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OFFICE OF
PREVENTION, PESTICIDES AND
TOXIC SUBSTANCES

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MEMORANDUM

SUBJECT: Review of Carbaryl Incident Reports
DP Barcode D267127, Chemical #056801

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BACKGROUND

The following data bases have been consulted for the poisoning incident data on the active ingredient Carbaryl (PC Code:056801):

1) OPP Incident Data System (IDS) - reports of incidents from various sources, including registrants, other federal and state health and environmental agencies and individual consumers, submitted to OPP since 1992. Reports submitted to the Incident Data System represent anecdotal reports or allegations only, unless otherwise stated. Typically no conclusions can be drawn implicating the pesticide as a cause of any of the reported health effects. Nevertheless, sometimes with enough cases and/or enough documentation risk mitigation measures may be suggested.

2) Poison Control Centers - as the result of a data purchase by EPA, OPP received Poison Control Center data covering the years 1993 through 1998 for all pesticides. Most of the national Poison Control Centers (PCCs) participate in a national data collection system, the Toxic Exposure Surveillance System which obtains data from about 65-70 centers at hospitals and universities. PCCs provide telephone consultation for individuals and health care providers on suspected poisonings, involving drugs, household products, pesticides, etc.

3) California Department of Pesticide Regulation - California has collected uniform data on suspected pesticide poisonings since 1982. Physicians are required, by statute, to report to their local health officer all occurrences of illness suspected of being related to exposure to pesticides. The majority of the incidents involve workers. Information on exposure (worker activity), type of illness (systemic, eye, skin, eye/skin and respiratory), likelihood of a causal relationship, and number of days off work and in the hospital are provided.

4) National Pesticide Telecommunications Network (NPTN) - NPTN is a toll-free information service supported by OPP. A ranking of the top 200 active ingredients for which telephone calls were received during calendar years 1984-1991, inclusive has been prepared. The total number of calls was tabulated for the categories human incidents, animal incidents, calls for information, and others. Cases have also been collected for the years 1995 through 1999 in the same fashion.

CARBARYL REVIEW

I. Incident Data System

Please note that the following cases from the IDS do not have documentation confirming exposure or health effects unless otherwise noted. There were at least 380 minor cases (minimal symptoms with no residual disability e.g., mild gastrointestinal symptoms, skin irritation, drowsiness) as defined by the Poison Control Centers medical outcome category that were not further reviewed in detail. Also not reviewed were suicidal cases that lacked information on dose or symptomatology and cases involved in lawsuits that lacked specific symptomatology.

Incident #37-1

A pesticide incident occurred in 1992, when the product irritated an individual's hands. No further information on the disposition of the case was reported.

Incident #293-1 (same as #428-7)

A pesticide incident occurred in 1992, when a woman, who did not wear gloves, bathed her dog. The next morning, she experienced pressure in her chest, dry mouth, tension in her head, and red raw hands which peeled. No further information on the disposition of the case was reported.

Incident #344-1

A pesticide incident occurred in 1993, when a woman bathed her cats and experienced pruritus and dermatitis after developing a possible allergic reaction. No further information on the disposition of the case was reported.

Incident #561-1

A pesticide incident occurred in 1993, when a woman inhaled some of the product and experienced a scratchy throat. No further information on the disposition of the case was reported.

Incident #791-2

In 1993, a 21-year old male ingested about 75 ml of a 21.3% solution of carbaryl in a suicide attempt. Unfortunately, no information is available on the symptoms to judge the severity of the known dose. The individual was hospitalized for five days and released.

Incident #941-24

A pesticide incident occurred in 1994, when an individual inhaled the product and experienced vomiting, coughing, and choking. No further information on the disposition of the case was reported.

Incident #999-2

In 1994 an ingestion occurred with symptoms of nausea and fasciculations. No further information on the disposition of the case was reported.

Incident #999-17

A pesticide incident occurred in 1994, when an individual inhaled the product and experienced throat irritation. No further information on the disposition of the case was reported.

Incident #999-129

A pesticide incident occurred in 1994, when an individual inhaled the product and experienced respiratory symptoms. No further information on the disposition of the case was reported.

Incident #1061-1

A pesticide incident occurred in 1994, when an individual experienced eye injuries. No further information on the disposition of the case was reported.

Incident #1100-1

A pesticide incident occurred in 1994, when a man allegedly spilled a suspension containing

four pounds of carbaryl to four pounds of water on his neck, back, arms, and legs while he was working. He did not remove his clothes and showered about an hour later. He experienced nausea and headache about three hours later. He went to the emergency room and was released about four hours later. No further information on the disposition of the case was reported.

Incident #1191-26

A pesticide incident occurred in 1994, when an individual inhaled the product and experienced nausea, vomiting, and diarrhea. No further information on the disposition of the case was reported.

Incident #1191-42

A pesticide incident occurred in 1994, when an individual inhaled the product and experienced ataxia, drowsiness, and dizziness. No further information on the disposition of the case was reported.

Incident #1191-157

A pesticide incident occurred in 1994, when an individual was both dermally and orally exposed and experienced nausea, vomiting, confusion, hallucinations, and delusions. No further information on the disposition of the case was reported.

Incident #1191-440

A pesticide incident occurred in 1994, when an individual was exposed dermally to the product and experienced nausea and dizziness. No further information on the disposition of the case was reported.

Incident #1192-200

A pesticide incident occurred in 1994, when an individual was exposed to the product and experienced muscle weakness. No further information on the disposition of the case was reported.

Incident #1192-234

A pesticide incident occurred in 1994, when an individual was exposed to the product and experienced diarrhea, nausea, vomiting, and bronchospasm. No further information on the disposition of the case was reported.

Incident #1192-288

A pesticide incident occurred in 1994, when an individual inhaled the product and experienced nausea and drowsiness. No further information on the disposition of the case was reported.

Incident #1192-305

A pesticide incident occurred in 1994, when an individual was exposed to the product dermally and experienced hives, welts, pruritus, muscle weakness, and fever. No further information on the disposition of the case was reported.

Incident #1192-397

A pesticide incident occurred in 1994, when an individual was exposed dermally to the product and experienced hives, welts, and a rash. No further information on the disposition of the case was reported.

Incident #1192-398

A pesticide incident occurred in 1994, when an individual was exposed dermally to the product. Specific symptoms were not mentioned. No further information on the disposition of the case was reported.

Incident #1192-459

A pesticide incident occurred in 1994, when an individual experienced dizziness, headache, and fever. No further information on the disposition of the case was reported.

Incident #1192-536

A pesticide incident occurred in 1994, when an individual experienced vomiting and diaphoresis. No further information on the disposition of the case was reported.

Incident #1264-250

A pesticide incident occurred in 1994, when an individual was exposed dermally to the product and experienced dermal irritation and pain. No further information on the disposition of the case was reported.

Incident #1264-311

A pesticide incident occurred in 1994, when an individual was exposed to the product and experienced diarrhea, vomiting, and headache. No further information on the disposition of the case was reported.

Incident #1264-315

A pesticide incident occurred in 1994, when an individual was exposed dermally to the product and experienced abdominal pain, nausea, drowsiness, and muscle weakness. No further information on the disposition of the case was reported.

Incident #1264-399

A pesticide incident occurred in 1994, when an individual was exposed dermally to the product and experienced abdominal pain, nausea, and vomiting. No further information on the disposition of the case was reported.

Incident #1302-1

A pesticide incident occurred in 1994, when a man, who was wearing a short-sleeved shirt, formulated a fertilizer mixture and experienced vomiting and difficulty breathing. He was treated by a physician. No further information on the disposition of the case was reported.

Incident #1426-1

A pesticide incident occurred in 1994, when a woman, who has asthma, experienced severe respiratory distress after bathing her dog with the product. No further information on the disposition of the case was reported.

Incident #1563-1

A pesticide incident occurred in 1994, when a forty-seven year old female, who was treated by a physician, was exposed to the product every other day for sixty-five minutes. She used the product to treat sarcoptic mange. No further information on the disposition of the case was reported.

Incident #1611-1

A pesticide incident occurred in 1994, when a man, who was wearing a respirator, long pants, and a long-sleeved shirt sprayed the product in a peach orchard. His body was covered with the spray solution and he experienced a loss of appetite, stomach cramps, and dry heaves. He was treated by a physician. No further information on the disposition of the case was reported.

Incident #1697-1

A pesticide incident occurred in 1995, when a woman's daughter used the product on her cat. The daughter experienced a swollen throat. No further information on the disposition of the case was reported.

Incident #1827-253

A pesticide incident occurred in 1993, when an individual experienced melena and vomiting. No further information on the disposition of the case was reported.

Incident #1827-267

A pesticide incident occurred in 1993, when an individual experienced melena and vomiting. No further information on the disposition of the case was reported.

Incident #1827-517

A pesticide incident occurred in 1993, when an individual inhaled the product. Specific symptoms were not mentioned. No further information on the disposition of the case was reported.

Incident #1827-934

A pesticide incident occurred in 1993, when an individual was dermally exposed to the product. Specific symptoms were not mentioned. No further information on the disposition of the case was reported.

Incident #1867-1

A pesticide incident occurred in 1995, when a breeder bathed a litter of five puppies and the product splashed onto her lips. She experienced burning lips for two days and red and itchy hands. No further information on the disposition of the case was reported.

Incident #1905-1

A pesticide incident occurred in 1995, when a boy experienced vomiting, diarrhea, and nausea after the product was used on the family dog. He was treated by a physician in the emergency room. No further information on the disposition of the case was reported.

Incident #2029-1

A pesticide incident occurred in 1995, when an individual used the product on her dogs and experienced sneezing. No further information on the disposition of the case was reported.

Incident #2073-1

A pesticide incident occurred in 1995, when an individual, who was not wearing gloves, used the product on their dog and experienced tiny red bumps. No further information on the disposition of the case was reported.

Incident #2078-29

A pesticide incident occurred in 1994, when an individual was exposed to the product and experienced confusion, coughing, choking, and a fever. No further information on the disposition of the case was reported.

Incident #2196-55

A pesticide incident occurred in 1995, when an individual was exposed to the product and experienced a seizure. No further information on the disposition of the case was reported.

Incident #2224-1

A pesticide incident occurred in 1995, when a woman used the product and experienced a sore throat. No further information on the disposition of the case was reported.

Incident #2304-1

A pesticide incident occurred in 1995, when a woman used the product on her pet which got into her eyes. She experienced burning eyes and immediately washed them out. No further information on the disposition of the case was reported.

Incident #2414-11

A pesticide incident occurred in 1995, when an individual experienced respiratory irritation, dyspnea, and a rash. No further information on the disposition of the case was reported.

Incident #2414-63

A pesticide incident occurred in 1995, when an individual experienced abdominal pain and a coma. No further information on the disposition of the case was reported.

Incident #2414-88

An incident occurred in 1995, when an individual inhaled the product and experienced a rash, nausea, and vomiting. No further information on the disposition of the case was reported.

Incident #2414-149

A pesticide incident occurred in 1995, when an individual experienced hives and welts, pruritus, and dyspnea. No further information on the disposition of the case was reported.

Incident #2549-1

A pesticide incident occurred in 1995, when a man used the product on his dog and experienced joint and muscle stiffness. No further information on the disposition of the case was reported.

Incident #2592-1

A pesticide incident occurred in 1995, when an elderly woman was exposed to carbaryl dust and experienced a burning sensation in her lungs and difficulty breathing. No further information on the disposition of the case was reported.

Incident #2603-1

A pesticide incident occurred in 1995, when a woman, who was not wearing gloves, used the product to bathe her pet and experienced numbness and a tingling sensation in her hands. No further information on the disposition of the case was reported.

Incident #2673-103

A pesticide incident occurred in 1995, when an individual inhaled the product and experienced moderate symptoms. No further information on the disposition of the case was reported.

Incident #2694-1

A pesticide incident occurred in 1995, when a woman used the product to bathe three cats and five dogs and experienced muscle soreness the next day. No further information on the disposition of the case was reported.

Incident #2783-1

A pesticide incident occurred in 1995, when a man used the product and developed lung irritation the next day. He coughed up blood and also had blood to drip from his nose when he blew it. No further information on the disposition of the case was reported.

Incident #2802-1

A pesticide incident occurred in 1995, when a woman used the product and experienced difficulty breathing and her hands turned purple. No further information on the disposition of the case was reported.

Incident #3119-1

A pesticide incident occurred in 1996, when a woman used the product three times and experienced fissures on her hands. No further information on the disposition of the case was reported.

Incident #3268-97

A pesticide incident occurred in 1996, when an individual inhaled the product and experienced chest pain, headache, irritability, agitation, coughing/choking, cyanosis, dyspnea, and respiratory depression. No further information on the disposition of the case was reported.

Incident #3326-97

A pesticide incident occurred in 1996, when an individual experienced a headache. No further information on the disposition of the case was reported.

Incident #3380-106

A pesticide incident occurred in 1996, when an individual experienced sinus congestion and infection. No further information on the disposition of the case was reported.

Incident #3390-1

A pesticide incident occurred in 1996, when a woman was accidentally splashed with the product and experienced a rash on her face. No further information on the disposition of the case was reported.

Incident #3550-1

A pesticide incident occurred in 1996, when a forty-four year old female, who is an employee at a hospital, used the product. Specific symptoms were not mentioned. No further information on the disposition of the case was reported.

Incident #3610-1

A pesticide incident occurred in 1996, when an individual used the product on their pet and experienced a rash. No further information on the disposition of the case was reported.

Incident #3620-53

A pesticide incident occurred in 1996, when an individual experienced liver problems and drowsiness. No further information on the disposition of the case was reported.

Incident #3694-1

A pesticide incident occurred in 1996, when a woman, who was hospitalized, used the product on her dog and experienced shock and severe respiratory problems. She later experienced a coma and died five days later. According to the medical examiner's office, the forty-four year old patient suffered from chronic asthma and acute bronchitis. A member of the medical examiner's staff considered her death consistent with her medical condition and by natural causes. No further information on the disposition of the case was reported.

Incident #3844-22

A pesticide incident occurred in 1996, when an individual experienced a rash. No further information on the disposition of the case was reported.

Incident #3844-169

A pesticide incident occurred in 1996, when an individual experienced nausea and dyspnea. No further information on the disposition of the case was reported.

Incident #3844-257

A pesticide incident occurred in 1996, when an individual experienced hives, welts, and pruritus. No further information on the disposition of the case was reported.

Incident #3844-282

A pesticide incident occurred in 1996, when an individual experienced oral irritation and ocular irritation and pain. No further information on the disposition of the case was reported.

Incident #3844-319

A pesticide incident occurred in 1996, when an individual experienced throat and respiratory irritation. No further information on the disposition of the case was reported.

Incident #3844-366

A pesticide incident occurred in 1996, when an individual experienced numbness at the tip of their thumb and index finger. No further information on the disposition of the case was reported.

Incident #3844-368

A pesticide incident occurred in 1996, when an individual experienced dyspnea. No further information on the disposition of the case was reported.

Incident #3844-455

A pesticide incident occurred in 1996, when an individual experienced coughing and choking. No further information on the disposition of the case was reported.

Incident #3844-505

A pesticide incident occurred in 1996, when an individual experienced throat irritation. No further information on the disposition of the case was reported.

Incident #3844-512

A pesticide incident occurred in 1996, when an individual experienced headache and sinus symptoms. No further information on the disposition of the case was reported.

Incident #3844-564

A pesticide incident occurred in 1996, when an individual experienced a rash. No further information on the disposition of the case was reported.

Incident #3844-594

A pesticide incident occurred in 1996, when an individual experienced a headache. No further information on the disposition of the case was reported.

Incident #3844-618

A pesticide incident occurred in 1996, when an individual experienced nausea and a headache. No further information on the disposition of the case was reported.

Incident #3844-621

A pesticide incident occurred in 1996, when an individual experienced hypertension. No further information on the disposition of the case was reported.

Incident #3844-628

A pesticide incident occurred in 1996, when an individual experienced dermal itching. No further information on the disposition of the case was reported.

Incident #3844-630

A pesticide incident occurred in 1996, when an individual experienced pruritus and a rash. No further information on the disposition of the case was reported.

Incident #4007-8

A pesticide incident occurred in 1996, when an individual experienced erythema, dermal irritation and pain, and pruritus. No further information on the disposition of the case was reported.

Incident #4007-64

A pesticide incident occurred in 1996, when an individual experienced hives/welts and a rash. No further information on the disposition of the case was reported.

Incident #4007-91

A pesticide incident occurred in 1996, when an individual experienced a rash and ocular irritation and pain. No further information on the disposition of the case was reported.

Incident #4007-194

A pesticide incident occurred in 1996, when an individual experienced lymphadenopathy. No further information on the disposition of the case was reported.

Incident #4007-404

A pesticide incident occurred in 1996, when an individual experienced dermal irritation and pain. No further information on the disposition of the case was reported.

Incident #4007-472

A pesticide incident occurred in 1996, when an individual experienced throat irritation. No further information on the disposition of the case was reported.

Incident #4007-481

A pesticide incident occurred in 1996, when an individual experienced dermal irritation and pain. No further information on the disposition of the case was reported.

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Incident #4007-510

A pesticide incident occurred in 1996, when an individual experienced a headache and hyperthermia. No further information on the disposition of the case was reported.

Incident #4007-527

A pesticide incident occurred in 1996, when an individual experienced joint pain in their wrist and knee. No further information on the disposition of the case was reported.

Incident #4007-551

A pesticide incident occurred in 1996, when an individual experienced muscle weakness, sneezing, rhinitis, and diaphoresis. No further information on the disposition of the case was reported.

Incident #4007-585

A pesticide incident occurred in 1996, when an individual experienced myalgia. No further information on the disposition of the case was reported.

Incident #4007-638

A pesticide incident occurred in 1996, when an individual experienced erythema. No further information on the disposition of the case was reported.

Incident #4007-674

A pesticide incident occurred in 1996, when an individual experienced ocular irritation and pain. No further information on the disposition of the case was reported.

Incident #4235-1

A pesticide incident occurred in 1996, when a woman, who has systemic lupus, bathed her two cats and got the product on her mouth. She experienced burning lips and a bad taste in her mouth. No further information on the disposition of the case was reported.

Incident #4241-1

A pesticide incident occurred in 1996, when a man used the product on his dog. On the third time of using the product he left it on for a few extra minutes and experienced hair loss on his arms. No further information on the disposition of the case was reported.

Incident #4283-1

A pesticide incident occurred in 1996, when a male used the product and experienced an asthma attack the next morning. No further information on the disposition of the case was reported.

Incident #4337-1

A pesticide incident occurred in 1996, when several employees experienced rashes after using the product to bathe animals during the past month. No further information on the disposition of the case was reported.

Incident #4348-1

A pesticide incident occurred in 1996, when a woman, who has several existing medical problems (undefined), used the product on her pet. On a recent visit to her physician, her liver enzymes were elevated. No further information on the disposition of the case was reported.

Incident #4413-1

A pesticide incident occurred in 1996, when a woman, who has thrombocytopenia, used the product over the past month and experienced a significant drop in her platelet count. No further information on the disposition of the case was reported.

Incident #4486-1

A pesticide incident occurred in 1996, when a woman used the product and experienced red and sore hands. No further information on the disposition of the case was reported.

Incident #4505-1

A pesticide incident occurred in 1996, when a man shampooed his dog in a bathtub along with himself and experienced irritated skin. No further information on the disposition of the case was reported.

Incident #4647-1

A pesticide incident occurred in 1997, when a woman used the product and experienced hives on her face and arms. No further information on the disposition of the case was reported.

Incident #4671-1

A pesticide incident occurred in 1997, when a nine year old girl used the product on her cat and experienced hives. No further information on the disposition of the case was reported.

Incident #5077-1

A pesticide incident occurred in 1997, when a woman used the product and experienced hives. No further information on the disposition of the case was reported.

Incident #5119-1

A pesticide incident occurred in 1997, when a woman accidentally got the product on her hand which she put in her mouth. She experienced headaches. No further information on the disposition of the case was reported.

Incident #5170-1

A pesticide incident occurred in 1997, when a woman bathed her cat and experienced itching on her hands. No further information on the disposition of the case was reported.

Incident #5623-1

A pesticide incident occurred in 1997, when a woman bathed her dog and touched her lips and experienced a rash. No further information on the disposition of the case was reported.

Incident #5675-1

A pesticide incident occurred in 1997, when a man, who has a heart condition, used the product and experienced tingling skin. No further information on the disposition of the case was reported.

Incident #6118-1

A pesticide incident occurred in 1992, when a twenty-six year old woman applied the product and thirty minutes later she experienced irritated hands. No further information on the disposition of the case was reported.

Incident #6223-1

A pesticide incident occurred in 1997, when a woman bathed her cat that her son touched. He experienced hives which continued to worsen. No further information on the disposition of the case was reported.

Incident #6439-1

A pesticide incident occurred in 1998, when an individual, who did not wear gloves, shampooed their dog and experienced a rash. No further information on the disposition of the case was reported.

Incident #6476-1

A pesticide incident occurred in 1998, when a woman bathed her cat, who scratched her, and she then experienced a rash. No further information on the disposition of the case was reported.

Incident #6511-1

A pesticide incident occurred in 1998, when a pet owner used the product and experienced burning hands. No further information on the disposition of the case was reported.

Incident #6531-1

A pesticide incident occurred in 1996, when the product was applied by a pest control operator in the attic. Fourteen months later the homeowner experienced a rash on his arm at two different times a year apart from each other. No further information on the disposition of the case was reported.

Incident #6539-1

A pesticide incident occurred in 1998, when an individual was exposed to the product at an orange grove and experienced skin problems. No further information on the disposition of the case was reported.

Incident #6599-39

A pesticide incident occurred in 1997, when an individual experienced dyspnea. No further information on the disposition of the case was reported.

Incident #6692-115

A pesticide incident occurred in 1998, when an individual experienced nausea, dizziness, and dyspnea. No further information on the disposition of the case was reported.

Incident #6750-1

A pesticide incident occurred in 1998, when a woman accidentally inhaled the product while treating her dog and experienced dizziness. No further information on the disposition of the case was reported.

Incident #6827-7

A pesticide incident occurred in 1998, when an individual experienced coughing, choking, dyspnea, and respiratory irritation. No further information on the disposition of the case was reported.

Incident #6827-29

A pesticide incident occurred in 1998, when an individual experienced a rash. No further information on the disposition of the case was reported.

Incident #7026-1

A pesticide incident occurred in 1998, when a woman used the product on her dog and experienced malaise. No further information on the disposition of the case was reported.

Incident #7028-2

A pesticide incident occurred in 1998, when an applicator sprayed the product and the next day experienced nausea and diarrhea. No further information on the disposition of the case was reported.

Incident #7077-1

A pesticide incident occurred in 1998, when a woman, who was not wearing gloves, used the product and experienced tingling hands. No further information on the disposition of the case was reported.

Incident #7579-2

A pesticide incident occurred in 1998, when an individual inhaled the product and experienced throat irritation, respiratory irritation, and nasal irritation. No further information on the disposition of the case was reported.

Incident #7579-235

A pesticide incident occurred in 1998, when an individual was exposed to the product dermally and experienced edema, skin irritation and pain, pruritus, and a rash. No further information on the disposition of the case was reported.

Incident #7659-7

A pesticide incident occurred in 1998, when a forty-four year old woman applied the

product and a few days later experienced puffy eyes, diarrhea, dehydration, high blood pressure, malaise, and a rash on her arms, face, and on the inside of the mouth. No further information on the disposition of the case was reported.

Incident #7659-24

A pesticide incident occurred in 1998, when a thirty-seven year old man was helping to mix the product and was sprayed during the process which may have also contaminated a beverage. About twelve hours later, he experienced joint aches and wheezing. No further information on the disposition of the case was reported.

Incident #7659-29

A pesticide incident occurred in 1998, when a man applied the product on trees and two days later he climbed a tree to do some pruning and straddled a branch. A day later, he experienced a rash on the inside and on the back of his legs. Nine days later, he experienced headaches, nausea, rashes on the insides and backs of thighs, buttocks, groin, and pubic areas. Fourteen days later his symptoms resolved. No further information on the disposition of the case was reported.

Incident #7659-39

A pesticide incident occurred in 1998, when a forty-seven year old woman applied the product and five days later when she was weeding in her garden, and wearing gloves, a small amount of mud got onto her wrist. About 10 minutes later, she washed her wrist and about twenty minutes later she experienced a burning sensation in this same area. The next day she experienced a rash, blisters, and a black and burned spot on her arm. She was hospitalized for four days because she was bitten by a brown recluse spider. No further information on the disposition of the case was reported.

Incident #7659-47

A pesticide incident occurred in 1998, when a fifty-five year old man used the product which was sprayed onto his body and face. Three weeks later, he experienced flu-like symptoms that progressed to joint aches. No further information on the disposition of the case was reported.

Incident #7659-49

A pesticide incident occurred in 1998, when a fifty-three year old woman applied the product while wearing shorts and a top. She experienced being unable to focus both eyes together on an object and had bumps on the inside of her eyelids. No further information on the disposition of the case was reported.

Incident #7764-9

A pesticide incident occurred in 1998, when a fifty year old man used the product and about 15 minutes later experienced hives and welts. The next day residual swelling occurred which went away a short time later. No further information on the disposition of the case was reported.

Incident #7764-29

A pesticide incident occurred in 1998, when an eighty-eight year old man, who had applied

the product by hand on his carpet, experienced confusion, sweating, coughing, choking, and seizures. He was hospitalized for a few days and was later released. No further information on the disposition of the case was reported.

Incident #7782-2

A pesticide incident occurred in 1998, when a man sprayed his son's field with 200 gallons of the product. He experienced respiratory irritation and problems and pain in his lower left quadrant. He was hospitalized for pneumonia which had progressed to the point of intubation. No further information on the disposition of the case was reported.

Incident #7782-3

A pesticide incident occurred in 1998, when a man sprayed the product on rose bushes. About ten minutes later he worked on the roses without wearing gloves. The next day he experienced abdominal pain, cramps, diarrhea, and blood in his stools. No further information on the disposition of the case was reported.

Incident #7896-25

A pesticide incident occurred in 1998, when an individual mixed the product and then sprayed the inside of her house for the next three days. She experienced muscle spasms in her back and legs, felt faint, diaphoresis, numbness in the legs, lips, tongue, and mouth, and difficulty walking. She was hospitalized for two days. No further information on the disposition of the case was reported.

Incident #8050-14

A pesticide incident occurred in 1998, when a man applied the product with a spreader. The next day, he experienced severe muscle dystonia and shaking. No further information on the disposition of the case was reported.

Incident #8050-17

A pesticide incident occurred in 1998, when a woman applied the product because she thought it was the dust product. There was no direct exposure to the dust. She experienced extremely swollen legs and slightly swollen hands. A few days later she also experienced swollen ankles and went to the emergency department. The doctor told her that her symptoms were from eating too much salt. About a week later she continued to experience swelling. About two weeks later she was hospitalized, but not due to the use of the product. No further information on the disposition of the case was reported.

Incident #8050-20

A pesticide incident occurred in 1998, when a man applied the product on his cat and got some of it on his hands, which he washed off. Twenty minutes later, he experienced burning of his neck muscles. He saw a physician who suspected other causes for his symptoms. No further information on the disposition of the case was reported.

Incident #8113-7

A pesticide incident occurred in 1998, when an individual moved into a house and put the product on the floor before laying down new carpeting. He experienced a rash over his entire body area which progressed to sores and was hospitalized for four days with an elevated white blood cell count. No further information on the disposition of the case was reported.

Incident #8219-3

A pesticide incident occurred in 1998, when a couple applied an entire box of the product to their rental house to control fleas. The husband did not read the label of the product and the wife vacuumed the carpet. About two weeks later she experienced bronchitis and lung pain. No further information on the disposition of the case was reported.

Incident #8250-1

A pesticide incident occurred in 1998, when a man sprayed the product on corn at the rate of 4 quarts to 50 gallons. The weather conditions were hot and humid while he picked corn in the field for a few days. He experienced a red line down the sides of the upper torso with lumps under his skin. No further information on the disposition of the case was reported.

Incident #8406-1

A pesticide incident occurred in 1999, when a mother used a product that contained carbaryl and metaldehyde on dirt outside her house. Her twenty-five lb child ate the dirt and experienced vomiting and also experienced diarrhea two days earlier. No further information on the disposition of the case was reported.

Incident #8462-3

A pesticide incident occurred in 1999, when an elderly woman sprinkled the product on the carpet inside her home, which is a misuse of the product. She experienced difficulty breathing. No further information on the disposition of the case was reported.

Incident #8462-10

A pesticide incident occurred in 1999, when a man experienced hives and a swollen right eye. He was seen by a physician. No further information on the disposition of the case was reported.

Incident #8571-21

A pesticide incident occurred in 1999, when a boy pulled the product down from a shelf in his garage. The product may have landed on his eye or in his face. He experienced a rash on his entire body area and shaking. No further information on the disposition of the case was reported.

Incident #8573-1

A pesticide incident occurred in 1998, when the product was used in a man's yard. Three days later, he removed a piece of rotting soffit which was sprayed with the product and worked in the garden. Two days later, he experienced vertigo and sweating which has persisted. No further information on the disposition of the case was reported.

Incident #8675-3

A pesticide incident occurred in 1998, when a man experienced persistent throat irritation that lasted about 6 months. No further information on the disposition of the case was reported.

Incident #8693-12

A pesticide incident occurred in 1999, when a woman sprayed the product into a citrus tree and it blew back into her face. She experienced second and third degree burns, erythema, hives, and welts. No further information on the disposition of the case was reported.

Incident #8693-19

A pesticide incident occurred in 1999, when an individual, who was not wearing a mask, sprayed the product on fruit trees. He experienced rheumatoid arthritis, swollen hands, and knees. No further information on the disposition of the case was reported.

Incident #8693-22

A pesticide incident occurred in 1999, when a woman applied the product and forty minutes later she experienced itching on her hands and feet and welts all over her entire body area. No further information on the disposition of the case was reported.

Incident #8823-16

A pesticide incident occurred in 1999, when a man's son applied the product outdoors. The man experienced edema, hives, welts, and pruritus. No further information on the disposition of the case was reported.

Incident #8924-11

A pesticide incident occurred in 1999, when an individual sprayed the product on fruit trees. The next day, the man ate some fruit and experienced diarrhea. No further information on the disposition of the case was reported.

Incident #8938-2

A pesticide incident occurred in 1999, when a self-employed landscaper ate home made bread that was contaminated with the product. He experienced nausea, vomiting, sweating, and abdominal cramps and was hospitalized for about 6 days. No further information on the disposition of the case was reported.

Incident #9019-2

A pesticide incident occurred in 1999, when the product was applied and a woman's son experienced a rash on his face. No further information on the disposition of the case was reported.

Incident #9019-11

A pesticide incident occurred in 1999, when a woman, who has a heart condition, applied the product to her dogs. About a month later she experienced weakness and fatigue. No further information on the disposition of the case was reported.

Incident #9019-23

A pesticide incident occurred in 1999, when a man applied the product and experienced edema, erythema, and pruritus. No further information on the disposition of the case was reported.

Incident #9152-10

A pesticide incident occurred in 1999, when an individual sprayed trees for Japanese beetles over a one to two week period. He experienced nausea, diarrhea, numbness around the mouth and neck, and throat and chest tightness. No further information on the disposition of the case was reported.

Incident #9153-15

A pesticide incident occurred in 1999, when a male used the product and got dust on his shirt and pants. He experienced a rash on his torso and pruritus. No further information on the disposition of the case was reported.

Incident #9153-25

A pesticide incident occurred in 1999, when a woman sprinkled her tomato plants and about two weeks later experienced large welts on her body. No further information on the disposition of the case was reported.

Incident #9153-51

A pesticide incident occurred in 1999, when a worker was spraying the product and the wand on the machine was dripping. She experienced cellulitis and dermal irritation and pain. No further information on the disposition of the case was reported.

Incident #9262-7

A pesticide incident occurred in 1999, when a woman treated tomatoes and later experienced an earache and a swollen throat. No further information on the disposition of the case was reported.

Incident #9262-28

A pesticide incident occurred in 1999, when an individual applied the product on goats for the past three months. The individual experienced severe pain in all joints and swollen wrists, hands, and fingers. No further information on the disposition of the case was reported.

Incident #9397-2

A pesticide incident occurred in 1999, when a male ingested about ½ of a teaspoon of the product and passed out. Later, he was awake and breathing well. No further information on the disposition of the case was reported.

Incident #9924-1

A pesticide incident occurred in 1999, when a female experienced a rash. No further information on the disposition of the case was reported.

II. Poison Control Center Data - 1993 through 1998

Results for the years 1993 through 1998 are presented below for occupational reports, non-occupational reports involving adults and older children, and for children under age six. Cases involving exposures to multiple products are excluded. Tables 1-4 present the hazard information for carbaryl compared with all other pesticides on six measures: percent with symptoms, percent with moderate, major, or fatal outcome, percent with major or fatal outcome, percent of exposed cases seen in a health care facility, and percent hospitalized and percent seen in a critical care facility. Table 1 reports the number of reports which are the basis for the data derived in Tables 2-4. Only the products which contain "carbaryl" or "Sevin" as part of their name were included. Products meeting this criteria account for over two-thirds of all carbaryl containing products registered with EPA and are felt to be representative. Table 2 presents information for occupational cases, Table 3 for non-occupational cases, and Table 4 for children under age six.

Table 1. Number of carbaryl exposures reported to the Toxic Exposure Surveillance System (AAPCC), number with determined outcome, number seen in a health care facility for occupational and non-occupational cases (adults and children six years and older) and for children under six years of age only, 1993-1998.

Subgroup	Exposures	Outcome determined	Seen in Health Care Facility
Occupational: adults and older children	174	90	78
Non-occupational: adults and older children	3033	1351	685
Children under age six	2147	1248	282

Table 2. Comparison between carbaryl and all pesticides for percent reports with symptomatic outcome (SYM), moderate or more severe outcome (MOD), life-threatening or fatal outcome (LIFE-TH), seen in a health care facility (HCF), hospitalized (HOSP), or seen in an intensive care unit (ICU) reported to Poison Control Centers, 1993-1998 for occupational cases only.

Pesticide	SYM*	MOD*	LIFE-TH*	HCF*	HOSP*	ICU*
Carbaryl	91.1%	15.6%	0%	44.8%	5.13%	2.56%
All Pesticides	86.0%	18.8%	0.62%	47.3%	7.18%	2.85%
Ratio	1.06	0.83	0.00	0.95	0.71	0.90

* Symptomatic cases based on those cases with a minor, moderate, major, or fatal medical outcome. Denominator for SYM, MOD, and LIFE-TH is the total cases where medical outcome was determined. Denominator for HCF is all exposures. Denominator for HOSP and ICU is all cases seen in a health care facility.

Table 3. Comparison between carbaryl and all pesticides for percent reports with symptomatic outcome (SYM), moderate or more severe outcome (MOD), life-threatening or fatal outcome (LIFE-TH), seen in a health care facility (HCF), hospitalized (HOSP), or seen in an intensive care unit (ICU) reported to Poison Control Centers, 1993-1998 for non-occupational cases involving adults and older children (six years and older)

Pesticide	SYM*	MOD*	LIFE-TH*	HCF*	HOSP*	ICU*
Carbaryl	66.8%	12.6%	0.89%	22.6%	13.4%	5.98%
All Pesticides	68.5%	10.5%	0.36%	18.1%	7.35%	3.24%
Ratio	0.98	1.21	2.48	1.25	1.83	1.85

* Symptomatic cases based on those cases with a minor, moderate, major, or fatal medical outcome. Denominator for SYM, MOD, and LIFE-TH is the total cases where medical outcome was determined. Denominator for HCF is all exposures. Denominator for HOSP and ICU is all cases seen in a health care facility.

Table 4. Comparison between carbaryl and all pesticides for percent reports with symptomatic outcome (SYM), moderate or more severe outcome (MOD), life-threatening or fatal outcome (LIFE-TH), seen in a health care facility (HCF), hospitalized (HOSP), or seen in an intensive care unit (ICU) for adults and children six years and older reported to Poison Control Centers, 1993-1998 for children under six years old.

Pesticide	SYM*	MOD*	LIFE-TH*	HCF*	HOSP*	ICU*
Carbaryl	13.4%	1.60%	0%	13.1%	4.96%	2.13%
All Pesticides	21.8%	1.40%	0.12%	16.8%	5.12%	1.48%
Ratio	0.61	1.14	0.00	0.78	0.97	1.43

* Symptomatic cases based on those cases with a minor, moderate, major, or fatal medical outcome. Denominator for SYM, MOD, and LIFE-TH is the total cases where medical outcome was determined. Denominator for HCF is all exposures. Denominator for HOSP and ICU is all cases seen in a health care facility.

For occupational reports, carbaryl appears to have somewhat less hazard as determined by the measures reported in Table 2 than all pesticides combined. For cases involving children under six years of age, carbaryl has a similar hazard profile to all other pesticides (Table 5). Cases involving non-occupational adults and older children showed an increased risk in five of the six measures reported in Table 4. In particular these non-occupational cases were nearly twice as likely to require serious health care (hospitalization or treatment in a critical care unit) and were 2.5 times more likely to experience major medical outcome (life-threatening effects or significant residual disability). These data suggest that some consumers are using this product in a careless manner.

III. California Data - 1982,through 1996

Detailed descriptions of 226 cases submitted to the California Pesticide Illness Surveillance Program (1982-1996) were reviewed. In 90 of these cases, carbaryl was used alone or was judged to be responsible for the health effects. Only cases with a definite, probable or possible relationship were reviewed. Carbaryl ranked 37th as a cause of systemic poisoning in California. Table 1 presents the types of illnesses reported by year. Table 2 gives the total number of workers that took time off work as a result of their illness and how many were hospitalized and for how long.

Table 1. Cases Due to Carbaryl in California Reported by Type of Illness and Year, 1982-1996.

Year	Illness Type					Total
	Systemic ^b	Eye	Skin	Respiratory	Combination ^c	
1982	7	1	5	-	-	13
1983	5	3	2	-	1	11
1984	5	3	3	-	-	11
1985	8	1	2	-	1	12
1986	2	1	-	-	-	3
1987	3	1	1	-	-	5
1988	2	-	-	-	1	3
1989	3	2	-	-	-	5
1990	1	2	1	1	-	5
1991	-	1	-	-	-	1
1992	2	2	4	-	-	8
1993	-	1	1	-	-	2
1994	-	1	-	-	-	1
1995	1	-	1	-	1	3
1996	4	1	1	-	1	7
Total	43	20	21	1	5	90

^b Category includes cases where skin, eye, or respiratory effects were also reported.

^c Category includes combined irritative effects to eye, skin, and respiratory system.

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Table 2: Number of Persons Disabled (taking time off work) or Hospitalized for Indicated Number of Days After Carbaryl Exposure in California, 1982-1996.

Time period	Number of Persons Disabled	Number of Persons Hospitalized
One day	8	2
Two days	4	-
3-5 days	4	1
6-10 days	1	-
more than 10 days	2	-
Unknown	7	4

A total of 43 persons had systemic illnesses or 48% of 90 persons. A variety of worker activities were associated with exposure to carbaryl as illustrated in Table 3 below.

Table 3: Illnesses by Activity Categories for Carbaryl Exposure in California, 1982-1996

Activity Category ^a	Illness Category					Total
	Systemic ^b	Eye	Skin	Respiratory	Combination ^c	
Applicator	13	15	5	-	2	35
Mixer/loader	4	2	-	-	-	6
Coincidental	3	-	-	-	-	3
Drift	2	-	-	1	1	4
Expotocnc	2	1	6	-	-	9
Resifield	1	-	5	-	1	7
Resiother	1	1	1	-	-	3
Other	17	1	4	-	1	23
Total	43	20	21	1	5	90

^a Drift= exposure to pesticide that has drifted from intended targets; Expotocnc= shipping, warehousing, or retailing of pesticides; Resifield= field worker exposed to residue in the field; Resiother= exposed to residue but not agricultural; Other= other miscellaneous exposure;

^b Category includes cases where skin, eye, or respiratory effects were also reported

^c Category includes combined irritative effects to eye, skin, and respiratory system

According to the above activity categories, applicator was associated with more exposures than any other category. These illnesses included symptoms of nausea, vomiting, skin rashes, sore throat, lip swelling, chemical conjunctivitis, dizziness, eye irritation, contact dermatitis, blurry vision, chest pains, and several other symptoms. The number of reports from California declined by over half from the first five years of the reporting period (1982-1986) to the last five years (1992-1996). It is difficult to determine whether some of this decline might be related to a decrease in usage because the method of collecting use information changed after 1989.

IV. National Pesticide Telecommunications Network

On the list of the top 200 chemicals for which NPTN received calls from 1984-1991 inclusively, carbaryl was ranked 5th with 503 incidents in humans reported and 85 incidents in animals (mostly pets). For the years 1995 through 1998, carbaryl's rank ranged from 7th to 12th with 110 incidents in humans reported and 26 incidents in animals. Most of the decline in reported human reports from the earlier time period is due to the reduced level of incident reporting overall. However, even taking this into account, there does appear to be some reduction in carbaryl incidents which is also reflected in the lower rankings reported for the later years (1995-1998).

V. Literature Reports of Human Poisonings

Branch and Jacqz (1986) reported on a seventy-five year old man who experienced progressive neurologic syndrome associated with headaches, memory loss, proximal muscle weakness, muscle fasciculation, muscle cramps, anorexia, and weight loss. His blood cholinesterase levels were low and most of his symptoms subsided after termination of the high level exposure to carbaryl. The authors concluded that there is the possibility that long term exposure to carbaryl can cause neurotoxicity in humans.

In a letter to the editor, questions were raised by McEvoy and Schulman (1986) about the above study. The authors wanted evidence about whether discussion of the case in their study was adequate to determine a causal association between carbaryl exposure and neurotoxicity. Branch and Ward responded by stating that a close temporal relationship between toxicity was observed in the patient and both initial exposure and withdrawal of exposure. The man's symptoms did not return to normal after initial clean up, but did improve after he was relocated from his house and his belongings were discarded. Then, both his symptoms and blood cholinesterase returned to normal. Branch and Ward agreed that they may have oversimplified a complex situation but the internist, cardiologist, neurologist, and the orthopedist agreed that long-term exposure to carbaryl was the most likely cause of the patient's clinical syndrome.

Brewer (2000) reported on a forty-two year old man who used a product that contained 5% carbaryl to get rid of a wasps nest in his attic, an area that is enclosed without any windows and poorly ventilated. He wore a cotton homemade mask and he sustained two wasp stings. Twenty

minutes later, he staggered into the living room and lost consciousness. At the hospital, his short-term memory was severely impaired and he was acutely confused and combative. He also exhibited hypotension, sinus tachycardia, and lacrimation suggestive of cholinergic stimulation. He had no history of allergies and there was no evidence of a reaction at the site of the wasp stings. He was treated and gradually improved.

Devinsky et al. (1992) reported on a fifty year old scientist who applied a commercial tick powder that contained 5% carbaryl and 95% inert ingredients twice a day during a summer month to his cat. While he used the product some of it blew back into his face. He experienced aggressive behavior which he delivered in a menacing voice with a flushed face. He also experienced fatigue, aching joints, and tearful or swollen eyes. Within a week his symptoms ceased after he stopped using the product.

Dickoff et al. (1987) reported on a twenty-three year old man who swallowed rat poison that contained dicumarol, resulting in no effects. The next day, he swallowed an unknown amount of boric acid and 100 cc of a pesticide that contained 27% carbaryl and 73% water. The estimated dose was 500 mg/kg which is close to the estimated LD₅₀. Three hours later he experienced a coma. He was intubated for respiration and for control of profuse bronchial secretion that was discontinued the next day. Three days later, he lost the motor function in his legs and hands. His blood cholinesterase was 4 units/ml (normal is 3 to 8 units/ml) three days after his exposure. He also experienced excessive salivation, pupillary miosis, eyelid fasciculations, flaccid tone, pulmonary edema, diarrhea, and incontinence. Nine months later his strength was normal except for bilateral severe ankle and toe weakness. The authors concluded that neither boric acid or dicumarol contributed significantly to the clinical effects and suggest that a case of lingering encephalopathy may have occurred due to the exposure to carbaryl. They note that hypoxia and hypotension are potential alternative explanations for the encephalopathy.

Park et al. (2000) reported on a forty-one year old female who ingested 40 ml of 80% carbaryl in an attempt to commit suicide (dose was not specified but appears to be slightly higher than the dose described in the case presented by Dickoff et al. above). She was admitted to the hospital and was comatose and unresponsive to stimuli. She experienced miotic pupils, excessive salivation, diaphoresis, excessive bronchial secretion, and diffuse rales over both lungs, alveolar pulmonary edema and pneumomediastinum. On the fourth day of hospitalization, the endotracheal intubation was removed and she still experienced dyspnea. She was later discharged from the hospital and about eight months later her chest radiograph and pulmonary function test were normal. The authors recommended that carbaryl be added to the list for chemical-induced interstitial pneumonitis.

Robinson (1990) reported on a forty-year old female who ingested about one cup (240 ml) of a pesticide (Isotox) containing carbaryl in a suicide attempt. She was hospitalized and was lethargic and cyanotic with pinpoint pupils. She was in the intensive care unit for several days where she received ventilatory assistance. Two days later after ingestion, her red blood cell cholinesterase levels were 10 U/ml which were remarkably low. Five days after ingestion, she had 3 mm reactive

pupils bilaterally and experienced excessive salivary and lacrimal secretions and increased pulmonary secretions. Recovery was largely complete at 12 days after ingestion.

Sargin et al. (1992) reported on a seventeen year old white female who accidentally drank a glass of carbaryl liquid. Two days later she experienced nausea, vomiting, abdominal pain, weakness in her limbs, and behavioral changes. Twenty-three days later she went to the hospital and was treated but her quadriplegia became worse and she died of respiratory and circulatory failure. She was diagnosed as having acquired porphyria which did not respond to treatment.

Wiener and Young (1995) reported on a sixty-nine year old female who became exposed to carbaryl when her neighbor sprayed his yard once a week for a month. Her husband experienced hypersomnia, her pets exhibited erratic behavior, and dead animals were noted in her yard. The female experienced diarrhea, abdominal cramps, anorexia, nausea, headaches, poor concentration, muscle weakness, malaise, confusion, lightheadedness, tearing, persistent tremor, anxiety, dysphoria, crying spells, weight loss and psychological effects including delusions of persecution. She was hospitalized after experiencing auditory hallucinations. Four days later she was transferred to a psychiatric hospital and was cognitively intact. Three to four weeks after being hospitalized, her blood cholinesterase levels were 3.1 U/ml and 3.3 U/ml (normal level = 3.4-6.5 U/ml). By the fourth week her psychotic and depressive symptoms cleared. The authors suggest "this patient may have been vulnerable to carbaryl on the basis of demographic factors that influence pharmacokinetics and low baseline cholinesterase activity."

Savitz et al. (1997) reported on the Ontario Farm Family Health Study which studied male pesticide exposure and pregnancy outcome. The survey included data from several thousand couples that lived on farms that were most likely family-operated. Couples were eligible to participate if the woman was 44 years old or younger and lived on the farm year round. Two thousand nine hundred forty-six couples met the criterion and 1,898 provided forms for the farm operator, husband, and wife. Five thousand eight hundred and fifty-three pregnancies, of which 3,984 were included in the analysis. All pregnancies that were reported by the couples were classified based on outcome and were excluded if the time interval of the pregnancy could not be determined with certainty, if the pregnancy did not occur while the woman was living on the study farm, or if it was unlikely that the husband who completed the questionnaire was the father of the conception. The men were asked about their farm activities over the past five years and the months of the year when the activity was done. The following five activities were considered from direct pesticide exposure: mixing or applying crop herbicides, crop insecticides and fungicides, livestock chemicals, yard herbicides, and building pesticides. Considering male farm activities and reported use of specific chemicals on the farm suggested that thiocarbamates, carbaryl, and other pesticides were most strongly associated with miscarriage. The adjusted odds ratio for carbaryl used on crops was 2.1 with a 95 percent confidence interval of 1.1 to 4.1 (borderline significance). Use of carbaryl in the yard was not associated with a significantly increased risk of miscarriage and carbaryl was not a significant risk factor for preterm delivery or small for gestational age births.

Whorton et al. (1979) reported on a population of male workers who produced and packaged carbaryl to determine the effects of the chemical on the male reproductive process. A cohort of 99 males, including 53 baggers, 23 operators, and 23 other employees such as supervisory and maintenance were included in the study. The males were current or past carbaryl workers with at least 1 year of work experience. Of the 99 males, 47 provided satisfactory semen specimens and 27 men who had undergone vasectomies were excluded from the study. The cumulative percentage distribution of sperm counts in carbaryl workers was compared to chemical plant workers who were the controls in previous Environmental Health Associates (EHA) studies. There was not a significant difference between the proportions of oligospermic men in the control and exposed populations, the sperm-count distributions were similar, and there was not a significant association between sperm count and every meaningful measure of exposure intensity and duration. Overall, the authors concluded that there is no evidence of sperm-count suppression resulting from carbaryl exposure. Also, there is no evidence that exposure to carbaryl has caused infertility among the male employees.

Whorton et al. (1979) and Wyrobek et al. (1981) used the same cohort in their studies that included men that were exposed to carbaryl to determine the effects on fertility by checking for infertile marriages and by measuring sperm counts and serum gonadotropins. The carbaryl-exposed group included nearly three times as many oligospermic men as the control group. Wyrobek et al. (1981) concluded that a non-dose related, significant elevation in sperm head abnormalities compared to controls, that may not be reversible. Both of the studies had low participation rates, relied on self-reporting of exposure levels, and used less than ideal control groups.

Senthilselvan et al. (1992) reported on the association between self-reported asthma and pesticide use in 1,939 farmers. The prevalence of asthma was significantly associated with the use of carbamate insecticides regardless of age, smoking pack-years, and nasal allergic reactions. The authors concluded that the possibility of exposure to agriculture chemicals could be related to lung dysfunction in exposed farmers.

Sharma and Kaur (1990) reported on 30 farmers that had contact dermatitis after using pesticides for several years. The farmers included 25 males and 5 females, between the ages of 28 and 70 years old. Patch testing was conducted on the upper back and readings were taken on the second, third, and seventh day. Allergic reactions to one or more pesticides were seen in 11 patients. One patient was sensitive to carbaryl and two patients to 3 each (2,4-D, thiram, carbaryl; peridimethalin, methyl parathion and carbofuran). Carbamates, including carbaryl, were the most frequent sensitizers. Allergic reactions did not occur in the twenty controls included in the study.

VI. Conclusions

The data from the Incident Data System indicated that a majority of cases involved dermal reactions. A number of cases involve asthmatics and people who experienced hives and other allergic type reactions. According to California data, about half of the cases involved skin and eye

effects that were handlers. About a quarter of the skin reactions were due to workers that were exposed to residues on crops. Reports from the literature (Senthilselvan et al. 1992, Sharma and Kaur 1990) are very limited but tend to support the finding that carbaryl has irritant properties.

The Poison Control Center cases involving non-occupational adults and older children showed an increased risk in five of the six measures reported. These cases were almost twice as likely to require serious health care (hospitalization or treatment in a critical care unit) and were two and a half times more likely to experience major medical outcome (life-threatening effects or significant residual disability). This pattern of increased risk was not seen among occupational reports or young children. This may mean careless handling by non-professionals is a particular hazard.

Five case reports (Branch and Jacqz 1986, Brewer 2000, Devinsky et al. 1992, Dickoff et al. 1987, Wiener and Young 1995) were found that suggested that carbaryl may be a cause of long term neurological or psychological problems. Some of these effects appear to be consistent with those reported from organophosphate poisoning. However, unlike organophosphates, no controlled studies have been undertaken. If such effects occur as a result of over-exposure to carbaryl, they appear to be relatively rare. The effects reported among the five case reports are too inconsistent to draw any conclusions, but do suggest the need for further study.

VII. Recommendations

Carbaryl appears capable of causing dermal and allergic type reactions. Data support the need for personal protective equipment and eye protection for handlers and skin protection for field workers who may have extensive exposure to carbaryl. Labels for products should advise that carbaryl can cause sensitizing effects in some people.

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