APPENDIX K. Permethrin Incident Database Review

A review of the EIIS database for ecological incidents involving permethrin was completed on August 19, 2008. This database consists of exposure incident reports submitted to the EPA from 1994 to present. A summary of ecological incidents involving permethrin are listed in the tables below. Tables are divided into incidents involving aquatic organisms (**Table K.1**), terrestrial plants (**Table K.2**) and terrestrial animals (**Table K.3**).

Uncertainties Related to the Use of Incident Information from the Ecological Incident Information System

Incident data are used in risk assessments to provide evidence that the risk predictions from the screening level assessment are supported by actual effects in the field. Incident reports submitted to EPA since approximately 1994 have been tracked by assignment of incident numbers in an Incident Data System (IDS), microfiched, and then entered to a second database, the Ecological Incident Information System (EIIS). Additionally, there is an on-going effort to enter information to EIIS on incident reports received prior to establishment of current databases. Incident reports are not received in a consistent format (*e.g*., states and various labs usually have their own formats), may involve multiple incidents involving multiple chemicals in one report, and may report on only part of a given incident investigation (*e.g*., residues).

Incidents entered into EIIS are categorized into one of several certainty levels regarding the likelihood that a particular pesticide is associated with the incident: highly probable, probable, possible, unlikely, or unrelated. In brief, "highly probable" incidents usually require carcass residues and/or clear circumstances regarding the exposure. "Probable" incidents include those where residues were not available and/or circumstances were less clear than for "highly probable." "Possible" incidents include those where multiple chemicals may have been involved and it is not clear what the contribution was of a given chemical. The "unlikely" category is used, for example, where a given chemical is practically nontoxic to the category of organism killed and/or the chemical was tested for but not detected in samples. "Unrelated" incidents are those that have been confirmed to be not pesticide-related.

Incidents entered into the EIIS are also categorized as to use/misuse. Unless specifically confirmed by a state or federal agency to be misuse, or there was very clear misuse such as intentional baiting to kill wildlife, incidents are not typically considered misuse.

The number of documented kills in EIIS is believed to be a small fraction of total mortality caused by pesticides. Mortality incidents must be seen, reported, investigated, and have investigation reports submitted to EPA to have the potential for entry into the database. Incidents often are not seen, due to scavenger removal of carcasses, decay in the field, or simply because carcasses may be hard to see on many sites and/or few people are systematically looking. Poisoned animals may also move off-site to less conspicuous areas before dying. Incidents may not get reported to appropriate authorities capable of investigating the incident for a variety of reasons including the finder may not know of the

importance of reporting incidents, may not know who to call, may not feel they have the time or desire to call, or may hesitate to call because of their own involvement in the kill. Incidents reported may not get investigated if resources are limited or may not get investigated thoroughly, with residue analyses, for example. Also, if kills are not reported and investigated promptly, there will be little chance of documenting the cause, since tissues and residues may deteriorate quickly. Reports of investigated incidents often do not get submitted to EPA, since reporting by states is voluntary, and few resources are assigned to incident reporting.

Furthermore, the database relies heavily on registrant-submitted incident reports, and registrants are currently only required to submit detailed information on 'major' ecological incidents, while 'minor' incidents are reported aggregately. Based on the 40 CFR (§159.184 Toxic or adverse effect incident reports), an ecological incident is considered 'major' if any of the following criteria are met:

> **Fish or wildlife***:*
>
> (A) Involves any incident caused by a pesticide currently in Formal Review for ecological concerns.
>
> (B) Fish: Affected 1,000 or more individuals of a schooling species or 50 or more individuals of a non-schooling species.
>
> (C) Birds: Affected 200 or more individuals of a flocking species, or 50 or more individuals of a songbird species, or 5 or more individuals of a predatory species.
>
> (D) Mammals, reptiles, amphibians: Affected 50 or more individuals of a relatively common or herding species or 5 or more individuals of a rare or solitary species.
>
> (E) Involves effects to, or illegal pesticide treatment (misuse) of a substantial tract of habitat (greater than or equal to 10 acres, terrestrial or aquatic).
>
> **Plants**:
>
> (A) The effect is alleged to have occurred on more than 45 percent of the acreage exposed to the pesticide.

All other ecological incidents are considered 'minor' and only need to be aggregately reported. 'Minor' incidents reported by the registrants are not included in the EIIS database. Therefore, for example, an incident could affect 900 fish, 150 birds, 45 mammals, and 40% of an exposed crop and not be included in the EIIS database [unless is it reported by a non-registrant (*e.g.*, an incident submitted by a state agency – which are not systematically collected)]. Therefore, because the number of documented kills in EIIS is believed to be a small fraction of total mortality caused by pesticides, absence of reports does not necessarily provide evidence of an absence of incidents.

Summary of Permethrin Incident Review

The EIIS database contained 39 incidents involving permethrin. The reports included twenty-six aquatic, seven plant and six terrestrial permethrin-related incidents.

Aquatic Incidents

The majority of ecological incidents involving permethrin occurred in aquatic environments. Twenty-six aquatic incidents caused by permethrin have been reported to the EPA since 1994. Of these incidents, nine are listed as highly probable, ten as probable, and seven under possible. Twenty-three incidents affected fish species, and the other three reports involved crayfish. Approximately half (thirteen) of the incidents resulted from registered use of permethrin. Many of these incidents originate with permethrin application to residences or other buildings, followed by permethrin runoff into nearby water bodies. One case listed as a possible permethrin-related event involved frogs. A mosquito control employee of the Maryland Department of Agriculture sprayed permethrin within 100 feet of a pond, and one day later many frogs, fish and crayfish were found dead. Although the applicator's certificate was suspended, permethrin is implicated as only a possible cause because no tissues or water samples were analyzed. A complete list of permethrin-related aquatic incidents is included in **Table K.1**.

Plant Incidents

Seven permethrin incident reports were recorded for terrestrial plant species. All incidents were only listed as possible or unlikely. Two reports involved registered use. The first registered-use incident involved both permethrin and piperonyl butoxide, and the plant damage could not be solely attributed to either chemical. In the second registered-use incident, many pesticides were involved and imazethapyr was suspected to be the cause of any plant injuries, not permethrin. All permethrin-related plant incidents in the EIIS database are listed in **Table K.2**.

Terrestrial Incidents

Six permethrin incidents involving terrestrial animals exist in the EIIS database. Two incidents were listed as highly probable, and four as possible. One of the highly probable incidents resulted from registered use. A municipality was sprayed with permethrin, and hundreds to thousands of dead butterflies were found by residents of the area shortly after application. Species listed in these reports included bee, monarch butterfly, other unknown butterflies, parakeet, dog, unknown birds, unknown trees and ornamental plants. A full list of all incidents involving permethrin is shown in **Table K.3**.

Table K.1. Permethrin Incident Reports Involving Aquatic Organisms

Incident #	Organism(s) Affected	Certainty of Involvement	Legality of Use	Description
I001849-002	Unknown fish	Highly probable	Registered use	A commercial pesticide applicator treated a building with permethrin. The next night, a heavy rain caused runoff of permethrin to a nearby private pond, killing approximately

				300 fish. Louisiana, 4/6/1994.
I016338-006	Bullhead (*Ameiurus* sp.), flathead minnow (*Pimephales promelas*), and rainbow trout (*Onchorhynchus mykiss*)	Highly probable	Registered use	Multiple buildings were sprayed with permethrin and bifenthrin, with around 100 gallons of pesticides used combined. After application, a storm carried the pesticides to a nearby holding pond and killed hundreds of bullheads, flathead minnows, and rainbow trout. The pond water contained 0.098 - 3.40 ppb bifenthrin and 99.8 ppb permethrin. Trout fillets contained 34.4 ppb bifenthrin and 406 ppb permethrin. New York, 5/2/2005.
I005761-001	Unknown fish	Highly probable	Unknown	A rancher sprayed 120 cattle with permethrin and removed the livestock from the vicinity of the nearby pond for several hours. After the cattle returned to the pond, an undetermined number of fish died. Iowa, 8/5/1997.
I001849-003	Unknown fish	Highly probable	Registered use	Permethrin and terbufos were applied to approximately 3,769 acres of corn fields, prior to planting. Heavy storms during the next month created heavy runoff and subsequent death of an estimated 1386 fish. The LSU School of Veterinary Medicine attributed the fishkill to both permethrin and terbufos (no data shown). Louisiana, 4/12/1994.
I004374-003	Catfish (Ictaluridae) and sunfish (Centrarchidae)	Highly probable	Accidental misuse	A fishkill occurred after a home was treated with permethrin. The pesticide equipment was rinsed in a manner that resulted in runoff to a nearby pond. Rain occurring after the treatment also contributed to runoff. Thousands of catfish and sunfish were killed. Missouri, 6/10/1995.
I003402-005	Crayfish (Decapoda)	Highly probable	Registered use	Permethrin was applied to a residence for termite control. A heavy rain washed the pesticide into a stream, and thousands of dead crayfish were found 1-1.5 miles downstream. Soil samples taken underneath the house contained 46.0 ppm permethrin and soil near the drainpipe contained 0.554 ppm permethrin. Permethrin was not detected in water samples, but sampling did not occur until two days after the incident. Virginia, 11/14/1995.
I003653-001	Bass (Centrarchidae spp.), carp (*Cyprinus carpio*) and catfish (Ictaluridae spp.)	Highly probable	Registered use	The basement floor and walls of a home were treated with permethrin to control for termites. A snowstorm occurred after the treatment, and the

				following snowmelt washed the pesticide into a nearby lake. Tissue samples for bass, carp and catfish contained 3.27, 3.7 and 3.7 ppm permethrin, respectively. Pennsylvania, 3/3/1996.
I004439-038	Unknown fish	Highly probable	Accidental misuse	A fishkill of unknown magnitude occurred in a backyard pond, after the lawn was treated with permethrin. Massachusetts, 6/20/1996.
I009136-001	Crayfish (Decapoda)	Highly probable	Registered use	Heavy rains carried permethrin from a residence to a nearby stream. Dead crayfish were found one-third of a mile away from the home. Soil samples contained 10.0 ppb permethrin, while water samples had no detectable levels of the pesticide. Virginia, 4/13/1998.
I006022-001	Rockfish (*Sebastes* sp.)	Probable	Accidental misuse	A state mosquito control truck sprayed permethrin within 10 feet of a commercial fish pond, killing 3000 rockfish. Maryland, 6/16/1997.
I000598-022	Black bullhead catfish (*Ictalurus melas*) and bluegill (*Lepomis macrochirus*)	Probable	Accidental misuse	After aerial spraying of permethrin in a nearby cornfield, an estimated 500 fish were killed in a nearby pond. Ten days after the accident occurred, samples were taken from the water, soil and sediment of the pond. Residues were below detection levels. Nebraska, 7/5/1992.
I000124-014	Bluegill (*Lepomis macrochirus*)	Probable	Accidental misuse	Treatment of home with permethrin entered house sump pump and emptied into fish pond, killing an unknown number of bluegill. Illinois, 3/31/1992.
I001028-010	Unknown fish	Probable	Registered use	During a light rain, a home and outside deck were treated with permethrin. The runoff drained into a nearby canal, where dead fish were later discovered. The species and number of fish killed were not reported. Florida, 8/1/1993.
I006261-001	Crayfish (Decapoda) and rainbow trout (*Onchorhynchus mykiss*)	Probable	Accidental misuse	After permethrin termiticide application to a home, around 230 dead crayfish and 50 dead rainbow trout were reported in a creek 160 feet away from the residence. Soil samples indicated permethrin levels between 17.0 – 53.0 ppb. Virginia, 4/16/1997.
I007226-001	Bass (Centrarchidae sp.) and bream	Probable	Registered use	Permethrin was applied within the city limits of Greenville, Mississippi for vector control. Three days after the application, fifteen bass and two bream were found dead in a lake.

				Mississippi, 9/2/1998.
I003582-010	Unknown fish	Probable	Unknown	An unknown number of fish were killed as a result of permethrin contamination in a stream. Pennsylvania, 3/5/1996.
I003582-042	Unknown fish	Probable	Unknown	Runoff from permethrin treatment spray killed fish in a downhill pond. Indiana, 5/6/1996.
I004439-039	Unknown fish	Probable	Registered use	A home was treated for termites with permethrin, and a fishkill of unknown magnitude occurred in a pond 20 feet away. Tennessee, 6/21/1996.
I014689-015	Bluegill (*Lepomis macrochirus*) and catfish (Ictaluridae)	Probable	Misuse	Permethrin was applied 400 feet away from a pond. Eight bluegill and seventy-two catfish were found dead. No further information on treatment site or method of application. Indiana, 5/7/2003.
I003826-030	Unknown fish	Possible	Registered use	A fish kill occurred in a commercial fish pond. The owner attributed the problem to pesticide drift from nearby corn and soybean fields. After conducting tests for a range of pesticides, the NC Department of Agriculture stated that pesticides could not be determined as the cause of the fish kill. However, permethrin was found in the soil (0.41 ppm) and vegetation (1.4 ppm) of the area. Total magnitude of the fish kill was not reported. North Carolina, 6/14/1994.
B000175-001	Unknown fish	Possible	Registered use	Three pesticides (paraquat, permethrin and bicep) and fertilizer were applied to a corn field. A fishkill in a nearby pond occurred after a heavy storm. The incident was attributed to the fertilizer and low dissolved oxygen, but permethrin may be another contributing factor due to its high toxicity to fish. Kentucky, 1992.
I004439-121	Unknown fish	Possible	Unknown	A lawn was treated with permethrin. After an unspecified time, an unknown number of fish located in a nearby pond died. New Jersey, 9/9/1996.
I004439-119	Unknown fish	Possible	Unknown	A home exterior, 210 feet from a pond, was treated with permethrin. Four days later, a fish kill was observed. Virginia, 9/21/1996.
I007984-003	Striped bass (*Morone saxatilis)*, crayfish (Decapoda) and unknown frogs	Possible	Accidental misuse	An employee of the Mosquito Control section of the Maryland Department of Agriculture applied permethrin to a residential property. One day later, 600 fish, crayfish and frogs were

				found dead. The spraying was 74 feet away from the pond, while regulations require 100 feet. Pond water sampled a few days after the incident showed low dissolved oxygen. Maryland, 6/16/1997.
I014312-001	Goldfish (*Carassius auratus*)	Possible	Registered use	Permethrin was applied to a lawn, and runoff caused by rains resulted in an estimated 40 – 60 goldfish deaths in a proximate pond. Kansas, 4/1/2003.
I008293-001	Velvet swords (*Xiphophorus helleri*), oscars (*Astronotus ocellatus)* and discus (Symphysodon sp.)	Possible	Registered use	Drift from four pesticides (including permethrin) applied to tomato fields may have caused a fishkill in ponds 100 yards away. The species include several ornamental fish, including velvet swords, oscars, and discus. The applicator was observed lifting booms at row ends without ceasing spray flow. Oily residue was found at pond edges, and the ponds contained low dissolved oxygen. Dying fish exhibited tremors symptomatic of pyrethroid or organophosphate exposure. Florida, 12/1/1998.

Table K.2. Permethrin Incident Reports Involving Terrestrial Plant Species

Incident #	Organism(s) Affected	Certainty of Involvement	Legality of Use	Description
I007340-620	Unknown edible crop	Possible	Unknown	Damage occurred to an edible crop as a result of permethrin use. Florida, 4/22/1998.
I010927-003	Alfalfa (*Medicago sativa)*	Possible	Registered use	An alfalfa field had been previously treated with permethrin and chlorpyrifos, and damaged occurred due to carryover. Both pesticides are believed to have contributed to the damage. Wisconsin, 4/15/1999.
I012515-002	Unknown tropical plants	Possible	Unknown	Tropical plants were treated with permethrin and piperonyl butoxide. Plants exhibited burn spots, yellowing leaves and defoliation. Plants may have been suffering from nutrient deficiency, which may have compromised the waxy cuticle and made the plants more vulnerable to exposure. Unknown location, 8/13/2001.
I019442-001	Clover (Trifolium sp.), timothy-grass (*Phleum pretense*) and unknown grasses and legumes	Possible	Intentional misuse	Pesticide application to a right-of-way possibly caused chlorosis as far as 200 feet away in an adjacent hay and pasture field. Pesticides involved include permethrin, 2,4-D, acetochlor,

				atrazine, glyphosate, metribuzin and clomazone. Plant tissue samples from the right-of-way contained 9.85 ppm of Pendimethalin. None of the aforementioned chemicals were detected in samples from the hay and pasture field. The observed whitening of the vegetation is symptomatic of clomazone damage, but other herbicides present may have contributed. Ohio, 7/19/2007.
I009544-001	Soybean (*Glycine max*)	Possible	Unknown	A farmer attributes the reduced productivity of 142 acres of soybeans to permethrin and carboxin application. The pesticides are believed to have killed the *Rhizobium* bacteria in the soil inoculate added at the time of planting. The soybeans showed stunted growth and a light yellow color indicative of nitrogen deficiency. Wisconsin, 7/10/1999.
I016138-001	Cauliflower (*Brassica oleracea*)	Unlikely	Registered use	Aerial spraying of pesticides damages 70 acres of cauliflower, to the extent that the crop is claimed to be unfit for human consumption. Owner of field claims that the mixture of insecticides used was "contaminated and adulterated with herbicides". Pesticides involved include permethrin, indoxacarb and imazethapyr. Imazethapyr is toxic to cauliflower and not registered for use on this crop, but no evidence was presented to show that the herbicide was actually sprayed in this instance. California, 10/11/2004.
I000340-007	Unknown lawn plants	Unlikely	Unknown	Permethrin was applied near a residence, and browning of lawn plants was reported. However, permethrin is not known to cause plant damage, and it is unlikely to be the cause of the observed browning. Florida, 10/7/1992.

Table K.3. Permethrin Incident Reports Involving Terrestrial Animal Species

Incident #	Organism(s) Affected	Certainty of Involvement	Legality of Use	Description
I003826-028	Bee (Apidae)	Highly probable	Accidental misuse	Bee keepers report bee kills in hives and attribute the damage to aerial application of pesticide to a nearby soybean field. A certified aerial applicator treated 400 acres of soybean fields. Permethrin was found in nearby vegetation samples in concentrations

				ranging from 0.32 – 4.1 ppb. The applicator paid an $1800 fine to the North Carolina Department of Agriculture for misuse. North Carolina, 8/30/1994.
I011527-001	Monarch butterfly (*Danaus plexippus*) and unknown butterfly (Lepidoptera)	Highly probable	Registered use	A municipality was sprayed with permethrin and piperonyl butoxide. Several hours after application, residents began noticing hundreds to thousands of dead butterflies (mostly monarch). Analysis showed 20 – 37 ppm permethrin in butterfly samples. Minnesota, 8/23/2000.
I004852-015	Parakeet (Psittacidae)	Possible	Unknown	A residence was treated with permethrin and four days later, four parakeets died. No analytical evidence was reported. Oklahoma, 10/29/1996.
I000340-006	Dog (*Canis Familiaris*)	Possible	Unknown	A dog was treated with permethrin and cypermethrin. The dog then became ill and incapacitated. Both pyrethroids are known toxicants to animals. New York, 12/3/1992.
I012515-004	Bee (Apidae)	Possible	Unknown	Apiary damage possibly caused by permethrin and piperonyl butoxide. No information available on method of application or suspected misuse. Mississippi, 5/9/2001.
I015105-005	Unknown nursery trees, ornamentals and birds	Possible	Unknown	Drift from permethrin, atrazine, glyphosate and S-metolachlor caused the deaths of three birds and damage to trees and ornamentals in a nursery. The report did not specify which active ingredient may have caused the damage. Tennessee, 4/27/2004.