents used in wood preserving. This facility was selected on the criteria set forth in the Study Proposal based on information gathered in Phase I.

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STANDARD INDUSTRIAL
CLASSIFICATION OF PLANT:

SIC #2491
Wood Preserving

ABSTRACT

The comprehensive survey of the Santa Fe Railway Company, Somerville, Texas, wood treatment plant was done as partial fulfillment of obligations to the National Institute for Occupational Safety and Health under Contract No. 210-78-0060, "Industrial Hygiene Assessment of New Agents - III." The original field site visit of October 10, 1979 provided familiarization with current and past process methods and materials used for treating railroad ties. Existing control procedures and work practices used to reduce exposures in the treating plant were observed. Employee training efforts and historic exposure data were reviewed along with descriptive information on safety and health programs. Range finding general air sampling was conducted in the treatment building during regular operations to evaluate potential maximum employee exposures. Due to the significant cyclohexane extractable blank filter value, valid air concentrations could not be determined from the preliminary survey.

The comprehensive field survey of the plant was conducted on October 6 and 7, 1980 to determine actual occupational exposures under typical operating conditions. Both short-term

and long-term sampling was done to determine time weighted average and peak exposure levels. Of the 18 breathing zone samples taken on the treaters, switchman and locomotive crew, three (3) samples, two long and one short exceeded the current occupational limit of 0.2 mg/m^3 established for coal tar pitch volatiles. The reason for the short-term high exposure is unknown since wind and process factors did not appear to indicate unusual conditions. TWA exposures, however, meet current limits on all other samples.

INTRODUCTION

Stewart-Todd Associates, Incorporated, under NIOSH Contract No. 210-78-0060, "Industrial Hygiene Assessment of New Agents - III", conducted a comprehensive industrial hygiene survey at the Centralized Tie Treatment plant of the Santa Fe Railway Company, Somerville, Texas on October 6 and 7, 1980. A preliminary survey was conducted in October, 1979. The plant purchases and processes mixed hardwoods and conifers for treatment as railroad ties, bridge timbers, and miscellaneous or other specialty items, using Creosote and Chromated Copper Arsenate (CCA) pressure treatment systems. It was selected on the basis of size, geographical location and process materials as representative of a large Southwestern United States creosote pressure treating facility.

The purpose of the comprehensive survey was to document and evaluate employee exposures and factors affecting them as a function of process methods, materials used, work practices, and controls. The information obtained through this research effort will be utilized in technical reports on the wood preservative industry.

DESCRIPTION OF FACILITY

The creosote treatment plant was originally built in 1896 at another location. In 1905 the Santa Fe Railway Company purchased the facility and moved it to the present site in Somerville, Texas. The plant has 115 acres fully utilized for material loading and unloading, processing, treatment and yard storage.

Creosote pressure-treated cross ties account for 80-85% of the current production. Bridge timbers, which are the plant's other major product, make up most of the remaining 15-20% of the present annual wood treatment. Railroad sign posts and similar items are treated with CCA onsite.

All treated wood is for the exclusive use of the Santa Fe Railroad. Petroleum oil/creosote solutions of 70/30 and 50/50 are used respectively to treat the cross ties and bridge timbers. CCA is used to a limited extent to treat sign base material and other specialty items. Southern yellow Pine, mixed hardwoods and Oak are the predominate wood species treated for railroad ties and bridge timbers. The plant processes approximately 1,500,000 ties annually and 4,000,000 additional board feet of bridge timbers.

Originally, 3 cylinders, 8' x 124' were used for creosote treatment. In 1974, the treating and unloading facilities were renovated and rebuilt and the 124' cylinders were replaced with 8' x 155' units with hydraulically operated doors. The butt ends of the cylinders, some pumps and valves are enclosed in the treatment building.

A 6' x 132' CCA treatment cylinder was installed in 1973. Prior to that time a small experimental 27 foot cylinder was utilized. The CCA treatment and storage areas are separate from the creosote treating building and cylinders. The company may convert this cylinder to creosote in the future.

DESCRIPTION OF WORKFORCE

The plant presently employs 158 people; there are 8 supervisors, 8 office personnel, and 4 treating engineers. The remaining employees are production workers and yard personnel. Creosote treatment is conducted on all three shifts, 6 days per week, with treating operators round the clock. CCA treating is only done occasionally, i.e., approximately once per month. It requires one treating operator only on the day shift. The locomotive crew, which has three employees per shift, fills and

unloads the treating cylinders. All other personnel in the plant are involved in wood preparation, i.e., sawing, boring, inspecting, loading, or material storage and shipment. These operations are generally done on day shift, with a limited loading crew on the second shift.

The treating process and equipment were automated when the facility was rebuilt in 1974. The treating engineer's duties are generally limited to operating the cylinder control panels, checking pressure gauges, temperature conditions, and transferring creosote solutions. Most of his tasks are conducted in the treatment building. One mechanic is assigned to the treating area on each shift and he is responsible for leak correction and pump repairs or adjustments. The treating engineer also assists in some maintenance tasks. Clean-up of spills, leaks or contaminated soil are generally done by the yard labor crew.

The hourly plant employees are represented by the Brotherhood of Railway and Airline Clerks Union.

DESCRIPTION OF PROCESS

Cross ties cut to dimension are purchased from commercial producers and shipped to the plant by rail. They are either unloaded manually or by using Drott equipment which picks up 6-8 ties at one time. The ties are moved to a counting, sizing, and inspection station from which they are routed to one of two boring and cutting mills. The older, 1934 Greenley Boring machine is still in use. The more recent automated mill trims the ends, bores, and brands the ties and mechanically loads them onto tram cars. The locomotive crew moves these from either mill to the treating area for process drying and creosote treatment or to be stored in the yard area for a 7-13 month air seasoning period. Only when there is not sufficient cylinder capacity for vapor drying are the ties stored for air seasoning to approximately 15% moisture. When air seasoning is done, treatment may require only five hours.

Bridge timbers, panel crossings and other specialty items are processed in the sawmill which consists of several small buildings. In some cases, the machinery is either outside or only partially enclosed. An incisor is used for bridge timbers but is done only about three days per month.

Since 1953, a petroleum naphtha vapor-dry process has been utilized to condition unseasoned wood prior to creosote treatment. This eliminates where possible, the 7-13 month storage and air-drying period. Tram cars of ties or timbers usually on-site 60 days or less, are loaded into a cylinder and a low aromatic petroleum naphtha is added. The cylinder temperature is increased to 270 - 350⁰ F. which results in the naphtha vaporizing and extracting the excess moisture from the wood. This process requires about 14 hours after which a vacuum is applied for approximately another 2 hours to remove the wood sap, water, and remaining solvent. The solvent and water solutions are then gravity separated and the naphtha is recycled for further vapor-dry processing. The residual sap and water is neutralized and used in the boilers. The vapor-drying and subsequent pressure treatment processing with creosote typically require a total of 23 hours. A vacuum is applied at the end of the treatment cycle to remove excess creosote solution. The treating engineer then notifies the locomotive crew that the treatment cycle is completed since they are responsible for opening the cylinder door, removing the tram cars, and re-loading the new wood for treatment. The entire task of unloading and reloading typically requires approximately 20 minutes. There are 16-19 tram cars per charge which carry approximately 3600 cubic feet of lumber. The number of tram cars depends on the size of the ties being treated.

The CCA pressure cylinder is used about one day per month. The control room and solution preparation area were installed as a package unit from Osmose Corporation. The cylinder, however, was purchased separately. Sign base material and other specialty items are air-dried and then treated for 4-6 hours with CCA. This cylinder may be converted to creosote use in the near future.

Creosote, #1 Grade, is purchased from Koppers, Great Lakes Carbon, or Witco Chemical in bulk tank trucks for transfer to storage, on-site. It is blended, as needed, with petroleum oil (#5 or #6 fuel oil) in a closed system mix tank. The diluent oil is shipped by tank car from either Continental Oil or Kerr McGee Corporation.

CCA concentrate in paste form is received in 200 lb. drums from Sweden, through Taco, Inc., which is an American distributor located in South Carolina. CCA solution is prepared by inverting a can over a flush tank where the water is sprayed into the can dissolving the paste. The resulting solution is pumped to a work tank where it is diluted to 2% for use at the plant.

Storm water run-off and any drainage from the processing cylinders are pumped to a clean-up cylinder which is 6' x 132' where the water and contaminants are separated. The oil is re-utilized in the process. The remaining water and the blowdown from the boilers goes to the aeration treatment pond. Run-off from the CCA cylinder is pumped from the pit and re-cycled to the work tank.

DESCRIPTION OF PAST EXPOSURES

Water quality testing and ambient air monitoring has been conducted at the plant by the state EPA or a similar agency. No previous employee exposure monitoring had been done by either plant management or government organizations prior to the preliminary survey of 1979. OSHA conducted studies at the plant on May 30, 1980. They monitored the treatment operator, locomotive crew, and yard crew exposed to creosote fumes. All CTPV results, based on benzene extractions, were below the limits of detection. They also analyzed for 6 PNA's by fluorescence.

The plant has purchased a sound level meter for determining noise levels and sources; particularly, in the processing area. Ear muffs or plugs are available for production employees working in the old boring mill or at other excessively noisy equipment and work stations. The operator of the automated boring station works in an enclosure where sound-insulating has been done. According to plant management, most employees do not typically work in high-noise areas for sufficient time periods to be overexposed. They also indicate that significant exposure problems resulting from the treatment chemicals does not occur. Most lost-time reported accidents are typically related to finger and hand injuries.

DESCRIPTION OF MEDICAL, INDUSTRIAL HYGIENE AND SAFETY PROGRAMS

The Santa Fe Tie Plant has a formal medical surveillance program established by the parent Railway Company. Pre-employment physical examinations are required for all new employees and periodic examinations are provided by the company to employees on a voluntary basis. A majority of the employees participate in this program. Pre-employment medical examinations and emergency services or other routine treatment is provided by Dr. G.V. Pazdral of Somerville,

Texas. All periodic examinations, which include complete physicals with pulmonary function, blood tests, and chest x-rays are done at the Santa Fe Hospital in Temple, Texas. There is no licensed nurse at the plant. However, twelve (12) employees are trained in CPR and eighteen (18) employees are certified by the Red Cross in first aid. These training classes are usually conducted at the plant.

The Santa Fe Railway Company, through the Corporate offices in Chicago, provides basic safety and health guidance for this plant. Mr. Sam Barkley, Plant Manager, is also the Safety and Health Coordinator. He conducts formal safety meetings with employees and supervisors on a monthly basis and questions on problems concerning safety or health are presented and discussed. Foremen also hold weekly safety meetings with workers to discuss safety problems and review work practices and rules. The Company issues a book of Safety Rules to all employees which they are formally required to read. It pertains to all phases of the railroad industry. The industrial hygienist on staff is new to the company and has not yet conducted field surveys at the plant.

Hardhats and Safety glasses are required for all employees throughout the plant. Safety shoes are required for new employees with the company paying part of the cost.

Safety shoes are required in the plant areas. New lunch-room facilities were recently built, one at the treatment end and the other at the processing end of the plant. Many of the dayshift employees go home for lunch. All other shifts take one-half hour breaks for meal time. The employees provide their own work clothing. Shower and change room facilities are available, but their use is a matter of personal preference. No respiratory protection is used during cylinder entry when cleaning, or dislodging jammed tram cars of material. Typically, the cylinder is aired out for a day or two prior to entry for cleaning purposes. Since the plant was rebuilt in 1974, there have been no incidents requiring an employee to go inside the cylinder except for periodic cleaning.

PLANT SURVEY

The industrial hygiene survey of the treatment facility was conducted following preliminary discussions with plant personnel. Mr. Sam Barkley, Plant Superintendent and Dave Malter from the Corporation Offices, provided the basic

description and assistance as needed for plant access, etc. In addition to process discussions and air sampling, employee work practices and personal hygiene were reviewed. All air monitoring was conducted during creosote treating and movement of treated material in the yard for storage or shipment.

Personal breathing zone air monitoring was conducted on 8 different job categories which have routine or significant exposure periods to creosote. Area sampling was not deemed appropriate for the treating building or adjacent areas because they were very clean and had no obvious signs of recent spills or leaks. The treating engineer spends a significant part of his work day in this area since the control panels, pumps, and gauges for all the creosote cylinders are located inside the building. Cylinder openings were observed and the treater and assisting personnel were monitored. Sampling was also done on the yard crew moving and stocking freshly treated lumber to provide an estimate of these exposures.

DESCRIPTION OF SURVEY METHODS

All air sampling was conducted with Bendix BDx Model 41 sampling pumps, pre- and post-calibrated with a Universal Pump Calibrator, Model 302 and operated at flow rates of 1.3 - 1.8 liters per minute (LPM). The sampling train included an 0.8 micron silver membrane filter with a cellulose back-up pad in a 37 mm, 3-piece closed face cassette. The cassettes were covered with aluminum foil to preclude UV light effects on the high molecular weight aromatic compounds. The filters were submitted for analysis by the NIOSH P & CAM #217 method. This entails ultrasonic extraction of the filtered material, with cyclohexane, evaporation of a 1.0 milliliter aliquot, and gravimetric determination of the residue in pre-tared teflon boats. This was followed with a second analysis by ultraviolet absorption (UV) on a Beckman DU spectrophotometer at 252 Nanometers. A bulk sample of the creosote materials from the plant was used for the cyclohexane calibration curve. Previous laboratory data has indicated this provides more reliable data with greater sensitivity than the gravimetric method.

RESULTS AND DISCUSSION

A total of 17 personal short and long-term samples were taken on eight job categories including those who are routinely exposed such as the treater operators, switchmen and locomotive engineer, and those who occasionally work with freshly treated wood including the fork lift and pettybone operators.

The results are summarized below with the detailed sampling results appended.

<u>Job Classification</u>	<u>NIOSH Gravimetric results in mg/m³</u>	<u>UV Absorbance results in mg/m³</u>	<u>Sampling time in min.</u>
Locomotive foreman	0.020	0.008	181
	0.013	0.847	233
	1.668	0.056	22
Locomotive Engineer	0.016	0.003	184
	0.013	0.029	233
	0.159	0.032	36
Switchman Helper	0.017	0.031	185
	0.788	0.053	37
	0.083	0.762	233
Treater	0.057	0.002	371
	0.022	0.006	478
	0.007	0.006	475
	0.016	0.002	389
Pettybone operator	0.010	0.004	303
Checker and Fork-lift operator	0.010	1.211	301
	0.020	0.016	360
Tie lining operator	0.060	0.016	298

The data generally indicate low routine exposures, however the correlation between the two methods of analysis, gave highly variable results. The high gravimetric results on the short-term samples are readily explained by the analytical limitations of the method. The realistic lower gravimetric limit is 5 μg of weight change which is 25 μg per filter. On sample #109 with a 36 liter sample size, a blank even with proper care could yield a result up to 0.700 mg/m^3 . Therefore the gravimetric results on all air samples of less than an hour including #110 and #111 are subject to question.

Conversely, the analytical sensitivity of the second analysis shows results as anticipated with the exception of three samples, i.e., #106, 108 and 114. Two of these high results occurred during the same night shift during a period of only one cylinder opening. The data is questionable primarily because other personal samples during similar tasks, taken on other shifts showed very low levels of exposure. In addition, nothing unusual occurred during this cylinder opening which would account for the elevated levels. The third exposure of concern on the check fork-lift operator is also difficult to understand since the ties were cooling down and the creosote odor was not readily evident. Other yard crew working in closer proximity to the treated material than this individual, had very low CTPV exposures, i.e., 0.004 - 0.016 mg/m^3 .

The remaining 14 personal samples as previously stated, showed levels varying from 0.002 - 0.056 mg/m³. Statistically, even if all high results are accepted as correct, the average for the 17 NIOSH gravimetric results is 0.175 mg/m³.

The data from UV absorption yields an average of 0.181 mg/m³. If the questionable data is rejected then exposures in most instances would be less than 30% of the current occupational limits.

RECOMMENDATIONS

Most of the data indicates good airborne control of creosote exposures, as would be anticipated in a highly automated plant which had been rebuilt in 1974. Because a few exposures might be excessive, further follow-up field surveys should be done to determine if this was a chance occurrence or the result of wind direction or other process factors, such as spills, cable breaks, etc. To reduce the potential for intermittent high exposures at the face of the cylinder while changing damaged gaskets it is recommended that the gasket be fastened to the door instead of the cylinder. By moving the gasket to the door, the potential for its damage would be minimized and the need for individuals to be in close proximity to the hot cylinder would be reduced.

Work uniforms for those employees in the yard who routinely might contact creosote is suggested to preclude laundering of contaminated clothing in the home. Showering, particularly in warm weather, should be encouraged before leaving the plant. These aspects should become a part of the safety and health training sessions.

SAMPLE DESCRIPTION	PUMP# SAMPLE#	SAMPLING TIME (min)	FLOW RATE		COMPONENT	CONCENTRATION ug	CONCENTRATION mg/m ³
			TOTAL AIR VOLUME				
<u>10/6/80</u>							
<u>8 - 4 Shift</u>							
treatment operator	BDX-66 SAN-103	9:45-3:56 371 min.	1.661 lpm 0.616 m ³		Creosote (grav.) (UV)	35 1	0.057 0.002
locomotive foreman - two cylinder openings	BDX-47 SAN-100	11:35-2:36 181 min.	1.389 lpm 0.251 m ³		Creosote (grav.) (UV)	< 5 2	<0.020 0.008
Switchman/helper - two cylinder openings	BDX-130 SAN-101	11:36-2:41 185 min.	1.592 lpm 0.295 m ³		Creosote (grav.) (UV)	<5 9	<0.017 0.031
locomotive engineer - two cylinder openings	BDX-118 SAN-102	11:37-2:41 184 min.	1.734 lpm 0.319 m ³		Creosote (grav.) (UV)	5 1	0.016 0.002
<u>10/7/80</u>							
<u>8 - 4 shift</u>							
set in cab - operating "Jaws" lift truck - Super 20 Pettibone carry lift.	BDX-118 SAN-113	8:23-1:26 303 min.	1.712 lpm 0.519 m ³		Creosote (grav.) (UV)	<5 2	0.010 0.004
checker and forklift	BDX-130 SAN-114	8:25-1:26 301 min.	1.592 lpm 0.479 m ³		Creosote (grav.) (UV)	< 5 580	0.010 1.211

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SAMPLE DESCRIPTION	PUMP# SAMPLE#	SAMPLING TIME (min)	FLOW RATE		COMPONENT	CONCENTRATION	
			TOTAL AIR VOLUME	µg		mg/m ³	µg
<u>10/7/80</u>							
<u>8 - 4 Shift</u>							
tie lining operator - wears gloves - (pump accidentally shut-off for short period of time)	BDX-66	8:28-1:26	1.688 lpm	30	Creosote (grav.)	0.060	
	SAN-115	298 min.	0.503 m ³	8	Creosote (UV)	0.016	
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BZ - operator #77 Taylor lift - transferring ties that had been treated after 2:30 am.	BDX-47	8:30-2:30	1.389 lpm	10	Creosote (grav.)	0.020	
	SAN-116	360 min.	0.500 m ³	8	Creosote (UV)	0.016	
<hr/>							
SAN-117 Blank							
<hr/>							
<u>10/6/80</u>							
<u>4 - 12 shift</u>							
treatment operator - no open cylinders	BDX-154	3:57-11:55	1.420 lpm	15	Creosote (grav.)	0.022	
	SAN-104	478 min.	0.679 m ³	4	Creosote (UV)	0.006	
<hr/>							
<u>10/6/80</u>							
<u>12 - 8 snift</u>							
treatment operator - opened 3 cylinders	BDX-61	12:00-7:51	1.452 lpm	5	Creosote (grav.)	0.007	
	SAN-105	475 min.	0.690 m ³	4	Creosote (UV)	0.006	

SAMPLE DESCRIPTION	PUMP # SAMPLE #	SAMPLING TIME (min)	FLOW RATE		COMPONENT	CONCENTRATION	
			TOTAL AIR VOLUME	VOLUME		µg	mg/m ³
<u>10/7/80</u>							
<u>12 - 8 Shift</u>							
locomotive foreman	BDX-58 SAN-106	3:50-7:43 233 min.	1.673 lpm 0.390 m ³		Creosote (grav.) (UV)	< 5 330	< 0.013 0.847
locomotive engineer	BDX-116 SAN-107	3:50-7:43 233 min.	1.626 lpm 0.379 m ³		Creosote (grav.) (UV)	5 11	0.013 0.029
operator helper	BDX-128 SAN-108	3:50-7:43 233 min.	1.803 lpm 0.420 m ³		Creosote (grav.) (UV)	35 320	0.023 0.562
<u>10/7/80</u>							
<u>8 - 4 shift</u>							
5-4 treatment operator	BDX-82 SAN-112	7:58-2:27 389 min.	1.622 lpm 0.631 m ³		Creosote (grav.) (UV)	10 10	0.016 0.022
SAN-118 - Bulk sample of 30/70							
locomotive foreman - one cylinder opening	BDX-116 SAN-109	12:28-12:50 22 min.	1.632 lpm 0.036 m ³		Creosote (grav.) (UV)	60 2	1.668 0.556

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SAMPLE DESCRIPTION	PUMP# SAMPLE#	SAMPLING TIME (min)	FLOW RATE		COMPONENT	CONCENTRATION	
			TOTAL AIR VOLUME	1pm m ³		µg	mg/m ³
10/7/80 8 - 4 Shift							
Switchman/helper - one cylinder opening	BDX-61 SAN-111	12:26-1:03 37 min.	1.542	1pm	Creosote (grav.) (UV)	45	0.788
				0.057		m ³	3
Locomotive engineer - one cylinder opening	BDX-58 SAN-110	12:27 - 1:03 36 min.	1.742	1pm	Creosote (grav.) (UV)	10	0.159
				0.063		m ³	2