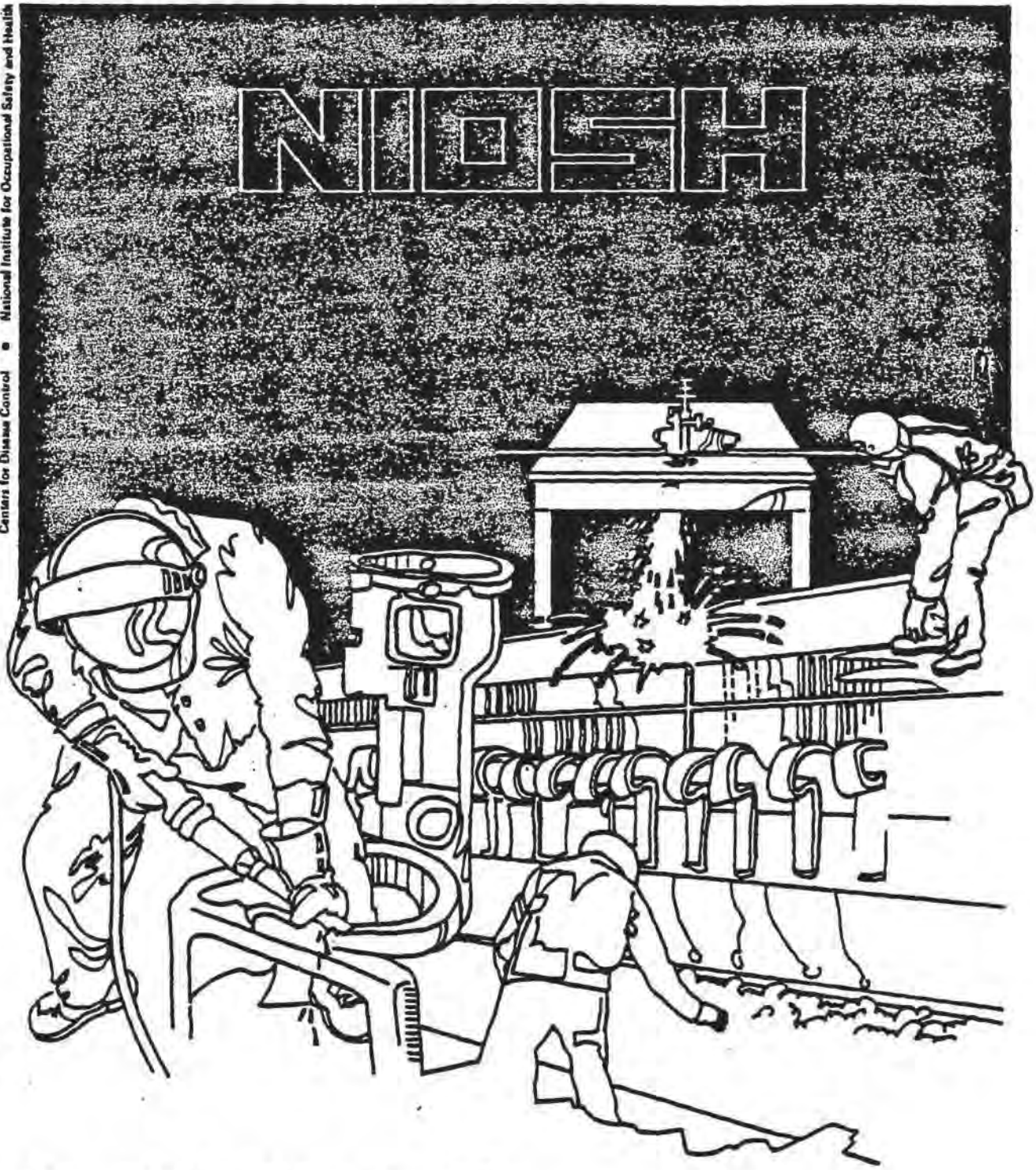
U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES • Public Health Service
Centers for Disease Control • National Institute for Occupational Safety and Health



Health Hazard Evaluation Report

HETA 82-234-1602
BLACK RIVER HARDWOOD COMPANY
KINGSTREE, SOUTH CAROLINA

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 82-234-1602
JUNE 1985
BLACK RIVER HARDWOOD COMPANY
KINGSTREE, SOUTH CAROLINA

NIOSH INVESTIGATORS:
Stanley Salisbury C.I.H.
Jeffrey Lybarger, M.D.

I. SUMMARY

On April 26, 1982, the National Institute for Occupational Safety and Health (NIOSH) received a request from the Black River Hardwood Company, Kingstree, South Carolina, to evaluate a possible excess of cancer occurring among company employees. The owner of the company had expressed concern regarding the number of cancer cases occurring among employees since 1974. In 1974, agricultural chemicals removed from a warehouse destroyed by fire were buried in a field adjacent to the Black River Hardwood Company property. The owner of the company believed these chemicals had contaminated the company's drinking water supply. This investigation reviewed the environmental sampling done by the South Carolina Department of Health and Environmental Control (DHEC) and evaluated the available medical and epidemiological information of the employees.

A retrospective cancer incidence study was conducted to compare illness or mortality rates when different numbers of persons are observed for varying periods of time for the specific outcome. In this study, that outcome was the occurrence of cancer at any tissue site. Standardization of demographic factors were controlled by determining the number of total person-years observed in each age, race, and sex category. Person-years of exposure were calculated for the potential exposure period (1974-1982). The expected number of cancers was then calculated and compared to the actual observed number of cancers found among current or former company employees.

Based on company or vital records, sixteen persons known to have worked at Black River Hardwood since 1974 were found to have died from any cause. Five cancer cases were observed in the workforce vs 4.928 expected; for statistical significance ($p<0.05$), ten or more cancer cases would have been observed.

Although buried chemicals had migrated and contaminated the surface soil near the disposal site, contamination of the company's water supply could not be documented. Based on our analysis of the available information, a hazard of cancer among employees of the Black River Hardwood Company was not documented. The observed number of cancers were equal to the number expected, and no consistent cancer site was observed. The maximum possible latency period was extremely short and not consistent with the natural history of environmentally induced cancers.

KEYWORDS: SIC 2426 (Hardwood Dimension and Flooring Mills), hazardous wastes, cancer, hardwood mills

II. INTRODUCTION

On April 12, 1982, the owner of the Black River Hardwood Company Inc. requested that NIOSH investigate what he thought to be an excess of cancer cases among employees. He was concerned these cases were related to the contamination of the company's drinking water supply from pesticides and other agricultural chemicals buried in an adjoining property site in 1974. On July 26, 1982 NIOSH and DHEC investigators visited the site and provided preliminary findings and recommendations in a report to the owner of the hardwood company on August 2, 1982. To further evaluate the reports of cancer among Black River Hardwood Company employees an epidemiologic evaluation was conducted.

III. BACKGROUND

A warehouse of the Southern Agricultural Chemical Company, Inc. was destroyed by fire on September 21, 1974. This warehouse was reported (according to company records supplied to Williamsburg County and South Carolina State officials) to have contained approximately 125-150 tons of solid pesticides and 2,300-3,000 gallons of liquid pesticides. After the fire, the damaged material was transported and buried in shallow trenches on property immediately east of the Black River Hardwood Company, a saw mill which supplies wood stock for the furniture industry (Figure 1). Drinking water for employees had been supplied from a shallow well. In August, 1981, DHEC began receiving complaints from the owner of the hardwood company stating that the ground water contained chemical odors. At that time, the shallow well was closed and a deep well was drilled adjacent to the old, shallow well. On August 12, 1981, DHEC representatives visited the site. They reported observing a thick, black oil-like substance in the surface soils near the disposal area.

Two environmental evaluations were performed at the site. DHEC agreed to sample the shallow and deep drinking water wells quarterly for "indicator parameters plus pesticides and herbicides" and annually for "a comprehensive analysis . . . covering all drinking water parameters." DHEC collected samples in April 1982, November 1982, April 1983, and August 1983 (Tables 1-4). In no sample was pesticide or heavy metal contamination detected. Volatile organic hydrocarbons were listed as being tested for on the April 1983 report, and were also non-detectable.

A second environmental evaluation was done by Ecology and Environment, Inc. under a contract from the U.S. Environmental Protection Agency (EPA) in December 1981. This evaluation included the sampling of ground water, surface water, and soil at and near the disposal area. Ground water was collected via six sampling wells installed surrounding the disposal site (Figure 1). These wells were drilled by DHEC but no DHEC sampling results from these wells were provided to NIOSH. According to the

hardwood company owner, these test wells were normally dry. Three wells were located between the disposal area and the hardwood company. Two wells were between the disposal area and a borrow pit where fill dirt was previously taken and one well was directly east of the disposal area on the side opposite the hardwood company. The results of this evaluation were that no contamination of the drinking water was detected. However, pesticide residues had been observed percolating to surface soils, solvents were detected in the eastern-most well (the well furthest from the plant), and metal contamination was detected moving laterally away from the disposal site.

IV. EVALUATION DESIGN AND METHODS

1. Initial Site Visit

On July 27, 1982, NIOSH investigators accompanied by an epidemiologist with the Bureau of Disease Control, DHEC visited the disposal site and met with the owner of the Black River Hardwood Company. Investigators observed an oily, jelly-like substance surfacing in a soybean field just west of the disposal area. A small sample of water taken from the shallow well showed no discoloration or detectable chemical odor.

During the initial site visit, NIOSH was unable to properly evaluate potential occupational exposures for company employees because the mill was temporarily shut down as a result of the poor economic conditions in the furniture industry. The owner stated that no chemicals or wood treatment compounds were applied to wood timber before receipt or during processing at the mill. The only potential exposures likely were from hardwood and occasional pine wood dusts, tree sap, and drying kiln emissions.

The only chemical contamination found at the site was the jelly-like substance oozing up in the nearby soybean field. This surface contamination was believed to represent minimal risk for company employees because of its physical distance from the sawmill operations. Because DHEC and EPA had not detected any measurable contamination of the company's drinking water, NIOSH could not establish any direct exposure of employees to toxic chemicals or hazardous wastes.

2. Epidemiologic Investigation

The Black River Hardwood Company provided the NIOSH medical investigator with a listing of all persons employed since 1974, the year of the Southern Agriculture Chemical fire occurred. The available information retained by the company was severely limited. It included only the sex and race of the worker and an approximate age of some workers.

A retrospective cancer incidence study was conducted. This study allowed for comparison of illness or mortality rates when different numbers of persons are observed for varying periods of time for the selected outcome. In this study, that outcome was the occurrence of a cancer at any tissue site. Standardization of demographic factors were controlled by determining the number of total person-years observed in each age, race, and sex category. (A person-year is the observation of one person for one year for the selected outcome. One person observed for 10 years would be identical to 10 persons observed for 1 year, each being 10 person-years.) Person-years of exposure were calculated for the 9 year time period from 1974 through 1982. The expected number of cancers in each age, race, and sex category was calculated as the product of the observed person-years in that category multiplied by an expected rate of cancers for persons with the same age, race, and sex characteristics. The expected number of cancers for each category were then summed to determine the expected number of cancers for the entire work population. The expected number of cancers for the entire work population was then compared to the actual observed number of cancers to determine if the observed number of cancers was greater than the expected number of cancers.

The expected cancer rate for this evaluation was selected using the Surveillance Epidemiology and End Results (SEER) reported cancer incidence. The 1975-77 Atlanta incidence rates were used as the base rate for comparison because it is SEER reporting area geographically closest to South Carolina. The number of cases of all cancers reported for 1975-77 was divided by the total three-year census for persons 20 years and older, to provide an expected rate of all cancers for this workforce (Table 5).

The lack of company information and the mobile workforce population did not allow for adequate tracking of individual workers. The workers were, therefore, considered free of cancer unless they had identified the cancer to the company owner, or died and the presence of the tumor was identified on the employee's death certificate.

The number of observed cancers was compared to the number expected from the Atlanta SEER registry. The only concern addressed by this study would be an excess number of cancers above the number expected as calculated using the Atlanta SEER registry. The 95% confidence level based upon the Poisson distribution was used to measure the statistical significance of excess cancers above the expected number. If the number actually observed was less than the number required for statistical significance, no excess number of cancers would be observed by this evaluation. If the number of observed cancers was greater than the number required for statistical significance, a greater number of cancers would have been observed than could be accounted for by chance alone.

Each cancer was evaluated to determine if a consistent organ site was predominant among the reported cases. The information was collected from death certificates, the patients, or from an attending physician. In only one case was a physician contacted. He was asked to confirm a company reported cancer which did not appear on the employee's death certificate.

Evaluation of the possible latency periods for the 5 cancer cases was attempted. Since the date of cancer diagnosis was not known, the latency period was estimated by calculating the time from 1974 or first employment at the Black River Hardwood Company until satisfactory information was obtained that the patient knew the diagnosis, or until death. This time period was defined as the maximum possible latency period. In performing this calculation, all of 1974 was included in the period, and the year of diagnosis or death was included if that date was after July 1 of that year.

V. EVALUATION RESULTS

The Black River Hardwood Company supplied data, excluding names, for 164 employees are listed in Table 6. Those persons known to be deceased are indicated in the column labeled vital status. Sixteen persons were identified by company or vital records as having died from any cause. Their year of death is indicated on Table 6. The number of person-years at risk to develop a cancer is also listed. As defined by this study, 1066 person-years of observation, where the employees were at risk to develop a cancer, were accumulated by this work force. The person-years, categorized by race and sex, are shown in Table 7 along with the expected cancer rates and number of cancers for each group. The number of expected cancers is the product of the number of person-years and the expected cancer rate.

Five cancer cases were observed in the workforce. The expected number of cancers was 4.928 cases. Using the Poisson distribution (Table 8), with an expected number of 4.928 cases, ten or more observed cancer cases were needed to achieve statistical significance ($p<0.05$). A similar calculation was done for each age-sex group, except black females since no cancers nor person-years of exposure were observed for this population group. For white males (Table 9), 0.619 cancers were expected, and 1 was observed, but 3 or more observed cancers were required for statistical significance. For black males (Table 10), 4.234 cancers were expected, and 3 were observed. Nine or more observed cancers were needed to achieve statistical significance. For white females (Table 11), 0.075 cancers were expected, and 1 was observed, but 2 or more observed cancers were needed to achieve statistical significance.

The organ system of cancer involvement and the maximum possible latency period were evaluated (Table 12). The organ systems listed on Table 12 were noted on the death certificates for 2 cases,

provided by a private physician for 1 case, provided by the patient for 1 case, and was unknown for one case. The organ systems for the four known cases were stomach, gastrointestinal, lung, and a type of head or neck cancer for the 4 known organ systems. The fifth case death certificate listed brain metastasis as the primary cause of death, but the primary cancer tissue or organ site was not recorded.

The latency periods were not known for any of the cancer cases, but a maximum possible period was calculated by noting the time between the year of first employment since 1974 and the date of death. For the one living case, that person was known to have cancer in 1981. The maximum possible latency periods for the five observed cases were therefore 5, 4, 3, 7, and 3 years (mean 4.4 years).

VI. DISCUSSION

The disposal area was merely a trench filled with chemicals and was not a satisfactory containment for the chemicals buried at the site after the warehouse fire. During the initial site visit, chemicals were observed oozing from the soil surface; although indicative of sub-surface chemical migration, contamination of the company water supply could not be documented. Environmental water samples obtained by DHEC failed to find significant quantities of toxic or carcinogenic chemicals. Only samples taken from the test well on the far side of the disposal area (opposite the Black River Hardwood Company) contained detectable chemical contaminants.

This medical evaluation was the best analysis of the available medical information. However, this evaluation has several potential sources of epidemiological bias:

(1) Tracking of the employees was not achieved to determine cancer status. Cancer cases identified were only those known by the company representative, or those former employees who were deceased with a death certificate on file in South Carolina, listed with cancer as a cause of death. The bias here was toward less likelihood of finding a significant outcome. The additional effort required to track all previous employees would have been extensive considering the minimum amount of information retained by the company and the extensive degree of mobility discovered when we attempted to find only several of the previous workers. With no available supporting information for the hypothesis that elevated cancer rates may exist in this population, this effort was not undertaken. However, there was some degree of safety provided by the analysis because ten or greater cancers would have been necessary to consider the number statistically significant. Five additional cancers, or 2 times the observed number would have been required for a problem to be recognized.

(2) The expected number of cancers were generated based upon rates of cancers for all persons above twenty years of age. This was done because the exact age of each employee was not known by the company. If ages were known, a more exact age stratification could have been performed and more exact estimates of the expected number of cancers could have been calculated. The direction of this bias cannot be estimated, but as the age of the employee population increases, it becomes more likely that the expected number of cancer cases was underestimated.

(3) The study was biased by the use of the Atlanta based SEER registry to generated expected number of cancer cases. The direction of this bias cannot be predicted. By using the Atlanta SEER data, we are comparing cancer rates among a predominantly urban area with a rural area. However the geographic areas are both in the Southeastern United States and no better source of cancer incidence data was available.

(4) The unknown dates of employment could have created minor changes in the number of person years, but this effect would be expected to be small. Errors in the interpretation of the organ systems could be present since death certificates and patient information were the source of this information.

(5) A final source of bias was present in the calculation of the maximum possible latency period. The bias stems from the lack of information regarding the date of cancer diagnosis for any of the cases. Since no additional latency time can be accumulated once the cancer is known to exist or the patient dies, the "maximum possible latency period" definition was the best available calculation. The bias would be toward a longer latency period since one would expect the cancer to have been diagnosed before the time of death.

The mortality analysis did not determine that the workforce or any race-sex group within the workforce had an excess number of cancers as compared with the rates of the Atlanta SEER registry. No consistent organ system was observed among the cancers. A consistent organ system and tissue type is a more characteristic finding in occupational carcinogenesis. Individual carcinogenic chemicals are frequently characterized by one or several characteristic cancers. Although a consistent organ site would not be required for concern of risk to the employees, a consistent organ site would have been more convincing. The latency period, as estimated by the maximum possible latency period is extremely short, ranging from 3 to 7 years. Solid tissue, environmentally induced cancers characteristically have a 15 to 40 year latency period. The maximum possible latency periods observed among employee cases is not consistent with the natural history of the environmentally induced cancers.

VII. CONCLUSIONS

The available information and analysis failed to document a hazard of cancer among employees of the Black River Hardwood Company, in Kingstree, South Carolina. The observed number of cancers were not above the number expected. No consistent cancer site was observed. The maximum possible latency period was extremely short and not consistent with the natural history of environmentally induced cancers.

VIII. RECOMMENDATIONS

(1) Pesticides and agricultural chemicals were buried, possibly improperly, and there is evidence that those chemicals are migrating. Continued monitoring of the company and community water supply should be performed.

(2) The company should consider providing bottled drinking water for employees and continue to use well water for toilet facilities and process water, until a municipal water system is available.

IX. AUTHORSHIP AND ACKNOWLEDGEMENTS

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X. DISTRIBUTION AND AVAILABILITY

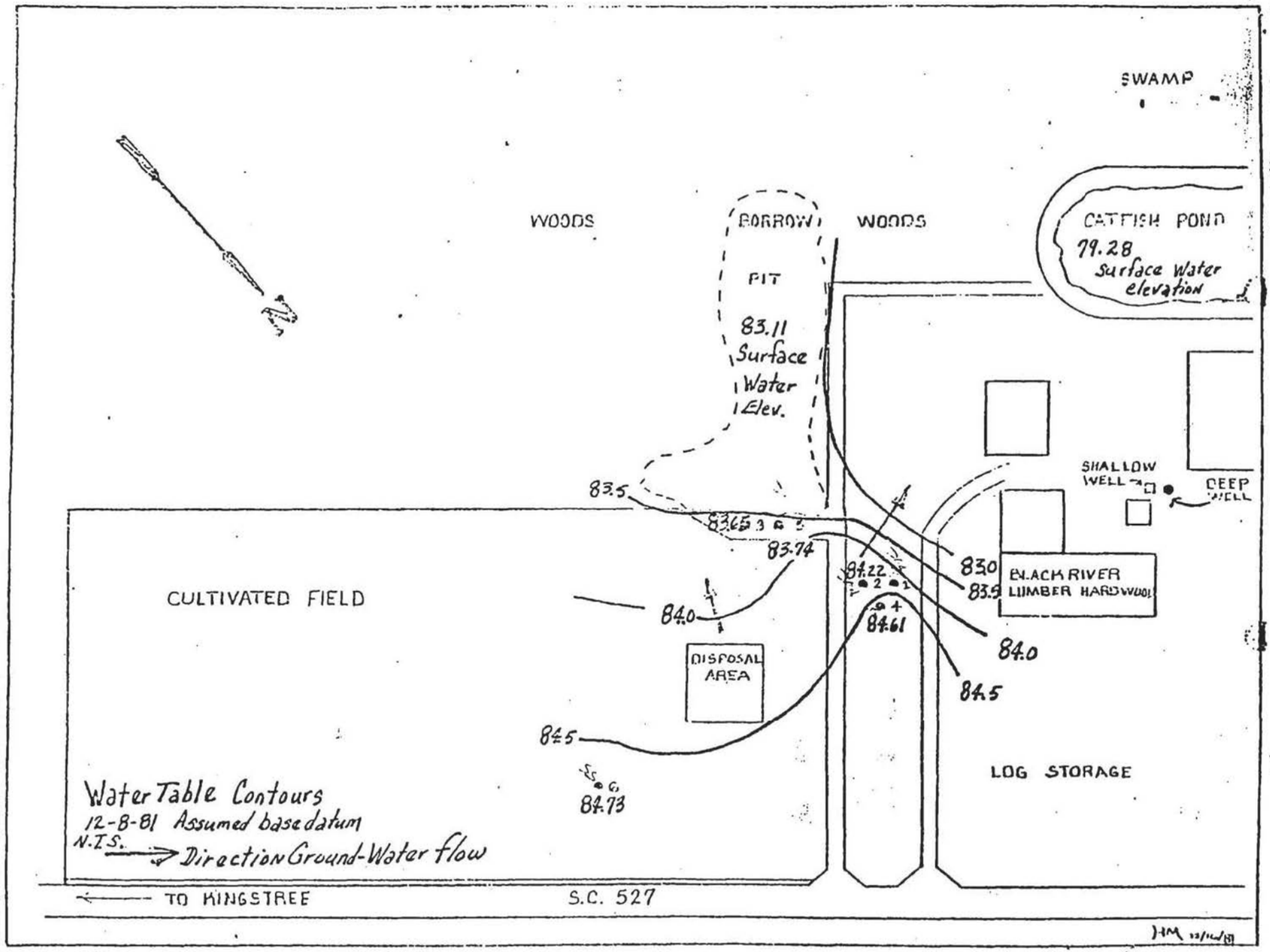
Copies of this report are currently available upon request from NIOSH, Division of Standards Development and Technology Transfer, Publications Dissemination Section, 4676 Columbia Parkway, Cincinnati, Ohio 45226. After ninety (90) days the report will be available through the National Technical Information Service (NTIS), Springfield, Virginia 22161. Information regarding its availability through NTIS can be obtained from the NIOSH Publications Office at the Cincinnati, Ohio address.

Copies of this report have been sent to:

1. Black River Hardwood Company, Kingstree, South Carolina
2. NIOSH Region IV
3. OSHA Region IV
4. Designated Safety and Health Agencies in South Carolina

For the purpose of informing the "affected employees", the employer will promptly "post" this report for a period of thirty (30) calendar days in a prominent place(s) near where the affected employees work.

Figure 1


SWAMP
WOODS
BORROW PIT
83.11 Surface Water Elev.
WOODS
CATFISH POND
79.28 Surface Water elevation
SHALLOW WELL
DEEP WELL
83.5
83.65
83.74
84.22
83.0
83.9
BLACK RIVER LUMBER HARDWOOD
CULTIVATED FIELD
84.0
84.61
DISPOSAL AREA
84.0
84.5
84.5
84.73
LOG STORAGE
Water Table Contours
12-8-81 Assumed base datum
N.I.S.
Direction Ground-Water flow
TO KINGSTREE
S.C. 527

Attachment 1

Summary of

29 March 1982 EPA Hazardous Waste Site Investigation Report

Southern Agricultural Chemicals, Inc.
Pesticide Residue Disposal Site
at Black River Hardwood Company
Kingstree, South Carolina

Report Prepared By
Ecology and Environment, Inc.
Under EPA Contract No. 68 - 01 - 6056

Summarized
May 1982
by
Paul Roper
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Atlanta, Georgia 30323

Telephone (404) 221-2396

Sequence of Events

September 21, 1974	Southern Agricultural Chemical warehouse fire.
	150 tons of waste from the fire buried in a field adjacent to Black River Hardwood Company.
	Disposal site eventually bought by hardwood company.
August 1981	S.C. DHEC received complaint from hardwood company that well water contained chemical odors.
August 12, 1981	DHEC inspected site, observed thick, black, oil-like substance in surface soil; soybeans in the field over the disposal pit showed signs of damage: Analytical results inconclusive
Dec. 8-10, 1981	Site study by EPA contractor, Ecology and Environment, Inc.
March 29, 1982	Ecology and Environment, Inc., released site survey report.
April 12, 1982	Black River Hardwood Company reported to NIOSH 3 employee cancer deaths and an additional employee terminal illness since the pesticide disposal site was established; hardwood company requested assistance from NIOSH.

Results of Samples by Ecology and Environment, Inc.

I. Surface soil contaminated by pesticide waste which had percolated to the surface.

Chemicals found:

DDT (chlorinated hydrocarbon insecticide)
chemicals related to DDT
dibutylphthalate (insect repellant)
endrin (chlorinated hydrocarbon insecticide)
arsenic, zinc, lead

II. DHEC's 4 monitoring wells

3 wells showed no groundwater contamination by organic chemicals

The eastern-most well contained traces of:
Bis (2-ethylhexyl) phthalate (used as a solvent or a plasticizer)
Dibutylphthalate (insect repellant)
1,1,1 - trichloroethane (solvent)
ethylbenzene (solvent)
toluene (solvent)

The wells did show evidence of groundwater contamination with metals and cyanide.

III. Surface Water and Sediment

No organic chemical contamination was found in the borrow pit water or sediment.

No organic chemical contamination was found in the fish pond water. The fish pond sediment contained traces of:

dibutylphthalate (insect repellant)
hexadecanoic acid (palmitic acid derived from palm oil)
4 polynuclear aromatic hydrocarbons (PNA's)*:

fluoranthene
benzo(a)pyrene
tetramethyl phenanthrene
dihydrotrimethyl benzopyanol

*(PNAs are formed from high temperatures (e.g., fires or pyrolysis), and are considered high-risk cancer causing chemicals. PNAs also occur naturally in the environment and can be found in the air, in tar, asphalt, and charcoal combustion products.)

IV. Black River Hardwood Company's water wells

No organic chemical contamination found in either well

V. Conclusions of E&E report

1. No contamination of the Black River Hardwood Company's drinking water wells has yet been found.

2. Pesticide residues have percolated to the surface soil at least at one point near the disposal pits.

3. Solvents in the eastern-most monitoring well indicates some contamination of the groundwater at the site and some movement of the contamination.

4. Metal contamination in the monitoring wells also indicates groundwater contamination and migration of buried waste laterally away from the pit area.

Table 1

SOUTH CAROLINA DEPARTMENT OF HEALTH AND ENVIRONMENTAL CONTROL
Environmental Quality Control
Analytical Services Data Sheet for Solid Waste and Hydrology

Sample Location *Black River Hardwood Co.* County *Williamsburg*

Sample Type ______ Comments ______

Date *7-22-82* Collected by *MDT* An "X" in the small column indicates test requested

Time Collected (Milit.)	1100	1115	
Sample Point	Shallow Well	Deep Well	
Lab No. F.	198	197	
NH_3-N, mg/l SW	16	17	
NO_3/NO_2-N, mg/l			
TKN			
Nitrite, N, mg/l			
T-P,			
Hardness, mg/l			
Cl, mg/l			
SO_4 mg/l			
Flashpoint, °F			
Solids, Total, mg/l			
Solids, Tot. Diss, mg/l			
Solids, %			
pH			
Alkalinity mg/l			
Fluoride, mg/l			
TOC			
Phenols, µg/l			
COD			
Cyanide, mg/l			
MBAS, mg/l			

SW		16		17
Calcium				
Magnesium				
Sodium				
Potassium				
Arsenic	X	*	X	*
Barium	X	<0.5	X	<0.5
Cadmium	X	<0.010	X	<0.010
Chromium	X	<0.05	X	<0.05
Copper				
Iron				
Lead	X	0.05	X	<0.05
Manganese				
Mercury				
Nickel				
Selenium	X	*	X	*
Silver	X	<0.05	X	<0.05
Zinc				
		mg/l		

Remarks: ** Results will report later.*

Date Received in Regional Laboratory *7/23/82* by *Patricia Haire*

Date Released from Regional Laboratory *7/23/82* by *Patricia Haire*

Date Received in Central Laboratory *7/27/82* by *AJM*

Date Released from Spec & A. A. Section ______ by ______

Date Released from Metals Section *8/23/82* by *AJ McAlister*

EQC/ASD:89 White - Program; Pink - Program; Yellow - Lab

Table 1 (Cont.)

Sheet No. F-13.83 C 1

SOUTH CAROLINA DEPARTMENT OF HEALTH AND ENVIRONMENTAL CONTROL
Analytical Services Division
Laboratory Services Data Sheet for Organics in Water Samples

Stream: Primary ( ) Secondary ( ) Facility Name BLACK RIVER HARDWOOD CO

County. _____ Receiving Stream _____ NPDES Permit #SC00 _____

Date 7/22/82 Collected by MDT District PEE DEE

Station No.			SHALLOW WELL	DEEP WELL					
Lab No.			200	199					
Time Collected			1100	1115			★ Herbicides		
HERBICIDE SCAN		X	★	★			SW18		SW19
Pesticide Scan		X				2,4-D µg/l	0.157		<0.05
α-BHC µg/l	39337		<0.05	<0.05		2,4,5-TP	<0.025		<0.025
β-BHC µg/l	39338					2,4,5-T	<0.025		<0.025
Lindane µg/l	39782								
Heptachlor µg/l	39410								
Aldrin µg/l	39330								
Hept. Epox. µg/l	39420								
Dieldrin µg/l	39380								
Endrin µg/l	39390								
Toxaphene µg/l	39400								
P,P' - DDE µg/l	39320								
P,P' - DDD µg/l	39310								
P,P' - DDT µg/l	39300								
O,P' - DDE µg/l	39327								
O,P' - DDD µg/l	39315								
O,P' - DDT µg/l	39305								
Methoxychlor µg/l	39480		↓	↓					
Ethion µg/l	39398		<0.10	<0.10					
Trithion µg/l	39786								
Guthion µg/l	39580								
Malathion µg/l	39530								
Parathion µg/l	39540								
Diazinon µg/l	39570								
Phosdrin µg/l	39610		↓	↓					
PCBs µg/l	39516		<0.50	<0.50					

An "x" in the small column indicates test required.

Date Received in Regional Laboratory 7/23/82 by Patricia Paine

Date Released from Regional Laboratory 7/26/82 by Patricia Paine

Date Received in Central Laboratory 7/27/82 by DRM

Date Released from Organic Section 8/11/82 by AWilliams

DHEC 40-26 (01/82) White-Program; Canary-Central Lab; Pink-District

Table 1 (Cont.)

SOUTH CAROLINA DEPARTMENT OF HEALTH AND ENVIRONMENTAL CONTROL
Environmental Quality Control
Analytical Services Data Sheet for Solid Waste and Hydrology

Sample Location Black River Headwaters County Williamsburg

Sample Type _____ Comments _____

Date 4-22-82 Collected by SCDT

An "X" in the small column indicates test requested

Time Collected (Milit.)								
Sample Point						Standard		Duplicate
Lab No.				5(.)		16		17
NH_3-N, mg/l					Calcium			
NO_3/NO_2-N, mg/l					Magnesium			
TKN					Sodium			
Nitrite, N, mg/l					Potassium			
T-P,					Arsenic	X	<0.005	X <0.005
Hardness, mg/l					Barium			
Cl, mg/l					Cadmium			
SO_4 mg/l					Chromium			
Flashpoint, °F					Copper			
Solids, Total, mg/l					Iron			
Solids, Tot. Diss, mg/l					Lead			
Solids, %					Manganese			
pH					Mercury			
Alkalinity mg/l					Nickel			
Fluoride, mg/l					Selenium	X	<0.005	X <0.005
TOC					Silver			
Phenols, µg/l					Zinc			
COD								
Cyanide, mg/l							ug/l	ug/l
MBAS, mg/l					Remarks:			

*Date Received in Regional Laboratory _____ by _____

Date Released from Regional Laboratory _____ by _____

Date Received in Central Laboratory 4/27/82 by AJM

Date Released from Spec & A. A. Section _____ by _____

Date Released from Metals Section 9-10-32 by AJM Crockett

DHEC.40-89 (01/81) White - Program; Yellow - Program; Pink - Program; Gold - Lab

Table 2

SOUTH CAROLINA DEPARTMENT OF HEALTH AND ENVIRONMENTAL CONTROL
Environmental Quality Control
Analytical Services Data Sheet for Solid Waste and Hydrology

Sample Location Black River Headwaters County Williamsburg

Sample Type water Comments

Date 11-10-82 Collected by Cooper, Sharpe An "X" in the small column indicates test requested

Time Collected (Milit.)		11:15		11:20				11:15		11:20	
Sample Point		Shallow well		Deep well				Shallow well		deep well	
Lab No. SW		103		104				103		104	
NH_3-N, mg/l	X	0.12	X	0.12		Calcium	X	3	X	9	
NO_3/NO_2-N, mg/l	X	<0.02	X	<0.02		Magnesium		0.31		1.3	
TKN						Sodium					
Nitrite, N, mg/l						Potassium					
T-P,						Arsenic	X	<0.005	X	<0.005	
Hardness, mg/l	X	9	X	28		Barium	X	<0.5	X	<0.5	
Cl, mg/l	X	03.5	X	03.5		Cadmium	X	<0.010	X	<0.010	
SO_4 mg/l						Chromium	X	<0.05	X	<0.05	
Flashpoint, °F						Copper	X	0.10	X	<0.05	
Solids, Total, mg/l						Iron	X	0.9	X	0.2	
Solids, Tot. Diss, mg/l	X	42	X	54		Lead	X	<0.05	X	<0.05	
Solids, %						Manganese	X	<0.05	X	<0.05	
pH	X	4.8	X	6.1		Mercury					
Alkalinity mg/l	X	6	X	50		Nickel					
Fluoride, mg/l						Selenium	X	<0.005	X	<0.005	
TOC						Silver	X	<0.05	X	<0.05	
Phenols, µg/l						Zinc	X	<0.05	X	<0.05	
COD											
Cyanide, mg/l								mg/L		mg/L	
MBAS, mg/l						Remarks:					
Turbidity	X	7.8	X	2.1							
Color	X	5	X	<5							

Date Received in Regional Laboratory _____ by _____

Date Released from Regional Laboratory _____ by _____

Date Received in Central Laboratory 11/10/82 by D Dft

Date Released from Spec & A. A. Section _____ by _____

Date Released from Metals Section 1-10-83 by Aprouchet

DHEC 40-89 (01/81) White - Program; Yellow - Program; Pink - Program; Gold - Lab

Table 2 (Cont.)

SOUTH CAROLINA DEPARTMENT OF HEALTH AND ENVIRONMENTAL CONTROL
Environmental Quality Control
Analytical Services Data Sheet for Organic Compounds in Solid Waste and Hydrology Samples

Sample Location [illegible] County [illegible]

Sample Type Drinking water Comments

Date ______ Collected By [illegible]

An "X" in the small column indicates test requested.

Time Collected (Milit.)		11:15		11:20	
Station No.		[illegible] well		[illegible] well	
Lab. No.	SW	103		104	
Chlorinated hydrocarbons, µg/l					
Endrin, mg/l		<0.0002		<0.0002	
Lindane, mg/l		<0.004		<0.004	
Methoxychlor, mg/l		<0.10		<0.10	
Toxaphene, mg/l		<0.005		<0.005	
Organophosphates, µg/l		<0.10		<0.10	
PCBs, µg/l		<0.50		<0.50	
Other [illegible]	X		X		
[illegible]	X		X		
Herbicides 2,4-D µg/l		<0.05		<0.05	
2,4,5-T		<0.025		<0.025	
2,4,5-TP		<0.025		<0.025	

Comments

Date Received in Regional Laboratory ______ By ______

Date Released from Regional Laboratory ______ By ______

Date Received in Central Laboratory 11/10/82 By DEH

Date Released from Organic Section 12/09/82 By [illegible]

White--Program; Yellow--Program; Pink--Lab; Gold--Program

DHEC 40-90 (09/81)

Table 3

SOUTH CAROLINA DEPARTMENT OF HEALTH AND ENVIRONMENTAL CONTROL
Environmental Quality Control
Analytical Services Data Sheet for Organic Compounds in Solid Waste and Hydrology Samples

Sample Location Black River Hardwood County Williamsburg

Sample Type drinking water Comments

Date 4-6-83 Collected By Martin, Sharpe An "X" in the small column indicates test requested.

Time Collected (Milit.)						
Station No.		Shallow well		Shallow dup. well		deep well
Lab. No. 5LW		219		220		221
Chlorinated hydrocarbons, µg/l						
Endrin, mg/l		<0.0002		<0.0002		<0.0002
Lindane, mg/l		<0.004		<0.004		<0.004
Methoxychlor, mg/l		<0.10		<0.10		<0.10
Toxaphene, mg/l		<0.005		<0.005		<0.005
Organophosphates, µg/l		<0.10		<0.10		<0.10
PCBs, µg/l		<0.50		<0.50		<0.50
Other herbicide scan	X		X		X	
pesticide scan	X		X		X	
Volatile Organic Analysis	X	N.D.		N.D.		N.D.
Herbicides: 1) 2,4-D µg/l		<0.05		<0.05		<0.05
2) 2,4,5-T µg/l		<0.025		<0.025		<0.025
3) 2,4,5-TP µg/l		<0.025		<0.025		<0.025

Comments N.D. = None detected

Date Received in Regional Laboratory _____ By _____

Date Released from Regional Laboratory _____ By _____

Date Received in Central Laboratory 4-6-83 By [illegible]

Date Released from Organic Section 4/20/83 By JWWilliams

White--Program; Yellow--Program; Pink--Lab; Gold--Program

DHEC 40-90 (09/81)

Table 3 (Cont.)

SOUTH CAROLINA DEPARTMENT OF HEALTH AND ENVIRONMENTAL CONTROL
Environmental Quality Control
Analytical Services Data Sheet for Solid Waste and Hydrology

Sample Location Black River Hardwood County Williamsburg

Sample Type Water Comments

Date 4-6-83 Collected by Martin, Sharpe An "X" in the small column indicates test requested

Time Collected (Milit.)								
Sample Point		Shallow well	Shallow dup. well	deep well		Shallow well	Shallow dup. well	deep well
Lab No.	SW	219	220	221	SW	219	220	221
NH_3-N, mg/l	X	<0.05	<0.05	<0.05	Calcium	X 3	X 3	X 10
NO_3/NO_2-N, mg/l	X	<0.02	0.03	<0.02	Magnesium	<0.1	0.1	0.5
TKN					Sodium			
Nitrite, N, mg/l					Potassium			
T-P,					Arsenic	X <0.005	X <0.005	X <0.00
Hardness, mg/l	X	8	8	29	Barium	X <0.5	X <0.5	X <0.5
Cl, mg/l	X	3.0	3.0	3.0	Cadmium	X <0.010	X <0.010	X <0.01
SO_4 mg/l					Chromium	X <0.05	X <0.05	X <0.0
Flashpoint, °F					Copper	X <0.05	X <0.05	X <0.0
Solids, Total, mg/l					Iron	X 4	X 4	X 0.3
Solids, Tot. Diss, mg/l					Lead	X <0.05	X <0.05	X <0.0
Solids, %					Manganese	X <0.05	X <0.05	X <0.0
pH	X	5.3	5.3	6.3	Mercury			
Alkalinity mg/l	X	12	11	50	Nickel			
Fluoride, mg/l					Selenium	X <0.005	X <0.005	X <0.00
TOC					Silver	X <0.05	X <0.05	X <0.05
Phenols, µg/l					Zinc	X 0.09	X 0.09	X 0.27
COD								
Cyanide, mg/l						mg/l	mg/l	mg/l
MBAS, mg/l					Remarks:			
Turbidity	X	5.7	3.3	3.3				
Color	X	15	3	5				

Date Received in Regional Laboratory _____ by _____

Date Released from Regional Laboratory _____ by _____

Date Received in Central Laboratory 4-6-83 by A. Pouchet

Date Released from Spec & A. A. Section 5/25/83 by C. Harmon

Date Released from Metals Section 5-24-83 by A. Pouchet

DHEC 40-89 (01/81) White - Program; Yellow - Program; Pink - Program; Gold - Lab

Table 4

SOUTH CAROLINA DEPARTMENT OF HEALTH AND ENVIRONMENTAL CONTROL
Environmental Quality Control
Analytical Services Data Sheet for Solid Waste and Hydrology

Sample Location: Black River Hardwood County: Williamsburg
Sample Type: Ground Water Comments: Acidified - Not filtered
Date: 8/2/83 Collected by: Knox/Ullery An "X" in the small column indicates test requested

Time Collected (Milit.)		1130		1155
Sample Point		Shallow		Deep
Lab No.	SW	21		22
NH_3-N, mg/l	X	0.47*	X	0.17*
NO_3/NO_2-N, mg/l	X	0.03	X	0.03
TKN	X	0.25*	X	0.3*
Nitrite, N, mg/l	X	<0.02	X	<0.02
T-P,				
Hardness, mg/l	X	9	X	28
Cl, mg/l	X	3.5	X	3.0
SO_4 mg/l	X	14	X	14
Flashpoint, °F				
Solids, Total, mg/l				
Solids, Tot. Diss, mg/l	X	44	X	62
Solids, %				
pH	X	6.0	X	6.7
Alkalinity mg/l	X	12	X	52
Fluoride, mg/l				
TOC	X	2.4	X	2.3
Phenols, µg/l				
COD				
Cyanide, mg/l				
MBAS, mg/l				

		1130		1155
		Shallow		Deep
	SW	21		22
Calcium	X	3	X	9
Magnesium	X	0.35	X	1.4
Sodium	X	3.0	X	8
Potassium	X	2	X	4
Arsenic	X	<0.005	X	<0.005
Barium	X	<0.5	X	<0.5
Cadmium	X	<0.010	X	<0.010
Chromium	X	<0.05	X	<0.05
Copper	X	<0.05	X	<0.05
Iron	X	0.8	X	0.27
Lead	X	<0.05	X	<0.05
Manganese	X	<0.05	X	<0.05
Mercury				
Nickel	X	<0.05	X	<0.05
Selenium	X	<0.005	X	<0.005
Silver	X	<0.05	X	<0.05
Zinc	X	<0.05	X	<0.05
		mg/l		mg/l
		1		1

Remarks: * U.S.G.S. pumped out of TOC bottle.

Date Received in Regional Laboratory _____ by _____
Date Released from Regional Laboratory _____ by _____
Date Received in Central Laboratory 8-2-83 by [illegible]
Date Released from Spec & A. A. Section 9/30/83 by CR Harrison
Date Released from Metals Section 9/30/83 by AM Williamson

DHEC 40-89 (01/81) White - Program; Yellow - Program; Pink - Program; Gold - Lab

Table 4 (Cont.)

SOUTH CAROLINA DEPARTMENT OF HEALTH AND ENVIRONMENTAL CONTROL
Environmental Quality Control
Analytical Services Data Sheet for Organic Compounds in Solid Waste and Hydrology Samples

Sample Location Black River Hardwood County Williamsburg
Sample Type Ground-Water Comments Wet Filtered
Date 8/2/83 Collected By Knox/Utley An "X" in the small column indicates test requested.

Time Collected (Milit.)		1130		1155	
Station No.		Shallow		Deep	
Lab. No. SW		21		22	
Chlorinated hydrocarbons, µg/l	X		X		
Endrin, mg/l	X	<0.0002	X	<0.0002	
Lindane, mg/l	X	<0.004	X	<0.004	
Methoxychlor, mg/l	X	<0.10	X	<0.10	
Toxaphene, mg/l	X	<0.005	X	<0.005	
Organophosphates, µg/l	X	<0.10	X	<0.10	
PCBs, µg/l					
Other					

Comments

Date Received in Regional Laboratory _____ By _____
Date Released from Regional Laboratory _____ By _____
Date Received in Central Laboratory 8-2-83 By AMT
Date Released from Organic Section 9/15/83 By ARW

White--Program; Yellow--Program; Pink--Lab; Gold--Program

DHEC 40-90 (09/81)

TABLE 5

OBSERVED CANCER INCIDENCE (ALL SITES), POPULATION, AND CANCER INCIDENCE RATES FOR THE ATLANTA METROPOLITAN SURVEILLANCE AREA, 1975-77, BY RACE AND SEX FOR PERSONS GREATER THAN 20 YEARS OF AGE

Group	Number of Cancers 1975-77	Estimated Population 1975-77	Cancer Incidence Rate Annual Incidence 1975-77
White Male	4460	1,130,775	394.42/100,000
Black Male	1330	277,078	480.01/100,000
White Female	5022	1,202,193	417.74/100,000
Black Female	1199	345,355	347.18/100,000

TABLE 6
BLACKRIVER HARDWOOD WORKFORCE VITAL STATUS AND YEARS OF FOLLOW-UP
BY RACE, SEX, AND YEAR OF FIRST EMPLOYMENT
BLACKRIVER HARDWOOD COMPANY, KINGSTREE, SOUTH CAROLINA

Case	Race	Sex	First Employed	Vital Status	Person-Years for Study
1	W	M	1974	Living	9
2	W	M	1974	Living	9
3	W	M	1974	Living	9
4	B	M	1974	Living	9
5	B	M	1974	Living	9
6	B	M	1974	Living	9
7	B	M	1974	Living	9
8	B	M	1974	Living	9
9	B	M	1974	Living	9
10	B	M	1974	Living	9
11	B	M	1974	Deceased-'79	5
12	B	M	1974	Deceased-'81	7
13	B	M	1974	Living	9
14	B	M	1974	Living	9
15	W	M	1974	Living	9
16	B	M	1974	Deceased-'77	5
17	B	M	1974	Deceased-'78	5
18	B	M	1974	Living	9
19	B	M	1974	Deceased-'76	3
20	B	M	1974	Living	9
21	B	M	1974	Deceased-'80	6
22	B	M	1974	Deceased-'75	1
23	B	M	1974	Living	9
24	B	M	1974	Living	9
25	B	M	1974	Living	9
26	B	M	1974	Living	9
27	B	M	1974	Living	9
28	B	M	1974	Living	9
29	B	M	1974	Deceased-'79	5
30	B	M	1974	Living	9
31	W	M	1974	Living	9
32	B	M	1974	Living	9
33	W	M	1974	Living	9
34	W	M	1974	Living	9
35	B	M	1974	Living	9
36	B	M	1974	Living	9
37	B	M	1974	Living	9
38	B	M	1974	Living	9
39	B	M	1974	Living	9
40	B	M	1974	Living	9
41	W	M	1974	Living	9
42	B	M	1974	Living	9
43	B	M	1974	Living	9
44	B	M	1974	Living	9
45	B	M	1974	Living	9
46	B	M	1974	Living	9
47	B	M	1974	Living	9
48	B	M	1974	Living	9
49	B	M	1974	Deceased-'74	1

TABLE 6. (CONTINUED)
BLACKRIVER HARDWOOD WORKFORCE VITAL STATUS AND YEARS OF FOLLOW-UP
BY RACE, SEX, AND YEAR OF FIRST EMPLOYMENT
BLACKRIVER HARDWOOD COMPANY, KINGSTREE, SOUTH CAROLINA

Case	Race	Sex	First Employed	Vital Status	Person-Years for Study
50	B	M	1974	Living	9
51	B	M	1974	Living	9
52	B	M	1975	Living	8
53	W	M	1975	Deceased-'78	3
53	B	M	1975	Living	8
54	B	M	1975	Living	8
55	B	M	1975	Living	8
56	B	M	1975	Living	8
57	W	M	1975	Living	8
58	B	M	1975	Deceased-'82	8
59	B	M	1975	Living	8
60	B	M	1975	Living	8
61	B	M	1975	Living	8
62	B	M	1975	Living	8
63	W	M	1975	Living	8
64	B	M	1975	Living	8
65	B	M	1975	Living	8
66	B	M	1975	Living	8
67	B	M	1975	Living	8
68	B	M	1975	Living	8
69	B	M	1975	Living	8
70	B	M	1975	Living	8
71	B	M	1975	Living	8
72	B	M	1975	Living	8
73	B	M	1975	Living	8
74	B	M	1975	Living	8
75	B	M	1975	Living	8
76	B	M	1975	Living	8
77	B	M	1976	Living	7
78	B	M	1976	Living	7
79	B	M	1976	Living	7
80	B	M	1976	Living	7
81	W	F	1976	Living	7
82	W	M	1976	Living	7
83	B	M	1976	Living	7
84	W	M	1976	Living	7
85	B	M	1976	Living	7
86	B	M	1976	Living	7
87	B	M	1976	Living	7
88	B	M	1976	Living	7
89	B	M	1976	Living	7
90	B	M	1976	Living	7
91	B	M	1976	Living	7
92	B	M	1976	Deceased-'77	2
93	B	M	1976	Living	7
94	B	M	1976	Living	7
95	B	M	1976	Living	7
96	B	M	1976	Living	7
97	B	M	1976	Living	7

TABLE 6. (CONTINUED)
BLACKRIVER HARDWOOD WORKFORCE VITAL STATUS AND YEARS OF FOLLOW-UP
BY RACE, SEX, AND YEAR OF FIRST EMPLOYMENT
BLACKRIVER HARDWOOD COMPANY, KINGSTREE, SOUTH CAROLINA

Case	Race	Sex	First Employed	Vital Status	Person-Years for Study
98	B	M	1976	Living	7
99	B	M	1976	Living	7
100	B	M	1976	Living	7
101	B	M	1976	Living	7
102	B	M	1976	Living	7
103	B	M	1976	Living	7
104	B	M	1976	Living	7
105	W	M	1977	Living	6
106	B	M	1977	Living	6
107	B	M	1977	Deceased-'81	2
108	B	M	1977	Living	6
109	B	M	1977	Living	6
110	B	M	1977	Living	6
111	W	M	1977	Deceased-'80	3
112	B	M	1977	Living	6
113	B	M	1977	Living	6
114	B	M	1978	Living	5
115	B	M	1978	Living	5
116	B	M	1978	Living	5
117	W	M	1978	Living	5
118	W	M	1978	Living	5
119	B	M	1978	Living	5
120	B	M	1978	Living	5
121	B	M	1978	Living	5
122	W	F	1978	Living	5
123	B	M	1978	Living	5
124	B	M	1978	Living	5
125	B	M	1978	Living	5
126	B	M	1978	Living	5
127	B	M	1978	Deceased-'82	5
128	B	M	1978	Living	5
129	B	M	1978	Deceased-'80	3
130	W	M	1978	Living	5
131	B	M	1978	Living	5
132	B	M	1978	Living	5
133	B	M	1978	Living	5
134	B	M	1978	Living	5
135	B	M	1978	Living	5
136	W	M	1979	Living	4
137	W	M	1979	Living	4
138	W	M	1979	Living	4
139	B	M	1979	Living	4
140	B	M	1979	Living	4
141	B	M	1979	Living	4
142	B	M	1979	Living	4
143	W	M	1979	Living	4
144	B	M	1979	Living	4
145	W	M	1979	Living	4
146	B	M	1979	Living	4

TABLE 6. (CONTINUED)
BLACKRIVER HARDWOOD WORKFORCE VITAL STATUS AND YEARS OF FOLLOW-UP
BY RACE, SEX, AND YEAR OF FIRST EMPLOYMENT
BLACKRIVER HARDWOOD COMPANY, KINGSTREE, SOUTH CAROLINA

Case	Race	Sex	First Employed	Vital Status	Person-Years for Study
147	B	M	1979	Living	4
148	W	F	1980	Living	3
149	B	M	1980	Living	3
150	W	M	1980	Living	3
151	B	M	1980	Living	3
152	W	F	1980	Living	3
153	B	M	1980	Living	3
154	B	M	1980	Living	3
155	B	M	1980	Living	3
156	B	M	1980	Living	3
157	B	M	1981	Living	2
158	W	M	1981	Living	2
159	W	M	1981	Living	2
160	B	M	1981	Living	2
161	B	M	1981	Living	2
162	W	M	1982	Living	1
163	B	M	1982	Living	1
164	B	M	1982	Living	1
165	B	M	1982	Living	1

TABLE 7
NUMBER OF PERSON-YEARS, CANCER INCIDENCE RATE (ALL SITES), EXPECTED NUMBER OF CANCERS, AND OBSERVED NUMBER OF CANCERS, BY RACE AND SEX

Group	Person-Years	Cancer Incidence Rate	Expected #	Observed #
White Male	157	394.42/100,000	0.619	1
Black Male	882	480.01/100,000	4.234	3
White Female	18	417.74/100,000	0.075	1
Black Female	0	347.18/100,000	0	0
Total	1056		4.928	5

TABLE 8

THE POISSON DISTRIBUTION CALCULATED PROBABILITY AND CUMULATIVE PROBABILITY OF OBSERVING A SPECIFIED NUMBER, OR GREATER NUMBER, OF CANCER CASES WITH AN EXPECTED NUMBER OF CASES EQUAL TO 4.928 (1)
BLACKRIVER HARDWOOD COMPANY, KINGSTREE, SOUTH CAROLINA

Observed # Cancer Cases	Probability of Observed Number	Probability of Observed Number or Less	Probability of Observed Number or Greater
0	0.0072	0.0072	1.0000
1	0.0357	0.0429	0.9928
2	0.0879	0.1308	0.9571
3	0.1444	0.2752	0.8692
4	0.1779	0.4532	0.7248
5	0.1754	0.6285	0.5468
6	0.1440	0.7725	0.3715
7	0.1014	0.8739	0.2275
8	0.0625	0.9364	0.1261
9	0.0342	0.9706	0.0636
10	0.0169	0.9875	0.0294 (2)

(1) $f(x)=\frac{e^{-m}\, m^{x}}{x!}$

m= the expected value
x= the observed value
e= base of the natural (Napierian) logarithm rounded to 2.7183

(2) Greater than or equal to 10 observed cancer cases is statistically greater than the 4.928 expected cases by the Poisson Distribution ($p<0.05$)

TABLE 9

THE POISSON DISTRIBUTION CALCULATED PROBABILITY AND CUMULATIVE PROBABILITY OF OBSERVING A SPECIFIED NUMBER, OR GREATER NUMBER, OF CANCER CASES AMONG WHITE MALES WITH AN EXPECTED NUMBER OF CASES EQUAL TO 0.619 (1) BLACKRIVER HARDWOOD COMPANY, KINGSTREE, SOUTH CAROLINA

Observed # Cancer Cases	Probability of Observed Number	Probability of Observed Number or Less	Probability of Observed Number or Greater
0	0.5385	0.5385	1.0000
1	0.3333	0.8718	0.4615
2	0.1032	0.9750	0.1282
3	0.0213	0.9963	0.0250 (2)

(1) $f(x)=\frac{e^{-m}\, m^{x}}{x!}$

m= the expected value
x= the observed value
e= base fo the natural (Napierian) logarithm rounded to 2.7183

(2) Greater than or equal to 3 observed cancer cases is statistically greater than the 0.619 expected cases by the Poisson Distribution ($p<0.05$)

TABLE 10

THE POISSON DISTRIBUTION CALCULATED PROBABILITY AND CUMULATIVE PROBABILITY OF OBSERVING A SPECIFIED NUMBER, OR GREATER NUMBER, OF CANCER CASES AMONG BLACK MALES WITH AN EXPECTED NUMBER OF CASES EQUAL TO 4.234 (1)

Observed # Cancer Cases	Probability of Observed Number	Probability of Observed Number or Less	Probability of Observed Number or Greater
0	0.0145	0.0145	1.0000
1	0.0614	0.0759	0.9855
2	0.1300	0.2059	0.9241
3	0.1834	0.3893	0.7941
4	0.1942	0.5835	0.6107
5	0.1644	0.7479	0.4165
6	0.1160	0.8639	0.2521
7	0.0702	0.9341	0.1361
8	0.0371	0.9712	0.0659
9	0.0175	0.9887	0.0288 (2)

(1) $f(x)=\frac{e^{-m}\, m^{x}}{x!}$

m= the expected value
x= the observed value
e= base fo the natural (Napierian) logarithm rounded to 2.7183

(2) Greater than or equal to 9 observed cancer cases is statistically greater than the 4.234 expected cases by the Poisson Distribution ($p<0.05$)

TABLE 11

THE POISSON DISTRIBUTION CALCULATED PROBABILITY AND CUMULATIVE PROBABILITY OF OBSERVING A SPECIFIED NUMBER, OR GREATER NUMBER, OF CANCER CASES AMONG WHITE FEMALES WITH AN EXPECTED NUMBER OF CASES EQUAL TO 0.075 (1) BLACKRIVER HARDWOOD COMPANY, KINGSTREE, SOUTH CAROLINA

Observed # Cancer Cases	Probability of Observed Number	Probability of Observed Number or Less	Probability of Observed Number or Greater
0	0.9277	0.9277	1.0000
1	0.0696	0.9973	0.0723
2	0.0026	0.9999	0.0027 (2)

(1) $f(x)=\frac{e^{-m}\, m^{x}}{x!}$

m= the expected value
x= the observed value
e= base fo the natural (Napierian) logarithm rounded to 2.7183

(2) Greater than or equal to 2 observed cancer cases is statistically greater than the 0.075 expected cases by the Poisson Distribution ($p<0.05$)

TABLE 12
ORGAN SYSTEM OF CANCERS AND MAXIMUM POSSIBLE LATENCY PERIODS (1)
FOR THE 5 CANCER CASES
BLACKRIVER HARDWOOD COMPANY, KINGSTREE, SOUTH CAROLINA

Case	Maximum Possible Latency Period	Organ System
1	5 years	Stomach
2	4 years	Gastrointestinal
3	3 years	Lung
4	7 years	Unknown
5	3 years	Head and Neck

(1) Period from time of employment at the Blackriver Hardwood Company from 1974 onward until death or time when cancer was known to have existed. Years calculated where all of 1974 was included, but the year of death or diagnosis was only included if death occurred after July 1 of that year.

DEPARTMENT OF HEALTH AND HUMAN SERVICES
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