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NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH  
CINCINNATI, OHIO 45226

HAZARD EVALUATION AND TECHNICAL ASSISTANCE  
REPORT NO. TA 76-74

Mississippi Authority for the Control of Fire Ants  
Mirex Formulation Plant  
Prairie, Mississippi 39756

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## I. Summary

Mirex is a chlorinated hydrocarbon pesticide used in the United States for control of imported fire ants (Solenopsis rechtei and Solenopsis invicta). The only U.S. bait formulation plant is operated by the State of Mississippi. The State Health Officer requested NIOSH to provide technical consultants to evaluate the bait formulation facility from a health and safety standpoint and to make appropriate recommendations to protect the safety and health of the employees.

There is insufficient human exposure, medical, and epidemiological data on mirex to state conclusively its adverse health effects on humans. Animal exposure data indicate that mirex is a suspected carcinogen and that it may have other adverse effects on physiological functions and health.

Since the beginning of the NIOSH evaluation, the facility has implemented a number of improvements, such as engineering controls, better housekeeping, and improved personal protective equipment. These changes have greatly reduced the exposure of employees to airborne mirex. With the present limited knowledge about mirex toxicity, it is not known precisely what degree of health risk that this rather low exposure presents. Adherence to the recommendations contained in Section VIII of this report is urged in order to safeguard formulation workers as much as feasible until a safer alternative to mirex is available for the control of fire ants.

## II. Introduction

Mirex is a chlorinated hydrocarbon pesticide used in the United States for control of imported fire ants (Solenopsis richteri and Solenopsis invicta). Mirex is very similar to kepone in chemical structure. It is a suspected carcinogen because of demonstrated carcinogenic effects on experimental animals<sup>1,2</sup>. The use of mirex as a pesticide has been the subject of much controversy in recent years because of concern about its potential effects on health and the environment.

Allied Chemical Corporation discontinued the formulation of the ant bait in July 1975. Subsequently, the State of Mississippi, Department of Agriculture and Commerce, assumed control of the sole U.S. formulation plant and resumed production of the bait with the same basic workforce on May 10, 1976. Since the workers are State employees in a State which has Federal OSHA enforcement, Federal OSHA representatives do not have authority to provide inspection or consultation services at the State facility. Hence, the State Health Officer, Dr. Alton B. Cobb, requested the Director of NIOSH to provide technical consultants to visit the plant, evaluate its operations, and make recommendations to the Mississippi Authority for Control of Fire Ants regarding any occupational hazards for the employees and any indicated changes in procedures and operations to protect the employees.

## III. Plant Process - Conditions of Use

At the time that the NIOSH investigation began, the technical grade mirex was purchased from the Hooker Chemical Company, Niagara Falls, New York.

Hooker discontinued production of mirex, and a source was located outside the United States. The Mississippi mirex plant began importing mirex from Paraquimica, S.A., Sao Paulo, Brazil, through Philipp Bros. Pan American Corp., New York, N.Y.

The technical grade mirex was about 98.7% mirex, with impurities as follows:

Perchloroethylene	0.2%
Hexachlorocyclopentadiene	0.02%
Octachlorocyclopentene	0.02%
Aluminum chloride	0.15%
Insolubles	0.1%

(Hooker Chemical data)

Mirex ant bait is formulated in the Mississippi plant. Technical grade mirex is weighed and added to soybean oil to form a 2% solution. At the time of the first NIOSH site visit in June 1976, the technical grade mirex was manually scooped out of fiber storage drums, weighed, and the mirex dumped into the top of a large mixing tank containing soybean oil. At the time of the NIOSH follow-up survey in March 1977, a vacuum feeding system had been installed. In the vacuum system, the fiber drum of technical grade mirex was placed on a scale, and the appropriate weight of mirex was drawn out of the drum through a nozzle and via a hose into a hopper and then into the soybean oil tank. The air used to pull the mirex through the system was then filtered 3 times prior to discharge of the air back into the room. During periods of high production, this mixing operation is performed about three times per week. The operation requires about one hour and is done after normal working hours.

The oil solution is then mixed in a screw conveyor with corn cob grits to form the ant bait. At the time of the NIOSH surveys, the formulation was composed of 15% oil solution and 85% corn cob grits, to form a 0.3% mirex formulation for aerial application. (A 0.15% formulation termed "commercial grade" was also prepared for purchase by individuals to apply directly to ant mounds.) Subsequently, the formulation at the plant has been changed to 0.1% mirex in the final bait.

The bait is bagged and packed for shipment. The bagging operation is the most unenclosed operation in the process. The return duct for excess bait from the bagger through the conveyor shaft back to the bait mixer tank has a large opening through which bait and mirex escape into the workroom. The filling of the bags from the hopper also exposes the freshly made bait to the workroom air and the bagging employees. The workers at the bagger have a substantial potential for skin exposure, since they find that wearing gloves is incompatible with rapid manual handling of the bags.

#### IV. Evaluation Methods

During both NIOSH site visits to the plant, the process and operations were physically inspected to determine what aspects of the operations represented occupational hazards and what improvements could be made to make the operations safer. Methods of control, including ventilation, process enclosure, respiratory protection, and sanitation were reviewed for adequacy and recommendations made to the State. During the initial survey, workers were privately interviewed by NIOSH personnel to determine whether the workers were experiencing any recognizable symptoms resulting from exposure, as well as to determine the workers' degree of understanding of the potential hazards, the need to observe good work practices, and the proper use and care of personal protective equipment.

Air samples were collected on several occasions by personnel from the State Board of Health; analyses were provided by NIOSH. Both area and personal air samples were collected by NIOSH and State Board of Health personnel during the NIOSH follow-up survey.

Some samples were collected to measure the levels of total airborne particulates which were not analyzed for chemical composition. These samples were collected by using an MSA Model G portable battery-powered vacuum pump to draw air at a rate of 1.7 liters per minute through a preweighed, non-hygroscopic, polyvinyl chloride membrane filter. The amount of collected dust was determined gravimetrically (by re-weighing).

Some samples were collected to measure the levels of airborne mirex (and kepone, if present). These samples were collected using MSA Model G pumps to draw air at a rate of 1.7 liters per minute through a cellulose membrane filter. The collected dust was later analyzed by chemical analytical techniques described below. Initially, the filter was backed up by an impinger containing sodium hydroxide solution. The back-up impinger was discontinued after the initial survey when it was found that the filters had a collection efficiency greater than 95% and that some mirex was converted to kepone by the sodium hydroxide solution.

Personal employee exposures to airborne total dust and mirex were measured by having the workers wear the sampling pumps on their belts with the filters attached to their shirts as close as possible to the mouth and nose.

Mirex and kepone samples were analyzed by dissolving them in benzene/4% methanol solution, separating the mirex and kepone on various chromatographic packing materials when necessary, and quantitating the compounds using a gas chromatograph with an electron capture detector.

Bulk samples of technical grade mirex, soybean oil/mirex solution, ant bait, and floor sweepings were also analyzed for mirex and kepone content.

## V. Evaluation Criteria

### Kepone

Workers who have been exposed to kepone regularly at their jobs have experienced such adverse symptoms as uncontrolled weight loss, nystagmus, tremors, visual disturbances, nervousness, insomnia, pain in the chest and abdomen, and in some cases, infertility and loss of libido. A carcinogenesis bioassay conducted by the National Cancer Institute found that two different mammalian species (both rats and mice) exposed to tolerated doses in the diet exhibited a significant increase of hepatocellular carcinoma, as well as extensive hyperplasia of the liver. In view of these findings, NIOSH must assume that kepone is a potential human carcinogen. Since there is not sufficient data upon which to establish a safe level of exposure, NIOSH recommends that the workplace environmental level for kepone be limited to one microgram/cu m as a time-weighted average concentration for up to a 10-hour workday, 40-hour workweek, as an emergency standard. See the NIOSH publication, "NIOSH Recommended Standard for Occupational Exposure to Kepone", January 27, 1976.<sup>3</sup>

### Mirex

NIOSH has obtained from the U.S. Environmental Protection Agency (EPA) a transcript of expert testimony offered at a public hearing concerning the carcinogenicity of mirex.<sup>1</sup> This testimony presented evidence which shows that mirex is a demonstrated liver carcinogen in experimental animals and must be considered suspect of having the potential to produce cancer in humans. Other toxic effects indicated by animal experimentation include acute and chronic myocarditis (inflammation of the heart), abbreviated lifespan, necrosis of the liver, necrosis of the kidney, chronic nephritis, parathyroid hyperplasia, and reduced fertility.

A subsequent report by a group of investigators at the University of Mississippi Medical Center indicates that mirex suppresses the liver's normal ability to rid the body of harmful chemical compounds and that the result may be an accumulation of these chemicals in the body to potentially harmful levels.<sup>4</sup> Another finding of this group was that mirex may induce drug-metabolizing enzymes of the liver. These enzymes may produce a high potential for the formation of high levels of oxidative-type metabolites of toxic chemicals which enter the body. With many toxic chemicals, the oxidative metabolites are causative agents of lesions (some epoxides being carcinogenic) or are more toxic than the parent chemical. "If one integrates the observations that mirex and kepone are efficacious inducers and also impair the liver's ability to remove foreign chemicals from the body, what one arrives at is a sandwich effect. That is, an individual who is pre-exposed to these chemicals (mirex or kepone) is automatically predisposed to a lesion caused by another toxic chemical, carcinogens, at much lower levels of exposure."

There is no published recommended standard or exposure level guideline for occupational exposure to mirex. On the basis of the suspected carcinogenic effects of mirex, as well as its other potential effects, including reproductive health effects, it is recommended that exposure to mirex should be minimized to the maximum feasible extent.

## VI. Evaluation Results

### Initial Screening Survey of June 22, 1976

On June 22, 1976, a joint site visit to the mirex plant was made by NIOSH industrial hygienists from the Region IV office and by State Board of Health personnel from the Division of Occupational Safety and Health office in Jackson. Discussions were held with the plant manager and representatives of the Mississippi Department of Agriculture and Commerce to gather information about the plant operation, medical surveillance of workers, work practices, personal protective equipment, administrative controls, numbers of employees, and employee education and training. A walk-through survey of the plant was conducted, and bulk samples of technical grade mirex, ant bait, and a process intermediate were collected. A number of recommendations for short-term and long-range improvement of the safety and health of the work environment were made in the SHEFS-1 report to the plant and other involved officials disseminated by NIOSH on July 7, 1976.

During this initial screening survey, NIOSH personnel privately interviewed three of the most highly exposed employees to inquire about any adverse health effects, the extent of employees' knowledge of the toxicity of mirex, and the need for safe work practices. The employees did not report any symptoms or health problems associated with mirex exposure, and disclosed that managers at the facility had reported to the employees the experiences of kepone workers and some information about the potential dangers of mirex. Respiratory protective equipment and protective clothing were provided routinely to personnel handling technical grade mirex.

### July 15 and 16, 1976, Environmental Survey by State Board of Health Personnel

On July 15 and 16, 1976, Mr. Jack Covington, Industrial Hygienist, Division of Occupational Safety and Health, Mississippi State Board of Health, conducted air sampling at the plant using sampling media and some loaned equipment from NIOSH. During the 1-hour operation in which technical grade mirex is batched with soybean oil, personal air samples were collected from the mixing operator and his helper operating a lift truck to transport fiber drums of technical grade mirex from the storage room. Area air samples were collected at the weighing station and at the top of the mixing tank. Employees wore NIOSH-approved pesticide cartridge-type respirators during this operation. The breathing-zone air concentration of mirex for the mixing operator was  $7.5 \text{ mg/m}^3$ , and for the lift truck operator,  $7.3 \text{ mg/m}^3$ . The area sampler behind the scale measured  $15 \text{ mg/m}^3$  of mirex.

Since the ant bait was composed of only 0.3% mirex, employees handling finished bait were sampled for total dust only. Personal samples were collected for about a 2-hour period from the bag stacker ( $0.19 \text{ mg/m}^3$ ), the bagger ( $0.29 \text{ mg/m}^3$ ), and the bag stitcher ( $0.58 \text{ mg/m}^3$ ). An area sample was collected on the lift truck used for transporting bait bags ( $0.14 \text{ mg/m}^3$ ). The results of the air sampling from the July 1976 survey are summarized in Table 1.

The personal samples for mirex and several bulk samples of technical grade mirex, soybean oil, corn cob grits, and ant bait were analyzed by Dr. Samuel Tucker, Measurements Research Branch, DPSE, NIOSH. Dr. Tucker analyzed each sample for both mirex and kepone. No kepone was detected in any of the bulks or on the filters. Some kepone was found in the back-up impingers following the filter, but this is attributed to conversion of mirex to kepone in the sodium hydroxide absorbing solution. The NIOSH analyses did not detect kepone in the workplace.

In the latter part of July, EPA, which has responsibility for pesticide regulation, visited the mirex plant. EPA reported that kepone was detected in the technical grade mirex and in the ant bait. The levels found by EPA were 2 ppm kepone in the mirex-oil concentrate and 1 ppm kepone in the final ant bait. Dr. Tucker has discussed the analysis results with the EPA analyst. Dr. Tucker cannot explain precisely why EPA would have detected kepone, when NIOSH analyses do not indicate its presence. There are two possible variables. EPA may have used a somewhat different analytical procedure. Also EPA's samples were collected several weeks after the NIOSH samples. Both agencies are experienced in kepone analysis and would be expected to be quite proficient.

A follow-up study was planned to measure the effects of the installation of a new vacuum feeding system for adding the technical grade mirex to the soybean oil. However, the plant discontinued production of ant bait during the autumn of 1976 and did not resume production until January 1977.

#### January 1977 Surveys by State Board of Health Personnel

Several surveys were made at the plant shortly after resumption of production in January 1977. Sampling was performed by State Board of Health personnel. Air sampling filters, sampling equipment supplementation, and laboratory analysis of samples were furnished by NIOSH. The NIOSH contract laboratory which actually performed the analyses was the Utah Biomedical Test Laboratory (UBTL), University of Utah Research Institute, Salt Lake City, Utah.

On January 19, bulk samples of technical grade mirex were collected from three containers. By this time the technical grade mirex was being supplied from the Brazilian source.

On January 21, personal samples were collected from the two employees during the mirex-oil mixing operation utilizing the new vacuum feeding system. Results are given in Table 2. These samples were used to measure

total dust exposure only. Mirex and kepone content of the dust could not be analyzed since the proper type of filter for such analysis was not used. The samples indicate a dramatic reduction in dust exposure during the new vacuum feeding system in comparison to the old manual system (Table 1).

On January 25 personal and area air samples were collected during bait bagging, bag stitching, and bag stacking operations. Results are given in Table 3. Total dust levels were similar to those measured previously on July 15, 1976, (Table 1). Mirex exposure levels of baggers and stackers had not been measured previously. Mirex air levels were found to be less than 0.5 micrograms /cu m.

No kepone was detected in any of the air samples collected during the January 1977 surveys. Kepone concentrations of 5 to 7 ppm in the technical grade mirex were reported by the NIOSH contract laboratory. However, these results are considered questionable for reasons to be discussed later in this report. Therefore, kepone analysis results in technical grade mirex, oil solution, and ant bait will not be reported here.

#### March 1977 Follow-up Survey

A final follow-up survey was conducted jointly by NIOSH Region IV personnel and State Board of Health personnel on March 1 and 2, 1977. Air samples for mirex, kepone, and total dust were collected throughout the bait formulation process. Results for the mirex-oil mixing are given in Table 4.

Because of previous discrepancies between NIOSH and EPA in the detection of kepone at the mirex plant, duplicate samples were collected and sent to both the EPA Office of Pesticide Programs and the NIOSH contractor, UBTL, for analysis.

The total dust levels measured during the mixing operation were similar to those measured during the January 1977 survey (Table 2). The mirex-in-air levels were found to have been reduced dramatically from the levels in the old manual mixing operation (Table 1). Levels of mirex in the air in the breathing zones of the workers had been reduced from 7 and 15 milligrams/cu.m. to 0.1 and 0.8 milligrams/cu.m.

Results of air samples in the final bait bagging, stitching, stacking, and storage operations are given in Table 5. The levels of airborne mirex and total dust were similar in magnitude to levels measured on previous surveys.

Neither the EPA nor UBTL could detect any kepone in any of the air samples. However, a discrepancy between laboratories again occurred on the bulk samples of technical grade mirex and the ant bait. This time EPA was unable to detect any kepone, but the UBTL reported kepone in the bulk solids as follows:

<u>Sample</u>	<u>Mirex</u>	<u>Kepone</u>
(1) Technical grade mirex, can # 45, lot No. 478	91%	5.5ppm
(2) Technical grade mirex, can #74, lot No. 15	88%	8.4ppm
(3) Fire ant bait	0.78 mg/g	none detected
(4) Old floor sweepings	1.10 mg/g	2.1ppm

The UBTL identification of kepone in the samples was based upon gas chromatography retention time. The presence of kepone was not confirmed by mass spectrometry. UBTL required in excess of 7 months to complete the analyses and revised the reported findings twice. For some of the bulks, retention times for sample peaks and a kepone standard could not be matched on more than one chromatographic column. Because of these difficulties and uncertainties in the UBTL analysis, and because the findings were not verified by another proficient and independent laboratory, the UBTL kepone results must be considered suspect. The presence of kepone in the bulk samples was not clearly confirmed or disproved in this investigation. What is clear is that no kepone was detected in any of the air samples by either laboratory.

## VII. Conclusions

There is insufficient human exposure, medical, and epidemiological data on mirex to state conclusively its adverse health effects on humans. Animal exposure data indicate that mirex is a suspected carcinogen and that it may have other adverse effects on physiological functions and health.

Improved engineering controls, housekeeping, and personal protective equipment have greatly reduced the generation of airborne mirex at the Mississippi formulation facility. Airborne exposure to workers is generally less than one microgram per cubic meter during the bait bagging and handling. The weighing of technical grade mirex and the addition of mirex to the soybean oil still generates significant mirex dust for a short period of time. The wearing of respiratory protective devices and scrupulous personal sanitation are probably sufficient to protect the exposed employees during the weighing and mirex-oil mixing operations.

Kepone, if present in the air of the workplace, is at a concentration too low to be detected by the measurements made by the NIOSH investigators. Mirex, not kepone, appears to be the agent of concern.

Adherence to the following recommendations is urged in order to safeguard formulation workers as much as feasible until a safer alternative to mirex is available for the control of fire ants.

## VIII. Recommendations

### A. Respirator Program

The use of respiratory protective devices is required to provide protection of workers from inhalation of mirex whenever technical grade mirex is being handled.

The respirator program should be designed in accordance with NIOSH recommendations<sup>5</sup> and must conform to OSHA requirements as set forth in Title 29, Code of Federal Regulations, Part 1910, Section 134.<sup>6</sup> Specifically, the respirator program should include the following elements:

1. Written operating procedures governing the selection and use of respirators should be developed.
2. Respirators should be selected which are suitable to protect against the hazard to which workers are exposed.
3. Only respirators approved by NIOSH and MSHA shall be used, when available.
4. The users must be instructed and trained in the proper use of the respirators and their limitations.
5. Respirators should be assigned to individual workers for their exclusive use.
6. Respirators shall be regularly inspected, cleaned, disinfected, and repaired when necessary.
7. Respirators shall be stored in a convenient, clean and sanitary location.
8. Other specific OSHA requirements are found in 29 CFR 1910.134.

### B. Bagging Operation

Air sampling has indicated that employee exposure to airborne mirex in this operation is generally one microgram per cubic meter or less, a relatively low exposure level. Nevertheless, considerable skin contact is present in this operation. The manual bagging is probably the most "unenclosed" and crude operation in the production process. Plant managers are urged to continue to search for an impervious glove which is compatible with rapid manual handling of the bags, or to consider installation of an automated bagger and stitcher.

### C. Medical Surveillance of Exposed Workers

Unfortunately there is not a large amount of data available on mirex. It is known that mirex is absorbed by inhalation and by oral ingestion and that its greatest point of concentration is in the adipose tissue of animals and man. Animal studies have shown mirex to cause liver tumors in those animals that were fed a diet containing mirex over a prolonged period of time. However, there is no human data available on this subject. In man there have been suggestions that increased levels of mirex cause disarrangement of normal reproductive function affecting both males and females, but seeming to affect females to a greater degree. High blood concentrations of mirex can cause tremor as well as increased hepatic fat content and enlarged liver. In view of the inconclusive data the following recommendations for medical surveillance are suggested at this time.

1. Initial and periodic blood mirex levels. The standard method of collection requires approximately 10 cc's of whole blood in EDTA, the red cells being spun down and the plasma removed and frozen before analysis.
2. Initial and periodic (no longer than one year intervals) liver profiles (including SGOT, SGPT, Aklphos, Bilirubin).
3. A bromsulphalein (BSP) clearance test is recommended for screening of new workers and periodic testing for workers already employed to assess overall liver function.
4. A yearly physical examination with particular emphasis on signs of hepatic, neurologic, and reproductive abnormalities.
5. Animals exposed experimentally to mirex have been found to have reduced reproductive fertility. Possible reproductive health effects of mirex on humans are not known at this time. Past experiences with other pesticides, such as dibromochloropropane (DBCP), where reproductive health effects in animal experiments have later been observed in occupationally exposed humans, indicate that surveillance is important as a precautionary measure.

A pre-employment semen analysis is highly recommended for male workers being newly hired into areas of mirex exposure. Semen analysis on all currently employed male workers exposed to mirex is recommended as early as feasible. These tests should include tests for sperm density and sperm morphological examination. Follow-up semen tests should be scheduled as appropriate, based on initial findings and any major changes in conditions of exposure at the workplace. (Procedures and protocols for semen testing are available from Channing Meyer, M.D.)

6. Since epidemiologic data on humans exposed to mirex is not available, it is important to follow these workers in future years. Personnel and medical records of mirex plant employees should be retained by the state for at least 30 years. These records should include, for each employee, the job title, environmental exposure measurements, and other medical data regarding medical surveillance test results, illnesses, hospitalizations, surgery, disabilities, and death.

#### D. Sanitation

It is most important that workers who are handling a suspected carcinogen be afforded safeguards to minimize possible ingestion of the suspect agent and to prevent the agent from being taken home on the body or clothing, or being transported inadvertently out of the production area.

NIOSH has issued a management guide to the regulation and control of carcinogens. It is recommended that this guide be used to model a plant program for regulating exposure areas and contamination control. Highlights of these guidelines include:

1. Eating, drinking, smoking, chewing tobacco, and the use of cosmetics are forbidden in production areas, as well as the storage of food, beverage containers, cosmetics, and chewing and smoking materials.
2. Workers should be required to shower and change into clean clothes prior to leaving the plant.
3. Eating, drinking, and smoking should be allowed only in designated, non-contaminated areas. Prior thorough hand and face washing should also be required.
4. Separate lockers should be provided for storage of street clothing and work clothing (including uniforms, personal protective equipment, and shoes).

#### E. Vacuum System Filtration Maintenance and Testing

The vacuum system, whereby air is used to transport technical grade mirex from the storage drums to the hopper for mixing with soybean oil, is equipped to filter the air used in the system three times prior to discharge back into the room. If leakage should develop or filtration efficiency drop, large amounts of mirex could be discharged into the workroom. Several recommendations are given to minimize this hazard.

1. Filters and seals on the system should be inspected on a periodic schedule. Filters should be replaced when needed, and new gaskets or other sealing devices installed whenever there are signs of wear or decomposition.
2. Air sampling for airborne mirex should be taken periodically during the routine operation of the vacuum system to ascertain the continuing effectiveness of the filtration system.
3. The management should give strong consideration to installing a mechanism for discharging the air outside of the building. If this is done, the discharge stack should be 1.3 to 2 times the height of the building to insure that discharged mirex will not be recirculated into the building.<sup>8</sup>

#### IX. References

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5. "A Guide to Industrial Respiratory Protection", NIOSH Publication No. 76-189, June 1976.
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TABLE 1

Air Sampling Results  
(Samples Collected by State Board of Health Personnel)

Mirex Plant  
Mississippi Authority for the Control of Fire Ants  
Prairie, Mississippi

July 15, 1976

<u>Operation</u>	<u>Sampling Station</u>	<u>Type of Sample</u>	<u>Sample No.</u>	<u>Sampling Period</u>	<u>Air Volume Sampled (Liters)</u>	<u>Contaminant Concentration (mg./cu.m.)</u>	
						<u>Total Dust</u>	<u>Mirex</u>
Mirex-oil Mixing	Mixing Operator	Personal Breathing Zone	C7852-251	4:16 PM - 5:02	44.9	-	7.5
Mirex-oil Mixing	Mixing Operator	Personal Breathing Zone	-252	4:16 PM - 5:02 PM	70.6	3.0	-
Mirex-oil Mixing	Lift Truck Operator	Personal Breathing Zone	-253	4:17 PM - 5:03 PM	51.7	-	7.3
Mirex-oil Mixing	Behind Weighing Scale	Fixed Area Sampler	-254	4:02 PM - 5:07	83.7	-	15
Mirex-oil Mixing	Rail at top of mix tank	Fixed Area Sampler	-255	4:00 PM - 5:05 PM	76.2	-	3.2

-----July 16, 1976-----

Bait Bagging	Bagger	Personal Breathing Zone	-260	9:19 AM - 11:39 AM	173	0.29	-
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Table 1 (Continued)

<u>Operation</u>	<u>Sampling Station</u>	<u>Type of Sample</u>	<u>Sample No.</u>	<u>Sampling Period</u>	<u>Air Volume Sampled (Liters)</u>	<u>Contaminant Concentration (mg./cu/m.)</u>	
						<u>Total Dust</u>	<u>Mirex</u>
Bait Bagging	Bag Stitcher	Personal Breathing Zone	-261	9:20 AM - 11:40 AM	156	0.58	-
Bag Stacking	Stacker	Personal Breathing Zone	-259	9:12 AM - 11:29 AM	211	0.19	-
Bag Storage	Lift Truck Operator	Sampler on Truck	-262	9:25 AM 11:29 AM	140	0.14	-

Table 2

Air Sampling Results  
Mirex-Oil Mixing Operation  
(Samples Collected by State Board of Health Personnel)

Mirex Plant  
Mississippi Authority for the Control of Fire Ants  
Prairie, Mississippi

January 21, 1977

<u>Sampling Station</u>	<u>Type of Sample</u>	<u>Sample No.</u>	<u>Sampling Period</u>	<u>Air Volume Sampled (Liters)</u>	<u>Total Dust Concentration (mg./cu.m.)</u>
Mixing Operator	Personal Breathing Zone	V2176	11:25 AM - 12:27 PM	109	N.D.*
"	"	V2859	"	"	N.D.
Helper	Personal Breathing Zone	V2127	11:26 AM - 12:27 PM	109	N.D.
Weigh scale, lower portion	Area Sampler	V2324	11:27 AM - 12:27 PM	110	0.27
Weigh scale, upper support	Area	V2330	11:26 AM - 12:27 PM	113	0.44
Rail adjacent to air discharge	Area	V2334	11:26 AM - 12:27 PM	96	0.21

\* N.D. = None detected

Table 3

Air Sampling Results  
(Samples Collected by State Board of Health Personnel)

Mirex Plant  
Mississippi Authority for the Control of Fire Ants  
Prairie, Mississippi

January 25, 1977

<u>Operation</u>	<u>Sampling Station</u>	<u>Type of Sample</u>	<u>Sample No.</u>	<u>Sampling Period (min.)</u>	<u>Air Volume Sampled (Liters)</u>	<u>Contaminant Concentration</u>	
						<u>Total Dust (mg./cu.m.)</u>	<u>Mirex * (µg./cu.m.)</u>
Bait Bagging	Bagger	Personal Breathing Zone	C7852 -340	106 min.	192	-	0.26
"	"	"	-341	106	152	0.46	-
Bag Stitching	Stitcher	"	-342	105	188	-	0.37
Bagging	Bagging Area	Area	-343	104	166	0.12	-
Bagging	Bagging	Area	-344	103	186	-	0.11
Stacking	Stacker	Personal Breathing Zone	-345	103	190	-	N.D.
Stacking	Stacking	Area	-346	103	161	0.06	-

\* N.D. = None detected

µg./cu.m. = micrograms of mirex/cubic meter of air

Table 4

Air Sampling Results  
Vacuum-Fed Mirex Weighing and Mixing Operation

Mirex Plant  
Mississippi Authority for the Control of Fire Ants  
Prairie, Mississippi

March 1, 1977

<u>Sampling Station</u>	<u>Type of Sample</u>	<u>Sample No.</u>	<u>Sampling Period</u>	<u>Air Volume Sampled (liters)</u>	<u>Contaminant Concentration</u> <u>Total Dust</u> (mg./cu.m.)	<u>Mirex</u> (ug./cu.m.)	<u>Lab</u>
Weigh Scale	Fixed Area Sampler	V1610	4:00 PM - 4:35 PM	63	0.3	-	UBTL
Mirex Hopper Over Mix Tank	Area	V1640	4:00 PM - 4:36 PM	61	1.5	-	UBTL
Forklift Oper. (& Helper)	Personal Breathing Zone	AA-F1	4:00 PM - 4:37 PM	68	-	830	UBTL
"	"	AA-F2	"	67	-	280	EPA
Mixer	Personal Breathing Zone	AA-F3	4:00 PM - 4:37 PM	67	-	171	UBTL
"	"	AA-F4	"	65	-	73	EPA
Air Discharge from Vacuum System	Area	AA-F5	4:00 PM - 4:35 PM	65	-	35	UBTL
"	"	AA-F6	"	63	-	31	EPA
Top of Mix Tank (at inlet)	Area	V1637	4:00 PM - 4:36 PM	52.5	0.2	-	UBTL

Table 5

Air Sampling Results  
Bait Bagging, Stitching, Stacking, and Storage Operations

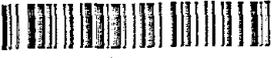
Mirex Formulation Plant  
Mississippi Authority for the Control of Fire Ants  
Prairie, Mississippi

March 2, 1977

<u>Operation</u>	<u>Sampling Station</u>	<u>Type of Sample</u>	<u>Sample No.</u>	<u>Sampling Period</u>	<u>Air Volume Sampled (Liters)</u>	<u>Contaminant Concentration</u>		<u>Lab</u>
						<u>Total Dust (mg./cu.m.)</u>	<u>Mirex (ug./cu.m.)</u>	
Bagging	Bagger	Personal	AA-F7	7:41 AM - 3:43 PM	868	-	0.70	UBTL
Bagging	"	"	AA-F8	"	844	-	0.40	EPA
Bagging	Stitcher	Personal	V1627	7:43 AM - 3:44 PM	866	0.3	-	UBTL
Bag Stacking	Stacker	Personal	AA-F9	7:47 AM - 3:41 PM	806	-	0.71	UBTL
Bag Stacking	Stacker	Personal	AA-F10	7:47 AM - 3:41 PM	877	-	0.27	EPA
Bag Unloading	Unloader	Personal	V1606	7:40 AM - 3:42 PM	868	0.2	-	UBTL
Bait Bag Storage	Lift Truck Operator	Personal	V1630	7:48 AM - 3:46 PM	860	0.6	-	UBTL
Laundry and Office	Laundry Person	Personal	AA-F11	7:52 AM - 3:26 PM	840	-	1.2	UBTL

Table 5 (Continued)

<u>Operation</u>	<u>Sampling Station</u>	<u>Type of Sample</u>	<u>Sample No.</u>	<u>Sampling Period</u>	<u>Air Volume Sampled (Liters)</u>	<u>Contaminant Concentration</u>		<u>Lab</u>
						<u>Total Dust (mg./cu.m.)</u>	<u>Mjrex (ug./cu.m.)</u>	
Bait Bagging	Bait Bagging	Area	V1628	8:10 AM - 3:45 PM	682	0.3	-	UBTL
"	"	"	AA-F12	"	864	-	0.72	UBTL
"	"	"	AA-F13	"	774	-	0.39	EPA

REPORT DOCUMENTATION PAGE		1. REPORT NO.	2.	 PB95-137410	
4. Title and Subtitle Hazard Evaluation and Technical Assistance Report No. TA-76-74, Mississippi Authority for the Control of Fire Ants, Mirex Formulation Plant, Prairie, Mississippi			5. Report Date 1978/05/00		
7. Author(s) Eoper, Jr., C. Paul			8. Performing Organization Rept. No. TA-76-74		
9. Performing Organization Name and Address National Institute for Occupational Safety and Health 4676 Columbia Parkway Cincinnati, Ohio 45226			10. Project/Task/Work Unit No.		
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12. Sponsoring Organization Name and Address National Institute for Occupational Safety and Health 4676 Columbia Parkway Cincinnati, Ohio 45226			13. Type of Report & Period Covered		
			14.		
15. Supplementary Notes					
16. Abstract (Limit: 200 words) A hazard evaluation and technical assistance survey of the Mississippi Authority for the Control of Fire Ants, Mirex Formulation Plant (SIC-2879), Prairie, Mississippi to determine possible hazardous exposure of workers to mirex (2385855) was conducted. Air samples, bulk samples and floor sweepings were analyzed for mirex and kepone (143500) content. In addition, employees were interviewed concerning their medical and occupational history. Breathing zone air concentration of mirex for the mixing operator was 7.5mg/m3. The area samples near the scale measured 15mg/m3 of mirex. Kepone, if present, was at concentrations too low to be measured. The facility has implemented a number of improvements since the survey, such as engineering controls, better housekeeping, and improved personal protective equipment. These changes have greatly reduced the exposure of employees to airborne mirex. There is insufficient human exposure, medical, and epidemiological data on mirex to state conclusively its adverse health effects on humans. With the present limited knowledge about mirex toxicity, the precise degree of health risk presented by this rather low exposure is unknown.					
17. <del>Document Analysis &amp; Descriptors</del> a. NIOSH-Publication; NIOSH-Author; NIOSH-Technical-Assistance-Report; Region-4; Air-sampling; Air-quality-measurement; Hazards-; Industrial-hygiene; Chlorinated-hydrocarbon-insecticides; Chlorinated-hydrocarbons; Insecticides-; Biocides-; Pesticides-; TA-76-74; Hazard-Unconfirmed; Agricultural-chemicals b. Identifiers/Open-Ended Terms  c. COSATI Field/Group					
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