Appendix D

Case Definition for Acute Pesticide-Related Illness and Injury Cases Reportable to the National Public Health Surveillance System

Appendix D

Case Definition for Acute Pesticide-Related Illness and Injury Cases Reportable to the National Public Health Surveillance System

Contents:

D.1 Clinical Description

This surveillance case definition refers to any acute adverse health effects resulting from exposure to a pesticide product (defined under the Federal Insecticide Fungicide and Rodenticide Act [FIFRA]) including health effects due to an unpleasant odor, injury from explosion of a product, inhalation of smoke from a burning product, and allergic reaction. Because public health agencies seek to limit all adverse effects from regulated pesticides, notification is needed even when the responsible ingredient is not the active ingredient.

A case is characterized by an acute onset of symptoms that are dependent on the formulation of the pesticide product and involve one or more of the following:

- Systemic signs or symptoms (including respiratory, gastrointestinal, allergic, and neurological signs/symptoms)
- Dermatologic lesions
- Ocular lesions

This case definition and classification system is designed to be flexible permitting classification of pesticide-related illnesses from all classes of pesticides. Consensus case definitions for specific classes of chemicals may be developed in the future.

A case will be classified as occupational if exposure occurs while at work (this includes working for compensation; in a family business, including a family farm; for pay at home; and as a volunteer emer-

gency medical technician [EMT], firefighter, or law enforcement officer). All other cases will be classified as nonoccupational. All cases involving suicide or attempted suicide should be classified as nonoccupational.

A case is reportable to the national surveillance system when there is:

- Documentation of new adverse health effects that are temporally related to a documented pesticide exposure, *and*
- Consistent evidence of a causal relationship between the pesticide and the health effects based on the known toxicology of the pesticide from commonly available toxicology texts, government publications, information supplied by the manufacturer, or two or more case series or positive epidemiologic investigations, *or*
- Insufficient toxicologic information available to determine whether a causal relationship exists between the pesticide exposure and the health effects.

See the Classification Criteria section for a more detailed description of these criteria.

D.2 Laboratory Criteria for Diagnosis

If available, the following laboratory data can confirm exposure to a pesticide:

- Biological tests for the presence of, or toxic response to, the pesticide and/or its metabolite (in blood, urine, etc.)
  - — Measurement of the pesticide and/or its metabolite(s) in the biological specimen
  - — Measurement of a biochemical response to the pesticide in a biological specimen (e.g., cholinesterase levels)
- Environmental tests for the pesticide (e.g., foliage residue, analysis of suspect liquid)
- Pesticide detection on clothing or equipment used by the case subject

D.3 Classification Criteria

Reports received and investigated by State programs are scored on the three criteria provided below (criteria A, B, and C). Scores are either 1, 2, 3, or 4 and are assigned based on all available evidence. The classification matrix (Table D-1) provides the case classification categories and the criteria scores needed to place the case into a specific category. Definite, probable, possible, and suspicious cases (see the classification matrix) are reportable to the national surveillance system. Additional classification categories are provided for States that choose to track reports that do not fit the criteria for national reporting. (Frequently asked questions [FAQs] that provide additional clarification on the classification criteria and use of the classification matrix are provided in Section D.5. Section D.6 lists the characteristic signs and symptoms for several pesticide active ingredients and classes of pesticides.)

Table D-1. Case Classification Matrix

CLASSIFICATION CRITERIA	CLASSIFICATION CATEGORIES *										
	Definite Case	Probable Case		Possible Case	Suspicious Case	Unlikely Case	Insufficient Information		Not a Case		
									Asymptomatic†	Unrelated‡	
A. Exposure	1	1	2	2	1 or 2	1 or 2	4	—	—	3	—
B. Health Effects	1	2	1	2	1 or 2	1 or 2	—	4	3	—	—
C. Causal Relationship	1	1	1	1	4	2	—	—	—	—	3

* Only reports meeting case classifications of Definite, Probable, Possible, and Suspicious are reportable to the NPHSS. Additional classification categories are provided for States that choose to track the reports that do not fit the national reporting criteria.
† The matrix does not indicate whether asymptomatic persons were exposed to pesticides although some States may choose to track the level of evidence of exposure for asymptomatic persons.
‡ Unrelated = Illness determined to be caused by a condition other than pesticide exposure, as indicated by a 3 in the evidence of Exposure or Causal Relationship classification criteria.

A. Documentation of Pesticide Exposure

1. Laboratory, clinical, or environmental evidence corroborates exposure *(at least one of the following must be satisfied to receive a score of 1*):

   a. Analytical results from foliage residue, clothing residue, air, soil, water, or biologic samples.

   b. Observation of residue and/or contamination (including damage to plant material from herbicides) by a trained professional. (Note: a trained professional may be a plant pathologist, agricultural inspector, agricultural extension agent, industrial hygienist, or any other licensed or academically trained specialist with expertise in plant pathology and/or environmental effects of pesticides. A licensed pesticide applicator not directly involved with the application may also be considered a trained professional.)

   c. Biologic evidence of exposure (e.g., response to administration of an antidote such as 2-PAM, Vitamin K1, or repeated doses of atropine).

   d. Documentation by a licensed health care professional (HCP) of a characteristic eye injury or dermatologic effects at the site of direct exposure to a pesticide product known to produce such effects (these findings must be sufficient to satisfy criteria B.1 under "Documentation of Adverse Health Effect").

   e. Clinical description by a licensed HCP of two or more post-exposure health effects (at least one of which is a sign) characteristic for the pesticide as provided in Section D.6.

2. Evidence of exposure based solely on written or verbal report (*at least one of the following must be satisfied to receive a score of 2*):

   a. Report by case

   b. Report by witness

c. Written records of application

d. Observation of residue and/or contamination (including damage to plant material from herbicides) by other than a trained professional

e. Other evidence suggesting that an exposure occurred

3. Strong evidence that no pesticide exposure occurred.

4. Insufficient data.

B. Documentation of Adverse Health Effect

1. Two or more new post-exposure abnormal signs and/or test/laboratory findings reported by a licensed HCP.

2. Two or more new post-exposure abnormal symptoms reported. When new post-exposure signs and test/laboratory findings are insufficient to satisfy a B1 score, they can be used in lieu of symptoms toward satisfying a B2 score.

3. No new post-exposure abnormal signs, symptoms, or test/laboratory findings reported.

4. Insufficient data (includes having only one new post-exposure abnormal sign, symptom, or test/laboratory finding).

C. Evidence Supporting a Causal Relationship Between Pesticide Exposure and Health Effects

1. Where the findings documented under the Health Effects criteria (criteria B) are:

   a. characteristic for the pesticide as provided in Section D.6, and the temporal relationship between exposure and health effects are plausible (the pesticide refers to the one classified under criteria A), *and/or*

   b. consistent with an exposure-health effect relationship based on the known toxicology (that is, exposure dose, symptoms, and temporal relationship) of the putative agent (that is, the agent classified under criteria A) from commonly available toxicology texts, government publications, information supplied by the manufacturer, or two or more case series or positive epidemiologic studies published in the peer-reviewed literature.

2. Evidence of exposure-health effect relationship is not present. This may be because the exposure dose was insufficient to produce the observed health effects. Alternatively, a temporal relationship does not exist (that is, health effects preceded the exposure or occurred too long after exposure). Finally, it may be because the constellation of health effects are not consistent based on the known toxicology of the putative agent from information in commonly available toxicology texts, government publications, information supplied by the manufacturer, or the peer-reviewed literature.

3. Definite evidence of nonpesticide causal agent.

4. Insufficient toxicologic information is available to determine causal relationship between exposure and health effects. (This includes circumstances where minimal human health effects data are available, or where there are less than two published case series or positive epidemiologic studies linking health effects to the particular pesticide product/ingredient or class of pesticides.)

D.4 Contacts for Additional Information

For information regarding acute occupational pesticide-related illness and injury, contact NIOSH at 1–800–35–NIOSH. For information about acute nonoccupational pesticide-related illness and injury, contact the National Center for Environmental Health (NCEH) at 404–639–2530. For information concerning regulation and use of pesticides, contact the US EPA, Office of Pesticide Programs, at 703–305–5336. The National Pesticide Information Center (NPIC) (1–800–858–7378) provides information about pesticides, acute pesticide-related illness and injury, and the toxicology and environmental chemistry of pesticides.

For more information about this case definition contact Geoffrey M. Calvert, M.D., M.P.H., at NIOSH (513–841–4448, e-mail jac6@cdc.gov).

Revised 11/29/04

D.5 Frequently Asked Questions (FAQs)

Question 1. *The terms* signs *and* symptoms *are used throughout the case definition. What is the difference between the two?*

Answer 1. *Signs* are objective findings that can be observed and described by a licensed HCP. Typically, this is the information found in the *physical exam* or *physical findings* section of a medical record or acute poisoning reporting form. These findings do not rely on the subjective reporting of sensations by the affected person. An objective, knowledgeable observer includes all licensed HCPs (e.g., medical doctor [MD], doctor of osteopathy [DO], physician's assistant [PA], registered nurse [RN], EMT, etc.).

Symptoms are any subjective evidence of a disease or a condition as perceived and reported by the patient. This includes reported changes from normal function, sensation, or appearance. This information is the *History* section of a medical record.

Question 2. *How should we classify the exposure when an affected person, their coworker, or family member indicates that they were "drenched" by pesticide spray?*

Answer 2. If no other corroborating evidence presented by an objective observer exists, the information meets criteria A2. If there is documentation by medical personnel, emergency responders (police, EMT, etc.), an employer, agency representative, or investigators that the person was observed to be drenched at the scene or treatment facility, this would be classified as meeting criteria A1b. However, it must be remembered that these observers must be objective and independent, and therefore they cannot be the affected person.

Question 3. *How should an exposure be classified when a person has a dermal exposure that is difficult to document as a direct exposure? For example, a person handles an object contaminated with pesticides, then touches another part of the body with their possibly contaminated hand. The person then develops a dermal response at the site of hand contact.*

Answer 3. If the person is confident that contact with the pesticide product definitely occurred, and the hand-to-body part contact occurred shortly afterward, and the dermal response is documented by a licensed HCP, code the exposure as A1d (documentation by a licensed HCP of a characteristic eye injury or dermatologic effects at the site of direct exposure to a pesticide product known to produce such effects). Code as A2 (evidence of exposure based solely on written or verbal report) if the dermal response is not documented by a licensed HCP. If the history is vague, or if contact may have been with a plant or product other than a pesticide, code as A4 (insufficient data).

Question 4. *How do we interpret cholinesterase results when performing case classification?*

Answer 4. Each State may choose to develop its own internal guidelines. The following very cursory discussion is provided to assist States in this process. *Cholinesterase depression* is defined as one or more of the following:

a. 30% depression from baseline (pre-exposure or 60 to 90 days post-exposure) red blood count cholinesterase level

b. 40% depression from baseline plasma cholinesterase level

c. Cholinesterase level below laboratory normal range

The level of depression may be determined by serial post-exposure testing if a baseline test is not available. (For example, testing 2 weeks and 4 weeks post exposure show a gradual increase in cholinesterase by percentages in 1 and 2 above, over the levels at initial testing.) A test that shows significant depression as described above should be considered evidence of exposure and ranked as meeting criteria A1c. It should also be considered evidence for a new post-exposure health effect and helps to meet the criteria for B1 (an additional post-exposure sign or test/laboratory finding would be needed to fully meet the criteria for B1). A test result that does not indicate depression should not be considered an indication that substantial exposure has not occurred. The timing of testing, laboratory variation, the wide normal range, and administration of praloxidime chloride (2PAM) prior to testing can all lead to negative results.

Question 5. *Can the applicator who is directly affected by exposure or who has performed the application that is associated with health effects supply information that can be considered "evaluation by a trained professional" specified in criteria A1b?*

Answer 5. No. Persons who are considered professional observers should be objective. An applicator who is the case cannot be considered an objective observer. Nor can an applicator be an objective observer when allegations or observations suggest a misapplication may have occurred. A trained,

licensed applicator not directly involved with the case could be an observer under A1b. For example, a second applicator is called in to help evaluate damage to plants on the property, or to help alleviate odors in an office from an application by another applicator. This second person's observation can meet the requirements of a trained professional observer as specified in A1b.

Question 6. *What is the definition of* antidote *that should be used to evaluate exposure (A1c)?*

Answer 6. By *antidote*, we mean an agent that counteracts the effects of the pesticide. Two types of antidotes satisfy this definition: pharmacological antidotes and specific antidotes. Pharmacological antidotes counteract the pharmacological effects of the absorbed pesticide. Often, persons poisoned with pesticides have a high tolerance to repeated doses of pharmacological antidotes. For example, those poisoned with anticholinesterase pesticides have a high tolerance to atropine. As such, very high doses of atropine are often required to treat persons poisoned with anticholinesterase pesticides. Another pharmacological antidote is phenobarbital.

Specific antidotes interact directly with absorbed pesticide or some product of it to block the biochemical effect of the pesticide. Examples include pralidoxime chloride (2-PAM), vitamin K, and pesticide-specific monoclonal antibodies that are under development.

Antidotes are not the same as adjunct treatment that may help relieve symptoms or effects of the exposure in a less direct manner. This also does not include agents that prevent absorption of the ingested pesticide (e.g., activated charcoal).

Question 7. *How can we end up with a classification that is different from the clinical diagnosis in the medical record? Isn't that second guessing the physician's evaluation of the patient?*

Answer 7. The case classification scheme and the clinical diagnosis serve different purposes. The purpose of the case classification scheme is to serve surveillance and epidemiologic-related functions. The classification scheme provides objective guidelines for assessing the certainty of the evidence regarding exposure and health effects. In contrast, the purpose of the clinical diagnosis is to guide the immediate treatment course for the person. In addition, the clinician may use more intuitive and subjective criteria when making a diagnosis. Therefore, it is possible that the classification category may differ from the clinical diagnosis.

Question 8. *The classification scheme seems too stringent. By excluding persons who report only one symptom, we may be missing important cases. For example, a child with seizures after N, N-diethl-m-toluamide (DEET) exposure would be excluded. How can we address this?*

Answer 8. The classification scheme requires the presence of at least two post-exposure symptoms for a report to be considered a case. This may result in the exclusion of a very small number of actual pesticide-related illnesses or injuries. Most concerns about excluding cases due to this criterion can be alleviated by using structured protocols for obtaining medical histories from the person and/or HCP. If a single sign or symptom is reported, requesting more details will usually elicit additional signs or symptoms. Asking about commonly related symptoms as part of an interview is an acceptable practice.

For example, it is appropriate to ask about symptoms of nausea if a person reports vomiting, stomach cramping if diarrhea is reported, or loss of consciousness with seizure. This approach should help resolve concerns about the classification system resulting in false negatives.

Question 9. *How do we assess signs and symptoms when a person has a pre-existing condition that may influence their physiologic response to an exposure?*

Answer 9. Few studies have examined the effect of pre-existing disease on the toxicity of pesticides. We are not aware of any studies that found differences in signs and symptoms among pesticide-poisoned persons with pre-existing conditions. Therefore, if someone presents with an atypical set of symptoms for a particular pesticide, a score of C2 should be strongly considered under "evidence supporting a causal relationship between pesticide exposure and health effects."

However, it is possible that those with some pre-existing conditions will have reduced physiologic reserve. Therefore, these persons may manifest symptoms at a lower pesticide dose compared with a young, healthy person. Nonetheless, in these persons, the signs and symptoms should be characteristic of the particular pesticide, and the temporal relationship should be appropriate.

It is possible that pesticide exposure may exacerbate a pre-existing condition (e.g., organophosphate exposure can cause increased shortness of breath in exposed persons, including persons with chronic lung disease). However, the signs and symptoms that are present should be consistent with poisoning from the pesticide in question.

Question 10. *How do we address a situation when the underlying condition may create a set of symptoms that are similar to the symptoms caused by the pesticide?*

Answer 10. As has been stated previously, pesticide exposure may exacerbate a pre-existing condition. However, keep in mind that the signs and symptoms that are present should be consistent with poisoning from the pesticide in question. In addition, there should be an appropriate temporal relationship (that is, exposure preceded the health effect and the latency between exposure and effect is appropriate), and the pesticide exposure should be of sufficient dose.

Question 11. *How do we determine whether the evidence for an exposure-health effect relationship is insufficient versus inconsistent?*

Answer 11. When there is little literature on the health effects associated with a particular pesticide and none of it describes the health effects of interest, then the evidence for an exposure-health effect relationship is considered insufficient and a score of C4 is appropriate. However, if there are many references on the health effects associated with a particular pesticide, and none describe the health effects of interest, then the evidence for an exposure-health effect relationship is considered inconsistent and a score of C2 is appropriate.

Question 12. *The term* exposure dose *is used in Section C: "Evidence Supporting a Causal Relationship Between Pesticide Exposure and Health Effects." Often little information is available on dose. How should we interpret* dose*?*

Answer 12. The use of this term refers to whether the dose was sufficient to produce the observed health effects. Unfortunately, there is a paucity of data available on the minimum dose of a pesticide needed to produce health effects in humans. In addition, reaction to a pesticide exposure can vary across persons. It should be remembered that some persons may be much more sensitive to a pesticide and manifest health effects at a much lower dose compared with other persons. Other factors such as duration of exposure, use of protective equipment, amount of time between exposure and collection of the environmental sample, and the effect of intervening weather conditions on environmental samples and observations must be factored in when evaluating the actual exposure dose likely experienced by the person. When available, the peer-reviewed literature should be examined for guidance. The judgment of colleagues in the State Department of Agriculture may also be helpful.

When dealing with self-reports, qualitative information about exposure dose can be obtained. For example, information can be obtained about proximity to the source of exposure, duration of exposure, did health effects manifest in others who were exposed, etc. Assessing this information may require experience and the assistance of other knowledgeable colleagues.

Question 13. *Often we learn that a person was exposed to a particular functional class of pesticides (e.g., insecticide, herbicide, etc.), but we cannot determine the name of the product or the active ingredient. Should an exposure score of A2=written or verbal report or A4=insufficient data be assigned?*

Answer 13. When only the pesticide class is known, a score of A4=insufficient data must be assigned. This is because the pesticides within a particular class can vary widely in toxicity. Therefore, it would be impossible to determine if any observed health effects are consistent and/or characteristic with the pesticide exposure. However, if the chemical class of the pesticide is known (e.g., organophosphate or carbamate), but the specific pesticide product or active ingredient is unknown, a score of A1 or A2 can be considered. This is because pesticides within a specific chemical class can produce similar health effects (see Section D.6).

Question 14. *Can documentation or a clinical description "by a licensed HCP" as specified in criteria A1d, A1e, and B1 be provided by the licensed HCP who is directly affected by exposure (please note that this is similar to question Question 5)?*

Answer 14. No. Persons who are considered professional observers should be objective. An HCP who is the case cannot be considered an objective observer. A licensed HCP not directly involved in the exposure event would meet the criteria under A1d, A1e, and B1.

D.6. Characteristic Signs and Symptoms for Several Pesticide Active Ingredients and Classes of Pesticides

Pesticide	Signs and Symptoms
Acrolein	Conjunctivitis (irritation of mucous membranes, tearing) Skin irritation, rash, blistering, or erosion (without sensitization) Pulmonary edema Tearing Upper respiratory tract irritation: rhinitis, scratchy throat, cough
Acrylonitrile	Seizures/convulsions (tonic-clonic), sometimes leading to coma Upper respiratory tract irritation: rhinitis, scratchy throat, cough
Aminopyridine	Behavioral-mood disturbances (confusion, excitement, mania, disorientation, emotional lability) Salivation Sweating (diaphoresis) Thirst
ANTU	Dyspnea Upper respiratory tract irritation: rhinitis, scratchy throat, cough
Arsenicals (inorganic)	Anemia Abdominal pain Behavioral-mood disturbances (confusion, excitement, mania, disorientation, emotional lability) Bloody diarrhea Keratoses, brown discoloration Kidney (proteinuria, hematuria, sometimes leading to oliguria, acute renal failure with azotemia Leukopenia, thrombocytopenia Metallic taste in mouth Paralysis, paresis (muscle weakness) Paresthesia of extremities Runny nose Stomatitis Thirst
Arsine	Anemia Chills Hemoglobinuria Hemolysis Hyperkalemia Kidney (proteinuria, hematuria, sometimes leading to oliguria, acute renal failure with azotemia)

Pesticide	Signs and Symptoms
Borate	Abdominal pain Beefy red palms, soles Diarrhea Hypotension, shock Kidney (proteinuria, hematuria, sometimes leading to oliguria, acute renal failure with azotemia) Nervous system depression (stupor, coma, respiratory failure, often without seizures/convulsions) Tremor
Cadmium compounds	Abdominal pain Conjunctivitis (irritation of mucous membranes, tearing) Cyanosis Diarrhea Dyspnea Pulmonary consolidation Pulmonary edema Salivation Skin irritation, rash, blistering, or erosion (without sensitization) Upper respiratory tract irritation: rhinitis, scratchy throat, cough
Carbamate insecticides	Abdominal pain Anorexia Bradycardia (sometimes to asystole) Diarrhea Diplopia Dyspnea Incoordination (including ataxia) Miosis Muscle twitching Nervous system depression (stupor, coma, respiratory failure, often without seizures/convulsions) Paralysis, paresis (muscle weakness) Runny nose Salivation Sweating (diaphoresis) Tearing Tremor

Pesticide	Signs and Symptoms
Carbon disulfide	Behavioral-mood disturbances (confusion, excitement, mania, disorientation, emotional lability) Breath odor of rotten cabbage Incoordination (including ataxia) Paresthesia of extremities Seizures/convulsions (tonic-clonic), sometimes leading to coma
Carbon tetrachloride	Jaundice Liver enlargement Liver enzymes elevated (lactate dehydrogenase [LDH], alanine amiotransferase [ALT], aspartate transaminase [AST], alkaline phosphatase)
Cationic detergents	Skin irritation, rash, blistering, or erosion (without sensitization) Pulmonary edema
Chlordimeform	Anorexia Hot sensations Kidney (dysuria, hematuria, pyuria) Skin irritation, rash, blistering, or erosion (without sensitization) Sweet taste in mouth
Chlorhexidine	Contact dermatitis Urticaria
Chloroform	Jaundice Liver enlargement Liver enzymes elevated (LDH, ALT, AST, alkaline phosphatase)
Chloropicrin	Conjunctivitis (irritation of mucous membranes, tearing) Dyspnea Tearing Upper respiratory tract irritation: rhinitis, scratchy throat, cough
Cholecalciferol	Anorexia Hypercalcemia Polyuria Thirst
Copper compounds	Abdominal pain Conjunctivitis (irritation of mucous membranes, tearing) Hypotension, shock Kidney (proteinuria, hematuria, sometimes leading to oliguria, acute renal failure with azotemia)

Pesticide	Signs and Symptoms
Copper compounds (*continued)*	Liver enlargement Skin irritation, rash, blistering, or erosion (without sensitization) Stomatitis
Coumarins	Bloody diarrhea Ecchymoses Hypoprothrombinemia
Creosote	Contact dermatitis Hypothermia Methemoglobinemia Pallor Pulmonary edema Seizures/convulsions (tonic-clonic), sometimes leading to coma Smoky urine
Crimidine	Cyanosis Seizures/convulsions (tonic-clonic), sometimes leading to coma
Cyanamide	Dyspnea Hypotension, shock Skin flushing Tachycardia
Cyanide	Behavioral-mood disturbances (confusion, excitement, mania, disorientation, emotional lability) Bradycardia (sometimes to asystole) Breath odor of bitter almonds Dilated pupils Salivation Seizures/convulsions (tonic-clonic), sometimes leading to coma Unreactive pupils
DEET	Contact dermatitis Seizures/convulsions (tonic-clonic), sometimes leading to coma Urticaria
Dibromochloropropane	Low sperm count Skin irritation, rash, blistering, or erosion (without sensitization)

Pesticide	Signs and Symptoms
Diquat	Abdominal pain Behavioral-mood disturbances (confusion, excitement, mania, disorientation, emotional lability) Bloody diarrhea Conjunctivitis (irritation of mucous membranes, tearing) Ileus Kidney (proteinuria, hematuria, sometimes leading to oliguria, acute renal failure with azotemia) Nervous system depression (stupor, coma, respiratory failure, often without seizures/convulsions) Skin irritation, rash, blistering, or erosion (without sensitization) Stomatitis
Endothall	Bloody diarrhea Conjunctivitis (irritation of mucous membranes, tearing) Hypotension, shock Seizures/convulsions (tonic-clonic), sometimes leading to coma Skin irritation, rash, blistering, or erosion (without sensitization)
Ethylene dibromide	Kidney (proteinuria, hematuria, sometimes leading to oliguria, acute renal failure with azotemia) Skin irritation, rash, blistering, or erosion (without sensitization) Pulmonary edema Upper respiratory tract irritation: rhinitis, scratchy throat, cough
Ethylene oxide	Cardiac arrhythmias Conjunctivitis (irritation of mucous membranes, tearing) Dermal sensitization Pulmonary edema Skin irritation, rash, blistering, or erosion (without sensitization)
Fluoride	Abdominal pain Bloody diarrhea Dilated pupils Hypocalcemia Seizures/convulsions (tonic-clonic), sometimes leading to coma Tetany, carpopedal spasms
Formaldehyde	Conjunctivitis (irritation of mucous membranes, tearing) Skin irritation, rash, blistering, or erosion (without sensitization) Upper respiratory tract irritation: rhinitis, scratchy throat, cough

Pesticide	Signs and Symptoms
Fumigants (halocarbon)	Cardiac arrhythmias Incoordination (including ataxia)
Hexachlorobenzene	Anorexia Porphyrinuria (wine-red urine)
Hexachlorophene	Contact dermatitis Seizures/convulsions (tonic-clonic), sometimes leading to coma Skin irritation, rash, blistering, or erosion (without sensitization)
Indandiones	Bloody diarrhea Ecchymoses Hypoprothrombinemia
Mercury (organic)	Behavioral-mood disturbances (confusion, excitement, mania, disorientation, emotional lability) Constricted eye fields Hearing loss Metallic taste in mouth Paresthesia of extremities Tremor
Metaldehyde	Abdominal pain Seizures/convulsions (tonic-clonic), sometimes leading to coma Tremor
Metam sodium	Conjunctivitis (irritation of mucous membranes, tearing) Skin irritation, rash, blistering, or erosion (without sensitization)
Methyl bromide	Behavioral-mood disturbances (confusion, excitement, mania, disorientation, emotional lability) Dyspnea Conjunctivitis (irritation of mucous membranes, tearing) Pulmonary consolidation Pulmonary edema Skin irritation, rash, blistering, or erosion (without sensitization)
Naphthalene	Anemia Conjunctivitis (irritation of mucous membranes, tearing) Hemoglobinuria Hemolysis Hyperkalemia

Pesticide	Signs and Symptoms
Naphthalene (*continued*)	Kidney (proteinuria, hematuria, sometimes leading to oliguria, acute renal failure with azotemia) Sweating (diaphoresis) Upper respiratory tract irritation: rhinitis, scratchy throat, cough
Nicotine	Abdominal pain Anorexia Behavioral-mood disturbances (confusion, excitement, mania, disorientation, emotional lability) Cardiac arrhythmias Diarrhea Cyanosis Diplopia Dyspnea Hypertension (early in poisoning) Incoordination (including ataxia) Muscle twitching Paralysis, paresis (muscle weakness) Salivation Seizures/convulsions (tonic-clonic), sometimes leading to coma Sweating (diaphoresis) Tremor
Nitrophenols	Behavioral-mood disturbances (confusion, excitement, mania, disorientation, emotional lability) Fever Hot sensations Kidney (proteinuria, hematuria, sometimes leading to oliguria, acute renal failure with azotemia) Skin flushing Sweating (diaphoresis) Tachycardia Thirst Yellow stain on skin Yellow sclera
Organochlorines	Cyanosis Pallor Paresthesia (chiefly facial, transitory) Seizures/convulsions (tonic-clonic), sometimes leading to coma

Pesticide	Signs and Symptoms
Organophosphates	Abdominal pain Acetylcholinesterase depression (RBC and/or plasma) Anorexia Bradycardia (sometimes to asystole) Diarrhea Diplopia Dyspnea Incoordination (including ataxia) Miosis Muscle twitching Nervous system depression (stupor, coma, respiratory failure, often without seizures/convulsions) Paralysis, paresis (muscle weakness) Paresthesia (chiefly facial, transitory) Runny nose Salivation Sweating (diaphoresis) Tearing Tremor
Organotin compounds	Abdominal pain Behavioral-mood disturbances (confusion, excitement, mania, disorientation, emotional lability) Conjunctivitis (irritation of mucous membranes, tearing) Skin irritation, rash, blistering, or erosion (without sensitization)
Paraquat	Abdominal pain Bloody diarrhea Conjunctivitis (irritation of mucous membranes, tearing) Contact dermatitis Cyanosis Dyspnea Jaundice Keratitis Kidney (proteinuria, hematuria, sometimes leading to oliguria, acute renal failure with azotemia) Myalgia Pulmonary consolidation Skin irritation, rash, blistering, or erosion (without sensitization) Stomatitis Upper respiratory tract irritation: rhinitis, scratchy throat, cough

Pesticide	Signs and Symptoms
Pentachlorophenol	Anorexia Contact dermatitis Dyspnea Fever Kidney (proteinuria, hematuria, sometimes leading to oliguria, acute renal failure with azotemia) Sweating (diaphoresis) Tachycardia Thirst Urticaria
Phosphorus	Abdominal pain Breath odor of garlic Hypotension, shock Jaundice Pulmonary edema Skin irritation, rash, blistering, or erosion (without sensitization) Tetany, carpopedal spasms Thirst
Phosphides	Abdominal pain Breath odor of garlic Hypotension, shock Jaundice Paresthesia (chiefly facial, transitory) Pulmonary edema Tetany, carpopedal spasms Thirst
Phosphine	Breath odor of garlic Chills Hypotension, shock Jaundice Liver enlargement Liver enzymes elevated (LDH, ALT, AST, alkaline phosphatase) Pulmonary edema Seizures/convulsions (tonic-clonic), sometimes leading to coma Thirst
Povidone-iodine	Cardiac arrhythmias Seizures/convulsions (tonic-clonic), sometimes leading to coma

Pesticide	Signs and Symptoms
Propargite	Dermal sensitization Skin irritation, rash, blistering, or erosion (without sensitization)
Pyriminil	Behavioral-mood disturbances (confusion, excitement, mania, disorientation, emotional lability) Breath odor of peanuts Cardiac arrhythmias Constipation Glucosuria Hyperglycemia (elevated serum glucose) Ketoacidosis Ketonuria Paresthesia of extremities Urinary retention
Pyrethrins	Contact dermatitis Runny nose
Pyrethroids	Diarrhea Pulmonary edema
Sabadilla	Cardiac arrhythmias Sneezing
Sodium chlorate	Anemia Cardiac arrhythmias Cyanosis Hemoglobinuria Hemolysis Hyperkalemia Hypotension, shock Jaundice Kidney (proteinuria, hematuria, sometimes leading to oliguria, acute renal failure with azotemia)) Liver enlargement Methemoglobinemia Seizures/convulsions (tonic-clonic), sometimes leading to coma Skin irritation, rash, blistering, or erosion (without sensitization)

Pesticide	Signs and Symptoms
Sodium fluoride	Cardiac arrhythmias Hypotension, shock Kidney (proteinuria, hematuria, sometimes leading to oliguria, acute renal failure with azotemia) Pallor Nervous system depression (stupor, coma, respiratory failure, often without seizures/convulsions) Salivation Salty, soapy taste in mouth Thirst
Sodium fluoroacetate	Behavioral-mood disturbances (confusion, excitement, mania, disorientation, emotional lability) Cardiac arrhythmias Cyanosis Paresthesia of extremities Seizures/convulsions (tonic-clonic), sometimes leading to coma
Strychnine	Cyanosis Seizures/convulsions (tonic-clonic), sometimes leading to coma
Sulfur	Breath odor of rotten eggs Diarrhea Skin irritation, rash, blistering, or erosion (without sensitization)
Sulfur dioxide	Conjunctivitis (irritation of mucous membranes, tearing) Dyspnea Pulmonary edema Upper respiratory tract irritation: rhinitis, scratchy throat, cough
Sulfuryl fluoride	Dyspnea Kidney (proteinuria, hematuria, sometimes leading to oliguria, acute renal failure with azotemia) Muscle twitching Upper respiratory tract irritation: rhinitis, scratchy throat, cough
Thallium	Abdominal pain Behavioral-mood disturbances (confusion, excitement, mania, disorientation, emotional lability) Bloody diarrhea Cardiac arrhythmias (ventricular) Hypertension (early in poisoning)

Pesticide	Signs and Symptoms
Thallium	Hypotension, shock Ileus Incoordination (including ataxia) Loss of hair Paresthesia of extremities Ptosis Seizures/Convulsions (tonic-clonic), sometimes leading to coma Tremor
Thiram	Alcohol intolerance Contact dermatitis Diarrhea Skin irritation, rash, blistering, or erosion (without sensitization)
Veratrum alkaloid	(See sabadilla)

(Adapted from Morgan DP. Recognition and management of pesticide poisonings. 4th ed. Washington, DC: U.S. EPA; 1989; and Reigart JR, Roberts JR. Recognition and management of pesticide poisonings. 5th ed. Washington, DC: U.S. EPA; 1999.)

D.7 Glossary of Medical Terms

Anorexia	diminished appetite
Bradycardia	slow heart rate (generally less than 60 beats per minute)
Carpopedal spasms	spasm of the hands and/or feet
Conjunctivitis	inflammation of the conjunctiva (the mucous membrane covering the surface of the eye)
Cyanosis	a dark blueish or purplish coloration of the skin and mucous membranes
Diaphoresis	sweating, perspiration
Dyspnea	shortness of breath
Ecchymoses	bruises of the skin larger than 3mm in diameter
Glucosuria	presence of glucose in the urine
Hemoglobinuria	presence of hemoglobin in the urine
Hemolysis	destruction of red blood cells
Hypercalcemia	increased calcium in the blood
Hyperkalemia	increased potassium in the blood
Hypertension	increased blood pressure
Hypoprothrombinemia	low levels of prothrombin in the blood
Hypothermia	decreased body temperature (significantly below 98.6 F)
Ileus	obstruction of the bowel
Keratoses	a hard, thick circumscribed skin lesion (characterized by overgrowth of the horny layer)
Ketoacidosis	an increase in the pH of the blood caused by the enhanced production of ketones
Ketouria	presence of ketones in the urine
Leukopenia	decreased number of white blood cells in the blood
Methemoglobinemia	the presence of methemoglobin in the blood

Miosis	pinpoint pupils
Myalgia	muscular pain
Paresis	muscle weakness
Paresthesia	an abnormal sensation such as of burning, pricking, tingling or tickling
Polyuria	increased production of urine resulting in increased frequency of urination
Porphyrinuria	increased porphyrins in the urine manifesting as wine-red urine
Ptosis	a sinking down of the eyelid
Pulmonary consolidation	an infiltrate in the lung observed on a chest x-ray
Rhinitis	inflammation of the nasal mucous membranes
Stomatitis	inflammation of the mucous membranes of the mouth
Tachycardia	rapid heart rate (generally greater than 100 beats per minute)
Tetany	a clinical neurological syndrome characterized by muscle twitches, cramps, carpopedal spasm, and when severe, laryngospasm and seizures
Thrombocytopenia	decreased number of platelets in the blood

(January 31, 2000)