NIOSH HEALTH HAZARD EVALUATION REPORT

HETA #2003-0248-2940
Florida Department of Agriculture and Consumer Services
Gainesville, Florida

June 2004

DEPARTMENT OF HEALTH AND HUMAN SERVICES
Centers for Disease Control and Prevention
National Institute for Occupational Safety and Health

PREFACE

The Hazard Evaluation and Technical Assistance Branch (HETAB) of the National Institute for Occupational Safety and Health (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 (OSHA) 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 employers 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.

HETAB also provides, upon request, technical and consultative assistance 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. Mention of company names or products does not constitute endorsement by NIOSH.

ACKNOWLEDGMENTS AND AVAILABILITY OF REPORT

This report was prepared by Amee Patel of HETAB, Division of Surveillance, Hazard Evaluations and Field Studies. Field assistance was provided by Max Kiefer. Analytical support was provided by Ardith Grote of NIOSH, Division of Applied Research and Technology. Desktop publishing was performed by Deborah Gibson and Shawna Watts. Review and preparation for printing were performed by Penny Arthur.

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For the purpose of informing affected employees, copies of this report shall be posted by the employer in a prominent place accessible to the employees for a period of 30 calendar days.

Highlights of the NIOSH Health Hazard Evaluation

Evaluation of exposure to ammonium perfluorooctanoate (APFO) at the Florida Dept. of Agriculture and Consumer Services (FDACS)

In January 2004, NIOSH representatives looked at exposure to APFO at the FDACS and determined that the facility was not widely contaminated with APFO.

What NIOSH Did

- Collected surface samples to assess residual APFO in work areas.
- Observed the Fluon® application process.
- Reviewed personal protective equipment (PPE) practices and storage and handling procedures.
- Discussed concerns about exposure to APFO with employees.

What NIOSH Found

- There was no widespread APFO contamination in the facility (found in 6 of 24 samples).
- Latex gloves are worn when applying Fluon® to trays.
- Employees are concerned about exposure to APFO during Fluon® application and when handling dried Fluon®.

What FDACS Managers Can Do

- Implement a PPE program and provide nitrile gloves to employees.
- Improve housekeeping practices and keep all work surfaces clean.
- Prohibit eating and drinking in areas where Fluon® is used.

What the FDACS Employees Can Do

- Thoroughly wash hands before eating, drinking, or smoking and after handling Fluon®.
- Clean up spills of Fluon® promptly before the spilled material dries.

What To Do For More Information:
We encourage you to read the full report. If you would like a copy, either ask your health and safety representative to make you a copy or call 1-513-841-4252 and ask for HETA Report #2003-0248-2940

Health Hazard Evaluation Report 2003-0248-2940
Florida Department of Agriculture and Consumer Services
Gainesville, Florida
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SUMMARY

On January 20, 2004, National Institute for Occupational Safety and Health (NIOSH) investigators conducted a site visit at the Florida Department of Agriculture and Consumer Services (FDACS) facility in Gainesville, FL. The site visit was conducted in response to a management request for a health hazard evaluation (HHE) to assess worker exposure to ammonium perfluorooctanoate (APFO), a component in a material (Fluon®) used in the Biological Control Rearing Facility (BCRF). No health problems were reported; however, employees were concerned because of recent media reports regarding environmental and biological persistence of this material.

Fire ants are imported pests that are thriving in southern U.S. The BCRF employees cultivate fire ants to raise phorid flies, the ants' natural predator. The process includes the use of Fluon® to coat holding trays for containing imported fire ants. Fluon® is the only material that, when applied and dried, offers such low resistance that the ants cannot climb out of the containers. Because Fluon® degrades with time, it must be routinely reapplied to the containers. Employees were concerned about potential exposure to APFO during the application process and safe handling procedures when using Fluon®. The application process takes place outdoors behind the BCRF. Technicians wear latex gloves when applying the material to trays; no other protective equipment is worn.

Twenty-four surface samples for APFO analysis were collected during the survey. Although APFO was detected, the surface sample results did not indicate widespread contamination of APFO throughout the BCRF. APFO was detected in 6 samples: Imported Fire Ant (IFA) Trailer – center of worktable and left side of sink; Attack Room 1 – rim of brooding cup; IFA Workroom – Fluon® work cart handles; FAST building, refrigerator #2 (not for food consumption)– inside floor and outside door handle.

NIOSH investigators have not determined the hazard associated with exposure to APFO at the FDACS. However, the surface sampling results did not show substantial contamination of APFO throughout the BCRF, thus reducing exposure to APFO. Because APFO was detected in some areas, additional cleaning of surfaces such as worktables, sinks, floors, and handles is warranted. All work surfaces should be cleaned using wet-methods (e.g. damp cloth). Objects coated with Fluon®, such as trays, sieves, and brooding cups, should only be handled with gloves. Gloves worn during Fluon® application and when handling Fluon® coated objects should be properly discarded after application and before touching other surfaces. Food and beverage consumption should not take place in areas where Fluon® is handled or applied. Additional recommendations to improve housekeeping and work practices are included in the Recommendations section of this report.

Keywords: SIC 9641 (Regulation of Agriculture Marketing and Commodities). Ammonium Perfluorooctanoate, APFO, Perfluorooctanoic Acid, PFOA, Surface Sampling.

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INTRODUCTION

On May 2, 2003, the National Institute for Occupational Safety and Health (NIOSH) received a management request for a health hazard evaluation (HHE) at the Florida Department of Agriculture and Consumer Services (FDACS) facility in Gainesville, FL. On January 20-21, 2004, NIOSH investigators conducted a site visit to assess worker exposure to ammonium perfluorooctanoate (APFO), a component in a material (Fluon®) used in the Biological Control Rearing Facility (BCRF). No health problems were reported; however, employees were concerned because of recent media reports about this material.

The objectives of the site visit were to understand all uses of Fluon® at the BCRF and review work areas of concern, application processes, personal protective equipment practices, and storage and handling procedures. Additional activities included discussions with employees regarding health and safety concerns, and the collection of environmental samples (surface and bulk) to assess contamination in work areas. An interim letter with findings and recommendations was sent to the requestor and employee representative on March 3, 2004.

BACKGROUND

Facility Description

The FDACS Division of Plant Industry (DPI) complex in Gainesville, Florida houses the Entomology, Nematology, and Plant Pathology Laboratories in a contiguous single-story facility that includes administrative support groups and clerical personnel. In addition to various laboratory functions, there is an extensive entomology museum and several research greenhouses. Scientists in all three laboratories provide direct support to DPI plant inspectors and assist citizens who have questions regarding plant problems. Activities conducted at the DPI laboratory complex include pest and plant disease identification, soil inspection, electrophoresis, insect preservation, and research. A wide variety of laboratory chemicals are used for these procedures. Although each department (Entomology, Nematology, Plant Pathology) has a main laboratory work area, many scientists have work stations in their offices equipped with small amounts of chemicals, slide preparation materials, and microscopes. Each laboratory has a dedicated chemical storage area with shelf storage and a flammable storage cabinet for laboratory chemicals.

The BCRF, or Sterile Fly (a large function is Caribbean Fruit Fly rearing) facility, is located in a separate building constructed in 1987 on the DPI complex. The building encompasses approximately 15,000 square feet (ft^2) with the main portion of the facility accessible only through an air-lock system that routes employees through a locker room prior to entering the rearing area. This is intended to prevent unwanted pests from entering the facility and fertile Caribbean fruit flies (Caribflies) from escaping. Positive and negative air pressure controls within the facility help prevent pest contamination problems. Temperature and humidity are also controlled.

Phorid Fly Rearing

In August 2001, a USDA-sponsored project to control imported fire ants (IFA) via a biological control agent (phorid fly - *Pseudacteon tricuspis*) began at the BCRF. Nine employees are assigned to this project, which requires cultivating fire ants to raise phorid flies. In the first year, about 450,000 phorids were produced from six specialized attack boxes, used mostly to increase production and improve rearing techniques. Plans call to increase the colony to 16 attack boxes as flies, ants, and personnel permit. At the time of the NIOSH visit, Attack Room 1 had eight Attack Boxes (14 trays per box), and there were three operational Attack Boxes in Attack Room 2.

Phorid rearing is a labor intensive process as the adult phorid lives only a couple of days. Because of the short life cycle of the fly, large numbers of ants and phorids are needed to maintain the colony. To start the rearing process, IFA and

brood are collected from various field sites. When they are brought back to the facility, they are separated from the soil by flooding with water. The ants and brood float to the top, are collected from the buckets, and then are sized to accommodate the various species of phorids.

Each group of similarly sized ants is weighed, and the ants and brood are placed in covered holding cups for 30 minutes. This allows the ants to form a bond with the brood. Each cup is emptied into a plastic tray, 14 of which are placed into each attack box.

For each tray in the attack box, two cups are suspended from strings - one cup is raised while the other is lowered. As the ants are introduced, they begin to move the brood to the lowered cup. After 10 minutes the other cup is lowered. This causes the ants to trail, which signals the phorids to attack. The phorids parasitize the ants by injecting an egg into the thorax. Each group of ants is exposed for 48 hours with a nocturnal cycle when the lights are off and the cups are stationary. At this time, the ants rest under the lowered cup and the flies rest in various parts of the attack box.

After the 48-hour exposure period, the parasitized ants are removed, separated from the brood, and placed into holding containers for 42 days. Three times a week the dead ants are removed, the sugar wick is changed, and the moisture block is watered to maintain humidity starting at day 10. The dead ants are spread out onto a plaster; at this stage of development the parasitized ant heads separate from the body.

Fluon® Use and Application

The process to raise the phorid fly was transferred from the USDA and included the use of Fluon® as a material to coat holding trays for containing imported fire ants. Chemical pest control agents are not allowed at the rearing facility, and Fluon® is the only material that, when applied and dried, offers such low resistance that the ants cannot climb out of the containers. Talc is used occasionally and sparingly, because it is harmful to the ants. Because the Fluon® material degrades with time, it must be applied repeatedly.

Fluon® is a fluoropolymer dispersion, which consists of less than 0.5% APFO. The dispersion is milky in appearance and is viscous. It is contained in sealed five-gallon buckets and stored in refrigerator #2 (a non-food, walk-in refrigerator) in the Florida Accelerator and Services Technology (FAST) building. When needed, a technician transfers Fluon® into a half-gallon plastic container. The transfer usually takes place on the back deck; however, Fluon® is occasionally poured into the container inside the refrigerator. The smaller plastic container is placed in a white tray on a work cart and stored in the IFA Workroom. Food coloring is added to Fluon® to make it visible when it is applied to the trays.

Four different sized containers require Fluon® application: 1) large plastic trays for storing ants collected from the field, 2) white plastic attack trays sized 16 inches by 11 inches, 3) holding trays which are Rubbermaid® plastic food storage bins (#6), and 4) holding cups which are small Ziplock® food storage containers. Also, brooding cups and sieves that separate ants by size are painted with Fluon®. Any one of the five technicians applies Fluon®.

Trays needing Fluon® are first washed in the sink. Most trays are cleaned in the IFA Workroom; however, trays used in the IFA Trailer are cleaned either in the sink located inside the trailer or in the Diet Mix Room. Trays are soaked in cold water, rinsed, and scrubbed with a sponge to scrape off dried Fluon®. The cleaning process takes approximately ten minutes. The trays are then air dried, and the sponge is rinsed immediately after its use. When cleaning, technicians wear commercially–available reusable dishwashing gloves.

Approximately 30 holding trays are coated with Fluon® three times a week; the attack trays are coated with Fluon® when needed, averaging 10 trays a month. Trays requiring Fluon® application are loaded onto the work cart in the IFA Workroom and pushed outside to the back

of the BCRF. Fluon® is painted around all four sides of the tray with a sponge brush. After Fluon® has been applied, the tray is turned upside down on a table draped with a sheet of plastic to catch drippings, and allowed to dry for approximately 30 minutes. Painting Fluon® onto trays is scheduled around rain. Occasionally when this cannot be done, trays are painted in the Diet Mix room with the garage doors open.

When all trays are painted and dried, excess Fluon® is wiped off with a paper towel. The trays are loaded onto the cart and pushed back to the IFA Workroom. The sponge brush is rinsed out with cold water in the sink and allowed to dry.

Worker Health Concerns

Employee concerns began in March 2003 when information about the persistence of APFO in the environment and in humans was published in the media. Before concerns arose, Fluon® was painted onto trays inside the IFA Workroom, and technicians applying the material did not wear gloves. After media reports were released, the process was moved outside behind the BCRF, and employees began wearing chemical protective gloves (Ansell 394, natural rubber latex gloves). However, the Fluon® dried and "caked" onto the gloves, and the gloves could not be reused as they did not provide adequate flexibility. Technicians then began using disposable latex gloves for this task.

METHODS

Upon receipt of the HHE request, NIOSH investigators obtained background information about the facility, process, and specific use of APFO and scheduled a site visit. Additionally, they did a literature search regarding APFO to obtain current toxicological and analytical information. On January 20-21, NIOSH investigators made a site visit to the Gainesville facility. An opening conference was held with employers, an employee representative, and others familiar with the Phorid Fly/Fire Ant rearing process and use of Fluon®. During this meeting, specific concerns about APFO were discussed. Background information regarding the BCRF, employee job descriptions, status of safety and health concerns, and future plans regarding the use of Fluon® were also discussed. Following this meeting a walkthrough evaluation of the facility was conducted to review the process, layout, and areas where Fluon® was used and stored. After completing the walkthrough, an environmental evaluation strategy was developed and 28 surface samples were collected from various areas where Fluon® is used and from control areas where no Fluon® is expected. A closing meeting was held with management and employee representatives to review preliminary findings and recommendations.

Surface Samples

Wipe samples were collected to determine the extent of APFO surface contamination on work stations, tables, door handles, and desks. These samples were collected with 37 mm glass fiber filters and Whatman Smear Tabs® moistened with deionized water. When possible, approximately 100 square centimeters (cm^2) of surface area was wiped with each moistened gauze pad. The samples were collected according to the surface sampling protocol described in the OSHA Industrial Hygiene Technical Manual[1] and NIOSH Manual of Analytical Methods 4th ed.[2] The samples were placed in individual labeled conical vials and submitted, with blanks, to a NIOSH laboratory for analysis. Bulk samples of Fluon® were also obtained and submitted for analysis under separate shipment. The NIOSH laboratory developed a new analytical method for the detection of APFO in surface wipe samples. The samples were placed in a derivatizing agent and analyzed using a gas chromatograph with a mass selective detector (GC-MSD). Areas sampled were as follows:

- *IFA Trailer* - work desk, main worktable, wash sink counter
- *IFA Workroom* - main worktable, wash sink counter, Supervisor's desk, Fluon® work cart handles, scope table, inside wash glove

- *Attack Room 1* - attack box B bottom shelf, attack box A latches, inside right door panel, rim of brooding cup
- *Ant Holding Room* - surface of table, inside right door handle, 10-day holding tray, tray before washing
- *Paint Area* - outside of door right handle, inside of door right handle
- *Diet Mix Room* - adjacent to wash sink
- *FAST building* - refrigerator #2 floor, refrigerator #2 outside door handle
- *BCRF Office 103* - Computer Desk
- *DPI Complex* - Room A-1011 Table

EVALUATION CRITERIA

As a guide to the evaluation of the hazards posed by workplace exposures, NIOSH field staff employ environmental evaluation criteria for the assessment of a number of chemical and physical agents. These criteria are intended to suggest levels of exposure to which most workers may be exposed up to 10 hours per day, 40 hours per week for a working lifetime without experiencing adverse health effects. It is, however, important to note that not all workers will be protected from adverse health effects even though their exposures are maintained below these levels. A small percentage may experience adverse health effects because of individual susceptibility, a pre-existing medical condition, and/or a hypersensitivity (allergy). In addition, some hazardous substances may act in combination with other workplace exposures, the general environment, or with medications or personal habits of the worker to produce health effects even if the occupational exposures are controlled at the level set by the criterion. These combined effects are often not considered in the evaluation criteria. Also, some substances are absorbed by direct contact with the skin and mucous membranes, and thus potentially increase the overall exposure. Finally, evaluation criteria may change over the years as new information on the toxic effects of an agent become available.

The primary sources of environmental evaluation criteria for the workplace are: (1) NIOSH Recommended Exposure Limits (RELs),[3] (2) the American Conference of Governmental Industrial Hygienists' (ACGIH®) Threshold Limit Values (TLVs®),[4] and (3) the U.S. Department of Labor, Occupational Safety and Health Administration (OSHA) Permissible Exposure Limits (PELs).[5] Employers are encouraged to follow the OSHA limits, the NIOSH RELs, the ACGIH TLVs, or whichever are the more protective criteria.

OSHA requires an employer to furnish employees a place of employment that is free from recognized hazards that are causing or are likely to cause death or serious physical harm [Occupational Safety and Health Act of 1970, Public Law 91–596, sec. 5(a)(1)]. Thus, employers should understand that not all hazardous chemicals have specific OSHA exposure limits such as PELs and short-term exposure limits (STELs). An employer is still required by OSHA to protect their employees from hazards, even in the absence of a specific OSHA PEL.

A time-weighted average (TWA) exposure refers to the average airborne concentration of a substance during a normal 8- to 10-hour workday. Some substances have recommended STEL or ceiling values which are intended to supplement the TWA where there are recognized toxic effects from higher exposures over the short-term.

Ammonium Perfluorooctanoate

APFO is a principal salt of perfluorooctanoic acid (PFOA). The acronym PFOA is used to indicate not only perfluorooctanoic acid itself, but also its principal salts. PFOA (which includes APFO) is extremely stable and degrades slowly; therefore, it persists in the environment. Animal studies demonstrate that PFOA is absorbed by ingestion, inhalation, and dermal contact and is not metabolized. Animal studies have shown that PFOA distributes primarily to the liver, plasma, and kidney, and, to a lesser extent, other tissues and organs of the body. PFOA exposure increases the incidence of liver, pancreas, and Leydig cell adenomas in

lab animals.[6] It is eliminated primarily through the urine and feces.

Interactions between cigarette smoking and exposure to PFOA may transform PFOA into a more harmful agent. Smoking cigarettes or tobacco contaminated with particles or dust from fluoropolymer products has been associated with "polymer fume fever" (PFF).[7] PFF is a disease caused by inhalation of degradation product fumes from heated fluoropolymer products. Temperatures in excess of 315°C (600°F) have been sufficient to cause the production of chemical agents responsible for PFF. The temperature of burning tobacco in a cigarette is approximately 875°C (1600°F).

PFOA appears to be persistent in humans. Trace amounts of PFOA have been found in the blood of workers exposed during manufacturing operations involving its use[8,9] and in the blood of the general population.[10] Health studies performed on workers exposed to PFOA in manufacturing settings have shown no adverse human health effects and no increase in any cause of death. The Environmental Protection Agency (EPA) has released a preliminary risk assessment focused on the potential risks for developmental toxicity associated with exposure to PFOA and its salts. The assessment includes a review of medical literature and human health studies based on occupational exposure to PFOA and its salts. Also, a margin of exposure (MOE) was calculated to describe the potential developmental toxicity associated with exposure to PFOA and its salts. Description of MOEs, calculation of MOEs, toxicological studies contributing to the calculation of MOEs, and limitations are discussed in the assessment, which is available on EPA's website (http://www.epa.gov/opptintr/pfoa/pfoara.htm).

The ACGIH® TLV® for APFO is 0.01 milligrams per cubic meter of air (mg/m^3) as an 8-hour TWA.[4] The TLV is intended to minimize the potential for chronic asymptomatic accumulation of APFO in the blood. The half-life of APFO in human blood is more than 1 to 2 years.[4] ACGIH has designated a Skin notation and the A3, Confirmed Animal Carcinogen with Unknown Relevance to Humans notation to the TLV. There is no NIOSH REL or OSHA PEL for APFO. There are no criteria for surface concentrations of APFO.

Surface Contamination

Standards defining "acceptable" levels of surface contamination have not been established. However, wipe samples can provide information regarding the effectiveness of housekeeping practices, the potential for exposure to contaminants from other exposure routes (e.g., surface contamination on a table that is also used for food consumption), the potential for contamination of worker clothing and subsequent transport of the contaminant, and the potential for non-process-related activities to generate airborne contaminants (e.g., custodial sweeping).

Personal Protective Equipment - General Considerations

Protective clothing and equipment is designed to shield or isolate individuals from the chemical, physical, or biological hazards that may be encountered during their work.[11] Personal protective equipment (PPE) is generally considered the last line of defense, and is utilized after every effort to eliminate the hazard through feasible engineering or administrative controls has been implemented. PPE places the burden of protection on the employee, and if the equipment fails, exposure could occur. PPE can be an effective control technique for occupational hazards; however, PPE effectiveness depends on proper use by the wearer.[12] PPE is also appropriate in some situations as a backup in the event of an engineering control failure or for jobs of short duration. Selection of PPE appropriate for a given task should be made from assessments of the worksite hazards, which includes an evaluation of each activity. Hazard assessments require a good understanding of the work tasks, knowledge of the potential routes of exposure, the opportunities for exposure in the task assessed (nature and extent of worker contact), and the potential for adverse health outcomes if exposure were to occur. Accident and incident reports should be reviewed to identify those

injuries or exposure incidents (whether or not infection occurred) that could have been prevented by the proper use of PPE. Most approaches for selecting the appropriate PPE incorporate the following process:

1. Determination of the hazards most likely to occur
2. Assessment of the adverse effects of unprotected exposure
3. Identifying other control options that can be used instead of protective clothing
4. Determining the performance characteristics needed for protection
5. Evaluating the need for decontamination
6. Assessing any constraints that may hinder the use of PPE (ergonomics, safety, vision, dexterity)

Once it is determined that PPE is required for a task, its use should be mandatory. PPE should be individually assigned whenever possible. Written procedures should be in-place to ensure consistent selection and use of PPE. Affected users must be informed of the need for PPE, consequences of not wearing the appropriate PPE, and how to properly inspect, wear, maintain, and store the PPE. Users must also be informed of all limitations associated with the use of PPE and must be aware that the equipment does not eliminate the hazard. Finally, periodic inspections and evaluations of the PPE program should be conducted to ensure that procedures are consistently followed, to identify any process changes that may have occurred, and that the selected PPE is still appropriate for the given task.

RESULTS

Personal Protective Equipment

Latex gloves are provided but optional and not confined to the area of use, which is the Fluon® application area outside the building. Technicians who apply Fluon® wear latex gloves throughout the entire application process. The technicians continue wearing these gloves when applying Fluon® while rolling the cart back to the IFA Workroom and while cleaning the sponge brushes. These gloves are disposed after the sponge brushes have been cleaned. Fluon® on the gloves can potentially be spread to the work cart handles, door handles entering the building, and other surfaces touched by the technician's hands before removing and disposing the gloves. Work surfaces and door handles potentially contaminated by Fluon® from gloves worn by workers could facilitate ingestion or skin absorption of APFO. There are no designated containers for gloves disposal.

Employees have been provided medical scrubs because Fluon® can drip onto their clothes and will not wash out of their clothing. The employees are responsible for cleaning scrubs and shoes worn to work. During Fluon® application, technicians do not wear aprons or other protective clothing besides scrubs. After the application process, the contaminated clothing is worn for the remainder of the day and carried home.

Housekeeping

Food and beverage consumption is allowed in the IFA Workroom and IFA Trailer where Fluon® is handled. Work surfaces in these rooms and items, such as door handles touched by contaminated gloves, are not cleaned regularly. The sink areas in these two rooms may have potential contamination due to the environmental persistence of APFO. Smoking is prohibited inside the facility.

Employee concerns

During discussions with approximately 8 employees throughout the site visit, the primary safety and health concerns include 1) potential exposure to APFO, 2) potential health effects from exposure, and 3) safe handling procedures when using Fluon®. Employees are also concerned about exposure to APFO when applying Fluon® to trays and also when handling trays with Fluon® in its dried form.

Surface Sampling

Twenty-eight surface samples, including blanks, for APFO analysis were collected in the locations specified in Table 1. The analytical method used to detect APFO from surface wipe samples has not been fully evaluated. The values reported in Table 1 are estimates of amounts present. The results are reported as the amount of APFO detected in micrograms per 100 square centimeters of surface area sampled (µg/100 cm^2).

APFO was detected in 6 samples: IFA Trailer – center of worktable and left side of sink; Attack Room 1 – rim of brooding cup; IFA Workroom – Fluon® work cart handles; FAST building, refrigerator #2 – inside floor and outside door handle. Two of the samples had concentrations above the limit of detection and limit of quantification: IFA Trailer – left side of sink (3.0 µg/100 cm^2) and Attack Room 1 – rim of brooding cup, which had the largest amount of APFO present (8.0 µg/100 cm^2).

DISCUSSION

The relevance of exposure to APFO to human health effects is not fully understood. Because of APFO's environmental persistence and its long half-life in human serum, the recommendations provided in this report facilitate reducing potential exposure to as low as possible.

APFO sublimes at temperatures above 125 degrees Celsius (°C).[4] In other words, at temperatures above 125°C, APFO transforms directly from a solid to a gaseous state without becoming a liquid. Because of the low volatility of Fluon® and the absence of high temperatures to cause APFO to sublime, APFO is not considered an inhalation risk from direct handling of viscous Fluon®. However, dried Fluon® flakes can adhere to minute dust particles, which can become airborne when dusting or sweeping surfaces. To prevent generating dust when cleaning, personnel responsible for cleaning should employ wet-methods of clean-up, such as wiping surfaces with a damp cloth or cleaning floors with mops.

ACGIH has designated a skin notation to the APFO TLV, indicating the possibility of dermal exposure. When applying Fluon® to trays and cleaning the sponge brushes, technicians wear latex gloves for protection. Disposable nitrile gloves would provide better chemical resistance, avoid potential allergic problems associated with latex, and maintain the necessary dexterity.

Because there are no standards defining acceptable levels of surface contamination, and it is not possible to accurately determine worker dose from a measurement of surface contamination, interpretation of the results is generally qualitative and based on professional judgment. The surface sampling results from this HHE suggest no widespread contamination of APFO throughout the BCRF. Although technicians wear the same pair of gloves from the application area outside the BCRF to the IFA Workroom, surface samples taken on door handles and other areas inside the facility did not show the presence of APFO. However, APFO was detected on the work cart handles. The practice of wearing gloves when painting and keeping the gloves on when rolling the cart back into the building probably accounts for finding APFO on the handles. The Fluon® application process should be contained in one area to prevent possible spread of APFO to other work surfaces. Also, gloves worn during Fluon® application should be disposed of after painting and before touching other surfaces. Detecting APFO on the brooding cup was expected because it had Fluon® applied around the rim. Objects coated with Fluon®, such as trays, sieves, and brooding cups, should be handled wearing gloves.

The presence of APFO on work surfaces in the IFA Trailer and refrigerator #2 indicates the need for additional cleaning in these areas. Additionally, all work surfaces should be cleaned regularly using wet-methods (e.g., damp cloth). The IFA Trailer is where ants and brood collected from the field are separated, collected, and sized to accommodate the various species of phorids. The separated ant colonies are held in

large plastic trays located on the main worktable. When these trays need Fluon® reapplication, they are sometimes washed in the sink located in the trailer. The presence of APFO on the worktable and sink indicates that these two surfaces may not be cleaned regularly. Eating and drinking are allowed in the IFA Trailer and also in the IFA Workroom. Food and drinks may become contaminated with APFO found in these work spaces. Subsequently, they can facilitate entry of the agent into the body by ingestion and/or skin absorption.

Fluon® is stored in refrigerator #2 located in the FAST building and sometimes poured from a sealed five-gallon storage container into a half-gallon plastic container. Fluon® spilled or dripped onto the floor should be cleaned promptly. Any drips or spills should be soaked up with sawdust, sand, oil dry, or other absorbent material; swept up; placed into a covered container; and disposed of in a landfill that is permitted, licensed, or registered by the state to manage industrial solid waste. APFO found on the refrigerator #2 door handle could be attributed to employees not cleaning their hands immediately after handling Fluon® and then touching the door handle.

CONCLUSIONS

The purpose of the HHE was to determine the potential for employee exposure to APFO at the BCRF. The primary routes of exposure to APFO in this facility are ingestion and skin absorption. Without adequate cleaning, there may also be a potential inhalation exposure. Surface sampling indicates that work surfaces in the IFA Trailer and FAST building, refrigerator #2 are contaminated with APFO. These work surfaces should be cleaned routinely to reduce any potential exposure, and actions should be taken to prevent re-contaminating these areas. Employees handle Fluon® in its wet form (application process) and dry form (objects, such as trays, sieves, and brooding cups). Wearing appropriate gloves whenever handling wet or dry Fluon® can reduce exposure to APFO and prevent the potential spread of contamination to other surfaces.

RECOMMENDATIONS

1. Replace latex gloves with nitrile gloves. To inform employees of the need for nitrile gloves, consequences of not wearing the appropriate gloves, and how to inspect, wear, maintain, store, and dispose of gloves properly, a PPE program as outlined by OSHA should be in place.[11,13]

2. Fluon® application and PPE worn during the application process should be restricted to one area. Nitrile gloves should be worn:

    - during Fluon® application;
    - when handling objects coated with Fluon® such as trays, sieves, and brooding cups;
    - when pouring Fluon® from the sealed five-gallon bucket into smaller containers; and
    - when cleaning areas with potential APFO contamination.

    Gloves should be removed and discarded immediately after handling Fluon®. Proper hand washing and cleaning should take place prior to touching/opening doors or touching other surfaces, such as work tables.

3. Workers should be encouraged to practice good personal hygiene (thorough hand washing) before eating, drinking, and smoking and after handling Fluon®. Also, workers should avoid contaminating clothing and shoes when applying Fluon®. Any contaminated clothing or scrubs should be changed out, and employees should wash thoroughly to remove any contaminants prior to leaving work (to prevent any possible contamination of vehicles or dwellings). Contaminated clothing/scrubs and shoes should be thoroughly cleaned before re-use and should not be removed from the workplace. A laundry service may be needed to clean work clothes/scrubs. The

laundry service should be made aware of the potential dermal contact and potential hazards of APFO.

4. Regularly clean work surfaces using wet-methods.

5. Eating, drinking, and smoking should not be allowed in work areas. These activities should be restricted to designated areas away from contaminants. Food, drinks, cigarettes, and tobacco products may become contaminated with agents found in the workplace and then can facilitate entry of the agent into the body by inhalation, ingestion, and/or skin absorption. Smoking should be restricted to the outdoors (away from building entrances, air intakes, and the Fluon® application area behind the BCRF) to prevent a fire hazard and also to protect workers' health. This should be included in the hazard communication training associated with the use of this material.

6. Fluon® dripped or spilled should be cleaned promptly before the material dries to prevent contamination of other surfaces. During clean up, caution should be exercised, as the spill may be extremely slippery. Nitrile gloves should be used when cleaning the spill.

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Table 1 Florida Department of Agriculture and Consumer Services Surface Sampling Results – Ammonium Perfluorooctanoate (APFO) HETA 2003-0248-2940 1/21/2004	
Location	**Concentration (µg/100 cm^2)**
IFA Trailer – Employee's Work Desk	<LOD
IFA Trailer – Main Worktable (center)	(0.4)
IFA Trailer – Wash Sink Counter (left side)	3.0
Attack Room 1 – Attack Box B Bottom Shelf	<LOD
Attack Room 1 – Attack Box A Latches	<LOD
Attack Room 1 – Inside, Right Door Panel	<LOD
Attack Room 1 – Rim of Brooding Cup	8.0
Ant Holding Room – Table Surface	<LOD
Ant Holding Room – Inside, Right Door Panel	<LOD
Ant Holding Room – 10-day Holding Tray	<LOD
IFA Workroom – Wash Sink Counter	<LOD
IFA Workroom – Supervisor's Desk	<LOD
IFA Workroom – Fluon Work Cart Handles	(0.8)
IFA Workroom – Main Worktable	<LOD
IFA Workroom – Scope Table	<LOD
Ant Holding Room – Tray (#6) before washing	<LOD
IFA Workroom – Inside Wash Gloves	<LOD
Paint Area – Outside of Door, Right Handle	<LOD
Paint Area – Inside of Door, Right Handle	<LOD
Diet Mix Room – Sink (left side)	<LOD
FAST building, Refrigerator #2 – Inside Floor	(0.9)
FAST building, Refrigerator #2 – Outside Door Handle	(0.5)
BCRF Office 103 – Computer Desk	<LOD
DPI Complex – Room A-1011 Table	<LOD

µg/100 cm^2 = micrograms of contaminant per 100 square centimeters of surface area sampled
<LOD = below the limit of detection (LOD) when the sample was adjusted for the concentration detected on the field blank
( ) = values in parentheses indicate the concentration measured was between the analytical limit of detection (LOD) and the limit of quantitation (LOQ)

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