



California Department of Health Services  
SENSOR/EPA Occupational Pesticide  
Poisoning Prevention Project  
Field Investigation Report  
CA 002-99 – October 24, 2000

---

**Skin Rash**  
**Due to a Spray Application of**  
**Pesticide Formulations Containing**  
**Myclobutanol, Streptomycin Sulfate,**  
**and an Adjuvant**

**Summary:** A worker applying a mixture of three pesticide formulations containing myclobutanol, streptomycin sulfate and an adjuvant to apples developed a skin rash on his left calf. The work process involved spraying the pesticide mixture, under high-pressure, many feet up into the air, during windy conditions, in close proximity to the worker seated in an open-cab tractor. Under these conditions, the worker was primarily reliant on personal protective equipment to prevent pesticide exposure. The worker was exposed to the pesticide mixture because his lower left leg became damp with pesticide spray that leaked through a tear in his chemical-resistant jumpsuit. A physician diagnosed the case as contact dermatitis secondary to pesticide exposure and the worker received medical treatment. This incident involved exposure to a mixture of five “active” and seven “inert” chemical ingredients. Individually, many of the “active” and “inert” chemicals in this pesticide mixture have potentially significant acute health effects. Workers with repeated exposure to this pesticide mixture may be at risk of long-term health consequences such as cancer and reproductive effects. Of all the chemicals in the mixture that had the potential to harm the skin, the adjuvant was the most corrosive ingredient. The potential health impacts of exposure to a mixture of these 12 chemicals are not known.

**Conclusions:** Factors which contributed to this pesticide-related illness include: the toxicity of the chemical mixture applied to the apples, the use of torn personal protective clothing, and the use of an open-cab tractor.

**Recommendations** *Employers should:* (1) Implement the use of less toxic chemicals or non-chemical alternatives to controlling pests when available. Avoid use of chemicals that are highly or moderately toxic (categories 1 and 2), and chemicals known to cause cancer or reproductive health effects; (2) Implement engineering controls, such as enclosed cabs on tractors, rather than relying on the use of personal protective equipment to prevent exposure; (3) Ensure that there is always an adequate supply of clean, intact, personal protective equipment at the workplace if engineering controls are not feasible; (4) Store personal protective equipment in a clean area, separately from pesticides and other chemicals. *Manufacturers should* list all chemicals in a pesticide product, including “inerts”, on the product label.

## **Background**

The Sentinel Event Notification of Occupational Risk (SENSOR) Pesticide Poisoning Prevention Project is conducted by the California Department of Health Services through the support of the National Institute for Occupational Safety and Health and the US Environmental Protection Agency. The goal of the SENSOR project is to prevent pesticide poisoning among workers. SENSOR staff utilize a physician-based reporting system to conduct state-wide surveillance of pesticide illness among workers. Selected cases are followed up by a workplace investigation and interviews with workers, employers, and others involved in the incident. The investigations assess factors that may have contributed to occupational illness and make recommendations to prevent pesticide-poisoning among workers.

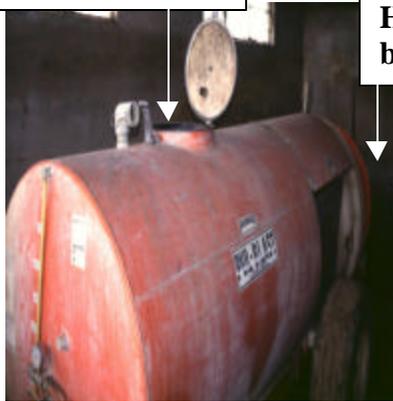
On March 20, 1999 the Fresno Division of the California Poison Control System reported a worker with myclobutanil exposure to the SENSOR Pesticide Poisoning Prevention Project. The incident occurred on March 19, 1999. SENSOR staff interviewed the index case at home by phone eleven days after the incident. An Industrial Hygienist and a Research Associate from the SENSOR project conducted an investigation on April 8, 1999 at the workplace where the incident occurred. SENSOR staff interviewed the grower, reviewed written training and pesticide application records, and observed and photographed the physical characteristics of workplace and the pesticide-application equipment.

## **Incident**

The incident occurred at an apple orchard in Fresno County that employed one full-time and up to two part-time workers. In addition, contract workers were employed for harvesting the apples. The incident involved one part-time worker applying a mixture of three pesticide formulations containing myclobutanil, streptomycin sulfate and an adjuvant to apples (Table 1). This application was not the worker's usual job.

The process involved mixing the pesticides with water from a hose in a 500-gallon tank (Figure 1a). The pesticide mixture was applied to the apples through five nozzles of a high-pressure (125 psi) sprayer located at the back of the tank (Figure 1b). The tank holding the pesticides was pulled through the orchard by an open cab tractor located immediately in front of the tank (Figure 2). The spray nozzles dispersed the pesticide mixture high up into the air, above the height of the tractor, in a 15 to 18 foot arc. The worker applied the pesticides for approximately seven and a half hours.

**Pesticides and water added to tank through hatch**



**Figure 1a. Tank holding pesticide mixture**

**High-pressure nozzles at back of tank**



**Figure 1b. Close-up of high-pressure nozzles in back of tank that sprayed the pesticide mixture up into the air**



**Tank holding pesticides**

**Worker sat in open cab tractor during pesticide application**

**Figure 2. Open cab tractor used for pesticide application**

The worker wore a long sleeve shirt and long pants, and a chemical-resistant jumpsuit. The chemical-resistant jumpsuit had a long tear on the left leg when the worker put it on. An intact jumpsuit was not available at the workplace. The worker also wore calf-high rubber boots, glasses with a side-shield, chemical-resistant gloves, a hard hat, and a disposable dust/mist mask. In addition, the worker held a full-face shield in his hand and moved it about his face as a shield, depending on the direction of the wind. The worker had received training on pesticide safety prior to the application.

When the worker completed the job, he removed his protective clothing, went home, and took a shower. While showering, the worker noticed a skin rash. He sought medical care the next day. A physician diagnosed the case as contact dermatitis on the left calf secondary to pesticide exposure and the worker received medical treatment. The rash persisted for at least 10 days after exposure.

The Fresno County Department of Agriculture investigated this incident. The county agency informed the grower that “anytime an employee uses “coveralls”, the coveralls must be in good condition, and that if an employee is mixing/loading chemicals that a second pair needs to be at the worksite” (Fresno County Department of Agriculture, June 1999). No citation was issued.

**Table 1. Characteristics of pesticide mixture\* involved in worker illness**

Product	Rally 40 W	Agri-Mycin 17	LI 700
<b>% of product in mixture (by vol.)</b>	0.03%	0.04%	0.02%
<b>Active ingredient</b>	myclobutanil	streptomycin sulfate	phosphatidyl choline, methylacetic acid, alkyl polyoxy ethylene ether
<b>Inert ingredients</b>	aluminum silicate dihydrate; non-ionic surfactant; calcium silicate, synthetic; sodium lignosulfate	surfactant diluent	undisclosed
<b>% of active ingredients in product (by wt.)</b>	40%	21.2%	80%
<b>% of inert ingredients in product (by wt.)</b>	60%	78.8%	20%
<b>Classification</b>	fungicide	bactericide	adjuvant (surfactant)
<b>Formulation</b>	wettable powder in water-soluble packets	dust/powder	liquid concentrate
<b>Signal word**</b>	WARNING	CAUTION	DANGER

\* Pesticide mixture used based on pesticide use report submitted to the Fresno County Department of Agriculture by the grower.

\*\* All pesticides have a signal word on the label that indicates the acute hazard of the product. “DANGER” means highly toxic, “WARNING” means moderately toxic, and “CAUTION” means minimally toxic. The signal words do not indicate anything about long-term health effects.

## Discussion

Factors which contributed to this pesticide-related illness include: the toxicity of the chemical mixture applied to the apples, the use of torn personal protective clothing, and the use of an open-cab tractor. Windy conditions during the application and that it was not the worker's usual job may have also played a role in this incident.

## Toxicity of the chemical mixture applied to the apples

This incident involved worker exposure to a mixture of at least 12 chemicals, five "active ingredients"<sup>1</sup>, and at least seven other chemicals that are classified as "inert" (Table 1).<sup>2</sup> Individually, many of the 12 chemicals in this mixture have potentially significant acute, and long-term health consequences such as cancer and reproductive effects.<sup>3</sup> The potential health impacts of exposure to the mixture of these 12 chemicals are not known.

The active ingredients, myclobutanil and streptomycin sulfate, are widely used as pesticides in California.<sup>4</sup> Seventeen cases of acute illness related to myclobutanil, streptomycin sulfate, or exposure to an adjuvant<sup>5</sup>, were reported to the California Department of Pesticide Regulation between 1991 and 1996.

The use of less toxic chemicals, or non-chemical alternatives to pest control may have prevented this illness, and would reduce the potential for long-term, or unrecognized, health effects. The use of chemicals that are highly or moderately toxic (categories 1 and 2)<sup>6</sup> should be avoided. Safer alternatives to the use of toxic chemicals should be implemented when available. In addition, to prevent illness among workers who are chronically exposed to pesticides, the use of chemicals known to cause cancer or reproductive health effects should be avoided.

Although many of the chemicals in the pesticide mixture applied can harm the skin, the adjuvant was the most corrosive ingredient. The adjuvant was the only ingredient with the signal word "danger". Adjuvants and the inert ingredients in pesticide mixtures may contribute to the potential health impacts of workers' exposures to pesticides. In general, human exposure to adjuvants and solvents used in the formulation of pesticides can result in significant toxic effects that, in many cases, exceed the toxicity of the active pesticide ingredient(s) (EPA, 1999a, p.183). Furthermore, the same chemical can be classified as an active ingredient in one product, and as an inert in another product. Inert ingredients that can be hazardous to human health or the environment are widely used.<sup>7</sup> It is of concern that, as law does not require most inert ingredients to be identified by name on the label, many pesticide-users are unable to readily access all the information they require to fully recognize their potential exposures. All chemicals in a pesticide product, including "inerts", should be listed on the product label.

## **Use of torn personal protective clothing and an open-cab tractor**

The work process involved spraying the pesticide mixture under high-pressure, many feet up into the air, during windy conditions, in close proximity to the worker seated in an open-cab tractor. Under these conditions, the worker was primarily reliant on personal protective equipment to prevent pesticide exposure. The worker was exposed to the pesticide mixture because his lower left leg became damp with pesticide spray that leaked through a tear in his chemical-resistant jumpsuit.

This incident underscores the limitations of primary reliance on personal protective equipment to prevent pesticide exposure. In this incident, personal protective equipment was torn. Pesticide handlers can also remove their personal protective equipment, or accidentally contaminate the inside of it, and it can be incorrectly or incompletely decontaminated or maintained, etc. (US EPA, 1992). The utility of personal protective equipment is also limited due to the potential for heat stress (Woodruff, 1994). A major disadvantage of personal protective equipment is that, in contrast to engineering controls, its use places the burden of risk reduction on workers (Woodruff, 1994). Providing a physical barrier between the worker and the pesticide spray, such as an enclosed cab or cockpit, may yield large reductions in average worker exposure to pesticides (Rutz, 1992). The first priority in workplace safety is to implement engineering and administrative controls to make the workplace safer rather than relying on the use of personal protective equipment to prevent exposure (Rutz, 1992).

If engineering controls are not feasible, intact, chemical-resistant work clothing is needed because usual work clothing, such as denim and twill, provide only a limited barrier to exposure (Branson, 1991). Fabric penetration research indicates that with a heavier spray or spill, usual work clothing does not give sufficient protection (Branson, 1991). Given the critical role of personal protective equipment in preventing worker exposure to pesticides, employers should ensure that there is always an adequate supply of clean, intact, personal protective equipment at the workplace. Personal protective equipment should be stored in a clean area, separately from pesticides and other chemicals.

## Recommendations

□ *Employers should:*

**(1) Implement the use of less toxic chemicals or non-chemical alternatives to controlling pests when available. Avoid use of chemicals that are highly or moderately toxic (categories 1 and 2), and chemicals known to cause cancer or reproductive health effects;**

**(2) Implement engineering controls, such as enclosed cabs on tractors, rather than relying on the use of personal protective equipment to prevent exposure;**

**(3) Ensure that there is always an adequate supply of clean, intact, personal protective equipment at the workplace if engineering controls are not feasible;**

**(4) Store personal protective equipment in a clean area, separately from pesticides and other chemicals.**

□ *Manufacturers should* list all chemicals in a pesticide product, including “inerts”, on the product label.

---

<sup>1</sup> Active ingredients are the chemicals that killed fungi, bacteria or were effective as an adjuvant. Adjuvants are products added to a pesticide mixture to make the pesticide work better. LI 700 is a detergent (surfactant) that is used to aid in the penetration of the pesticide.

<sup>2</sup> An inert ingredient is any ingredient in the product that is not intended to affect a target pest.

<sup>3</sup> Myclobutanil is a fungicide that is applied primarily to a wide variety of food crops. According to the manufacturer, direct contact with myclobutanil can irritate the eyes, and prolonged or repeated skin contact can cause slight skin irritation. Myclobutanil is harmful if swallowed or absorbed through the skin. Myclobutanil is one of 35 pesticides used in California that are listed on California's Proposition 65 list of chemicals "known to cause reproductive toxicity"(OEHHA, 1999).

Streptomycin sulfate is a bactericide used primarily to treat apples and pears. Streptomycin sulfate is relatively non-toxic if ingested but may result skin reactions and allergic responses (EPA, 1999a, page 72; EPA, 1988; EPA, 1992b). Streptomycin sulfate is also one of 35 pesticides used in California that are listed on California's Proposition 65 list of chemicals "known to cause reproductive toxicity"(Cal-EPA, 1999).

LI 700 is a corrosive liquid that can cause skin and eye burns. According to the manufacturer, exposure to the vapors are irritating to the eyes, nose and throat.

The inert ingredients also had many other potential acute and chronic health impacts. According to the manufacturers of the three products used in the pesticide mixture, these inert ingredients included chemicals that can cause temporary irritation of the eyes and skin, diarrhea and weakness, pneumoconiosis, silicosis or pulmonary fibrosis, and can be "reasonably anticipated to be a carcinogen".

<sup>4</sup> In 1997, 94,375 pounds of myclobutanil were applied, and there were 28,420 agricultural applications of myclobutanil in California. In 1997, myclobutanil usage contributed a small fraction (0.3%) to the total pounds of pesticides used in California that are known to cause reproductive toxicity. However, in the same year, of the 3,044,472 cumulative acres treated in California with pesticides known to cause reproductive toxicity, 29% (866,360 cumulative acres) were treated with myclobutanil. In 1997, 9,605 pounds of streptomycin sulfate were applied, and there were 3,534 agricultural applications of streptomycin sulfate in California (CDPR, June 1999).

<sup>5</sup> It is not known how many cases of illness, if any, were related to LI 700.

---

<sup>6</sup> The US EPA ranks pesticides into four acute toxicity categories. The most acutely toxic pesticides are in category 1 (highly toxic, signal word DANGER) and category 2 (very toxic, signal word WARNING). Moderately toxic pesticides are in category 3 (signal word CAUTION) and the least toxic pesticides are in category 4 (signal word CAUTION).

<sup>7</sup> The US EPA has identified eight chemicals currently used as inerts in 160 products as being “of toxicological concern” based on peer-reviewed studies indicating toxicological or adverse ecological effects. Another 93 chemicals used are listed by EPA as “potentially toxic/high priority for testing” because these chemicals have a structure similar to chemicals known to be toxic, and may have data suggesting a basis for concern (EPA, 1998, 1999b, 1999c). An additional 1700 chemicals are currently used as inerts although their health consequences have yet to be determined (EPA, 1998, 1999c).

## References

Berllner, Jeff. Pesticides Hazard Recognition. Department of Fish and Game, Office of Spill Prevention and Response. Presentation November 20, 1997, Pesticide Emergency Response, sponsored by the University of California Berkeley, Center for Occupational and Environmental Health.

Branson DH, Sweeney M. Pesticide Personal Protective Clothing. Reviews of Environmental Contamination and Toxicology. 1991; 122:81-109.

CDPR. California Environmental Protection Agency, Department of Pesticide Regulation, Worker Health and Safety Branch. Pesticide Illness Surveillance Program Summary Report 1991. HS-1692 May 26, 1994.

CDPR. California Environmental Protection Agency, Department of Pesticide Regulation, Worker Health and Safety Branch. Pesticide Illness Surveillance Program Summary Report 1992. HS-1701 December 14, 1994.

CDPR. California Environmental Protection Agency, Department of Pesticide Regulation, Worker Health and Safety Branch. California Pesticide Illness Surveillance Program Summary Report 1993. HS-1724 August 31, 1995.

CDPR. California Environmental Protection Agency, Department of Pesticide Regulation, Worker Health and Safety Branch. Pesticide Illness Surveillance Program Report 1994. HS-1733 December 12, 1996.

CDPR. California Environmental Protection Agency, Department of Pesticide Regulation, Worker Health and Safety Branch. Overview of the California Pesticide Illness Surveillance Program 1995. HS-1768 December 23, 1997.

CDPR. California Environmental Protection Agency, Department of Pesticide Regulation, Worker Health and Safety Branch. Overview of the California Pesticide Illness Surveillance Program 1996. HS-1776 February 3, 1999.

CDPR. California Environmental Protection Agency, Department of Pesticide Regulation, Environmental Monitoring and Pest Management Branch. Summary of Pesticide Use Data 1997. June 1999.

EPA. United States Environmental Protection Agency. Fact Sheet Number 186 Streptomycin. Washington, DC. 1988.

EPA. United States Environmental Protection Agency, Office of Pesticide Programs. Regulatory Impact Analysis of Worker Protection Standard for Agricultural Pesticides. August 11, 1992a.

EPA. United States Environmental Protection Agency. Registration eligibility document (RED) streptomycin and streptomycin sulfate. Washington, D.C. 1992b.

EPA. United States Environmental Protection Agency, Office of Pesticide Programs. Federal Register: Volume 63, Number 121. June 24, 1998

EPA. United States Environmental Protection Agency, Office of Prevention, Pesticides, and Toxic Substances. Recognition and Management of Pesticide Poisonings. EPA 735-R-98-003. March, 1999a.

EPA. United States Environmental Protection Agency, Office of Pesticide Programs. List of Inert Pesticide Ingredients. June 23, 1999b.

EPA. United States Environmental Protection Agency, Office of Pesticide Programs. Status Report for PPDC: "Inert" or "Other" Ingredients in Pesticide Products. (<http://www.epa.gov/oppfead1/cb/ppdc/inert.htm>) January 7, 1999c.

Fresno County Department of Agriculture. Pesticide Illness Investigation Report. June 4, 1999.

OEHHA. California Environmental Protection Agency. Office of Environmental Health Hazard Assessment. Safe Drinking Water and Toxic Enforcement Act of 1986. Chemicals Known to the State to Cause Cancer or Reproductive Toxicity. April 16, 1999.

Rutz R., Krieger R.I. Exposure to Pesticide Mixer/Loaders and Applicators in California. *Reviews of Environmental Contamination and Toxicology*. 1992; 129: 121-139.

Woodruff TJ, Kyle AD, Bois FY. Evaluating health risks from occupational exposure to pesticides and the regulatory response. *Environ Health Perspect*. 102:1088-1096 (1994).