

INTEGRATED PEST MANAGEMENT PROCEDURES
FOR VA NATIONAL CEMETERIES

- 1. REASON FOR ISSUE:** To update National Cemetery Administration (NCA) Integrated Pest Management (IPM) procedures.
- 2. SUMMARY OF MAJOR CHANGES:** The only changes to the contents of this handbook are to update website addresses on pages 9 and 20.
- 3. RESPONSIBLE OFFICE:** NCA, Office of Field Programs, 810 Vermont Avenue, NW, Washington, DC 20420, is responsible for the contents of this NCA Handbook. Questions may be referred to the NCA Chief Agronomist in the Office of Field Programs.
- 4. RELATED DIRECTIVES AND HANDBOOKS:**
 - a. VA Directive 0057 – VA Environmental Management Program (January 15, 2010)
 - b. NCA Directive 0320/3 – Emergency Preparedness Planning (May 30, 2008)
 - c. NCA Handbook 0320 – Emergency Preparedness Planning Procedures (July 13, 2004)
 - d. NCA Directive 3000 – Operational Standards for National Cemeteries (January 5, 2010)
 - e. NCA Handbook 3410 – Integrated Pest Management Procedures for National Cemeteries (published simultaneously)
 - f. NCA Handbook 3420 – Turfgrass Maintenance in VA National Cemeteries (February 29, 2012)
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/s/
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SECTION I – INTRODUCTION

1. PURPOSE AND SCOPE

a. Integrated Pest Management (IPM) is an ecosystem-based strategy that focuses on long-term prevention of pests or pest damage. IPM combines techniques such as biological control, plant selection, habitat manipulation, and cultural practice modification, with pesticide application only as necessary to maintain and comply with NCA standards of appearance. IPM can minimize risks to human health, beneficial and non-targeted organisms, and the environment associated with the misuse of pesticides. A properly designed IPM program will allow each national cemetery to identify and eliminate pest treatment practices that are ineffective and/or unnecessary.

b. This handbook updates procedures for the proper operation of an Integrated Pest Management program at all VA national cemeteries administered by the National Cemetery Administration (NCA). It addresses laws and regulations pertaining to the purchase, storage, application, and disposal of pesticides.

(1) The Cemetery Director is responsible for safe and proper handling of all pesticides from selection through disposal.

(2) General NCA-wide policies and responsibilities are outlined in accompanying NCA Directive 3410 – Integrated Pest Management at VA National Cemeteries. Any use of contracting services for pest management activities must comply with Statement of Work and contract requirements as stated in the directive.

(3) Specific procedural responsibilities for treating pest problems and handling chemical pesticides are specified in this handbook.

c. NCA does not endorse or recommend any commercial products, processes, or services. The use of trade, firm, or commercial product names in this publication is for information only, and does not constitute an official endorsement or approval by NCA to the exclusion of other products that may be similar and/or suitable.

d. The Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) of 1972, and other applicable Federal, State, and local (city, county, etc.) laws and regulations, require Federal agencies to use IPM techniques in carrying out pest management activities and to promote IPM through procurement and other activities. See Appendix A for a brief summary of relevant statutes.

2. BACKGROUND

a. IPM requires complete review, assessment, and decision-making to consider cultural, mechanical, biological and chemical controls prior to starting any pest management activity. Each situation must be considered separately to determine the safest and most cost-effective option available. The lowest toxicity pesticides or alternative methods for targeted application will be used.

b. Comprehensive records of all pesticide applications and other pest management actions must be kept, starting at the first observance of pest activity. After the treatment is completed those records should be used in a review of the effectiveness of the selected treatment technique.

c. If chemical controls are used, the pesticide should be applied in a manner that targets the most vulnerable portion of a pest or pest population, or is timed to act during the most vulnerable portion of the pest's life cycle.

d. IPM differs from traditional pest control in five major ways:

(1) Proactive versus Reactive. IPM is primarily a preventive maintenance process that attempts to control pests through biological control, plant selection, habitat manipulation, and cultural practice modification rather than chemical pesticide application.

(2) Management Process versus Pest Management. IPM recognizes that long-term solutions depend on coordinated management initiatives to properly manage buildings and structures, identify proper landscape materials, and maintain turf and landscape features in optimum condition, and properly timed treatments; rather than pesticide applications scheduled on a recurring basis without demonstrated need, or applied in reaction to a perceived rather than actual problem.

(3) Use of Pesticides Only when Necessary versus Scheduled Treatment. IPM uses chemical pesticides only when evidence indicates that pests are actually present and non-chemical approaches have been unsuccessful.

(4) Least Toxic Treatment versus Surface Spraying. IPM applies pesticides with precision and restraint; and uses only the safest compounds, formulations and methods of application. The presence of beneficial insects is considered before selecting/applying a pesticide. If beneficial insects are present in large numbers, the Cemetery IPM Coordinator may want to delay treatment. In some cases where beneficial insects are killed, the target pest population may increase because the natural predator is gone.

(5) Expertise versus Minimal Training. For an IPM program to be successful, it is essential that personnel have accurate technical guidance on all aspects of the pest control effort. IPM practitioners must receive regular training to stay current on pest management techniques.

e. IPM Program activities cover:

(1) Outdoor areas: Proper plant selection, monitoring, mowing, irrigation, fertilizing, and appropriate use of chemical pesticides for outdoor areas. See Appendices D, E, and F of this handbook, and NCA Handbook 3420 – Turfgrass Maintenance in VA National Cemeteries, for guidance for proper preventive care for outdoor areas.

(2) Structures/Indoor areas: Monitoring, cleaning, solid waste management, structural maintenance, occupant education and, if necessary, appropriate chemical pesticide application for areas such as buildings and offices.

SECTION II – IPM PROGRAM DEVELOPMENT

The following steps provide guidance for creating an IPM program:

Step 1: Site Assessment involves the collection of data about the site to use in identifying root causes of pest problems.

a. The first step is for the Cemetery IPM Coordinator (with the support of the MSN Agronomist) to collect detailed information about cemetery site conditions, including maps of irrigation, drainage, trees, soil types, elevations, shade patterns, traffic patterns, surface water, structures, planting beds, and turf species, as well as areas with recurring pest problems.

b. The maps and information should be reviewed to identify patterns of activity or arrangements of structures and natural features that may be causing pest problems. As new pest problems are discovered, they should be noted.

c. The Cemetery IPM Coordinator should work with the MSN Agronomist or State cooperative extension service to make sure pests are accurately identified.

d. Any pest damage identified during the site assessment that exceeds NCA appearance standards (see current NCA Directive 3000 – Operational Standards for National Cemeteries) should be treated immediately.

Step 2: Site Monitoring is used to track pest activity and population types and levels. This process compiles as much information as possible to help with recognizing patterns associated with pest damage. Cemetery staff should contact State cooperative extension service and/or the MSN Agronomist for advice on specific monitoring techniques for pests that are difficult to track or identify.

a. Data collected should include any information that cemetery staff determines to be relevant, such as pest type/size/population/life cycle stage, location, weather conditions (temperature, wind speed, precipitation), time of year, host plant species, past treatments and effect, time of day, and proximity to land features or buildings.

b. During monitoring, pest management personnel can determine when a pest population is approaching the action threshold (see below) and take appropriate measures to control pest activity. In cases where a pest poses a direct threat to health and safety, action should be taken to immediately eliminate the threat.

Step 3: Action Thresholds use appearance standards to identify acceptable pest populations, sizes, and effects. They are used to help cemetery staff decide when to treat a pest problem to maximize effectiveness, and minimize cost and threats to human health and the environment. Setting action thresholds involves the following steps:

a. The standards for appearance of grounds areas at all VA national cemeteries are contained in NCA Operational Standards and Measures for Grounds Maintenance Operations at NCA facilities (see current NCA Directive 3000 – Operational Standards for National Cemeteries). Each cemetery must consider these standards when determining the level of

treatment required to control a pest population. Grounds areas should not be treated for pests unless there is a problem that exceeds the established standards. Examples of the standards established for turfgrass and landscaped area quality include:

- 100% of visually prominent turf areas are expected to be generally free of weeds;
- 95% of visually prominent turf areas are expected to be generally free of bare areas;
- 95% of ornamental trees and shrubs should be healthy, vigorous, and free of pests and disease;
- 100% of plant bed areas should be generally weed free; and
- 90% of headstones, markers and niche covers should be clean and without evidence of debris or objectionable accumulations.

(1) Each cemetery will develop pest damage standards based on the type and severity of damage associated with a given pest. For each location where pest damage exceeds NCA or cemetery standards, the site assessment should identify the type (genus, species, and life cycle stage) and number of pests found at the damaged site.

(2) Damage standards for pests in buildings and offices will vary depending on potential threats to human health and safety and/or integrity of structures and buildings.

b. Record the level of pest population that should be considered as the action threshold for that particular pest in that specific location. The goal is to determine how many pests can be tolerated as acceptable. The Chief Agronomist provides some typical action thresholds in the standard operating procedures issued for turf and landscape.

Step 4: Evaluation of data about pest control treatment methods and results will help improve current and future IPM practices. Using information about past problems, treatment results, and action thresholds will help cemetery staff determine when and how to respond to a specific pest problem in a given location. Comparison of the effects of different control methods can help in reducing the use of chemical pesticides.

SECTION III – IPM CONTROL METHODS

Integrated Pest Management procedures require consideration of the target species as it relates to the entire ecosystem. IPM promotes the use of five basic pest control methods, as explained below. Chemical pesticides will be used only if these methods fail to achieve a satisfactory effect.

NOTE: *Non-chemical control methods, especially biological control, can have negative impacts on cemetery operations if not thoroughly evaluated prior to implementation. All alternatives should be evaluated for cost-effectiveness and potential impacts to non-target organisms and environment. MSN Agronomists and/or State cooperative extension service agents should be consulted before selecting a control method.*

a. **Cultural Control** involves adjusting human factors and controlling behavior. Each national cemetery will:

- Identify and correct sanitation, food storage, and garbage disposal activities that may encourage pest infestation in buildings and offices by enforcing cleaning and garbage disposal rules;
- Plant a variety of plant species to discourage spread of species specific pests and diseases;
- Use plants that are appropriate for the cemetery based on U.S. Department of Agriculture (USDA) plant hardiness zone, topography, and water availability;
- Use proper turfgrass mowing and irrigation practices to minimize pest populations;
- Install plants according to light, water, and nutrient requirements;
- Provide extra care for plants during extremes in moisture and temperature;
- Remove infested parts and pests from plants;
- Rake up and destroy fallen or diseased leaves and twigs; and
- Clean mowers and other equipment to remove weed seeds and other vegetation after mowing a weed-infested area.

b. **Biological Control** makes use of beneficial organisms to control pests. Each national cemetery will:

- Use beneficial organisms such as predators, parasites and disease causing bacteria, viruses, fungi, or nematodes to control pests; and
- Use guidance from the State cooperative extension service or from the MSN Agronomist to identify appropriate biological controls.

c. **Genetic Control** is the utilization of plants that have been selected or genetically adapted to become resistant or less susceptible to pests:

- Use locally adapted or resistant varieties of plants and trees.

d. **Mechanical or Physical Control** methods involve using barriers or traps to monitor, prevent, or reduce pest problems. Each national cemetery will:

- Seal or remove openings that may allow pests to enter buildings;
- Install and monitor glue boards, traps, and insect collection devices to track and/or control pest populations;
- Adhere to all regulatory controls from Federal and State Department of Agriculture bulletins concerning quarantines of plant material; and

- Inspect any new plant material to identify and remove pests not present at the cemetery such as fire ants, gypsy moth eggs, or grubs in soil or sod.

e. **Chemical Control** involves the application of chemical pesticides to eliminate a pest problem. Chemicals should only be used to control pest problems if cultural, biological, genetic, and mechanical/physical controls fail. Low-toxicity, non-persistent pesticides are preferred. Each national cemetery will:

- Use chemicals to contain a pest control problem only if biological, cultural, mechanical, and genetic control methods fail to achieve NCA standards;
- Only use chemical pesticides to manage pest populations that are at or above the action threshold;
- Eliminate use of a pre-scheduled pesticide application program unless monitoring evidence shows regular/repetitive applications are necessary; and
- Use precise spot application(s) rather than widespread application (fogging) to control pest populations.

SECTION IV – CHEMICAL PESTICIDES

1. POISONING SYMPTOMS AND FIRST AID

a. Pesticide Exposure:

Pesticides can enter the human body to cause poisoning in three ways:

(1) **Oral Exposure** is the direct ingestion of a product. It is the most serious type of exposure because of the possibility of rapid internal absorption and quick death.

(2) **Dermal Exposure** is absorption through the skin. It may occur as a result of a spillage, splash, or drift, or through contact with a deposit of residue remaining on the treated site. Skin cuts, abrasions, scratches, and scuffs can be sources of quick absorption. Individuals with skin problems should avoid exposure to pesticides.

(3) **Respiratory Exposure** is inhalation of amounts of pesticides sufficient to cause serious damage to nose, throat and lung tissues. Vapors and extremely fine particles represent a serious potential for respiratory exposure. Pesticide dust, aerosol, fog, smoke, and certain mists have a high potential for respiratory exposure. The pesticide label should contain information concerning the proper respirator to use for the pesticide being applied.

b. Poisoning Effects and Symptoms:

(1) **Organophosphorous Pesticides.** This is one of the largest groups of pesticides presently being used. The group includes *insecticides* such as Parathion, Malathion, Phorate, Mevinphos, Diazinon, and others.

(a) Organophosphorous pesticides can be absorbed dermally, orally, or through respiratory inhalation.

(b) The pesticides in this group attack a chemical in the blood (cholinesterase) that is necessary for proper nerve functions. This causes nerve impulse transmissions to race out of control because of a build-up of acetylcholine at the end of the nerve fibers. Muscle twitching becomes noticeable. Convulsions or violent muscle actions result if the tremors become intense.

(c) Signs of organophosphorous poisoning include: headache, giddiness, nervousness, blurred vision, dizziness, weakness, nausea, cramps, diarrhea, and chest discomfort. Other symptoms may include sweating, pin-point eye pupils, watering eyes, excess salivation, rapid heartbeat, excessive respiratory secretion and vomiting.

(d) Advanced stages of poisoning usually result in convulsions, loss of bowel control, loss of reflexes and unconsciousness. Quick action and proper medical treatment can save persons in the advanced stages of poisoning.

(2) **Carbamate Pesticides.** This group includes *insecticides* such as Aldicarb (Temik), Carbaryl (Sevin) and Carbofuran (Furadan); *herbicides* such as Cycloate (Ro-neet), Diallate (Avadex); and *fungicides* such as Benomyl (Benolate) and Ferban (Fermate).

(a) The action of these compounds is very similar to that of organophosphorous compounds in that they inhibit the enzyme cholinesterase. They differ in action as the effect on cholinesterase is brief.

(b) Symptoms and signs of carbamate poisons are essentially the same as caused by organophosphorous pesticides (as explained in paragraph 1.b.(1)(b-c-d) on page 7).

(3) **Chlorinated Hydrocarbon Pesticides.** This group includes *insecticides* such as DDT(dichlorodiphenyltrichloroethane), Aldrin (Aldrite), Dieldrin (Dieldrite), Endrin and Chlordane. These pesticides were used quite extensively until many of them were restricted or banned from use. Symptoms and signs of chlorinated hydrocarbon poisons are essentially the same as those stated in paragraph 1.b.(1)(b-c-d) on page 7.

c. First Aid:

First aid cannot be substituted for medical treatment, but should be provided until professional help arrives. The following list includes some general first aid guidelines:

(1) When a victim has been identified as being poisoned by pesticides, call 911 or a poison control center or a doctor immediately. Poison control centers have been established to give pertinent information on all types of poisonings. The Cemetery IPM Coordinator should ensure that the location and telephone number of the nearest poison control center is displayed by all cemetery telephones.

(2) Inform the call center/doctor/poison control center of the emergency, giving the name of the pesticide, and any information from the product label. Follow any directions for action, including administering artificial respiration if the victim is not breathing.

(3) If medical personnel are called on-site, provide them with the product label or appropriate Material Safety Data Sheet (MSDS).

(4) If there is evidence that the victim has been exposed to a pesticide spill, it will be necessary to decontaminate the victim immediately. Follow procedures provided on the product label or outlined in the product MSDS.

(5) Ensure the victim is not exposed to further contamination.

(6) Individuals providing assistance should not expose themselves to pesticides while helping the victim.

(7) Appropriate actions depend upon the type of exposure. Be sure to read the product label and MSDS prior to working with pesticides, and have any recommended antidote readily available. The following types of assistance may be called for:

(a) If the victim's eyes have been exposed to the poison, hold eyelids open and wash eyes with clear water for at least fifteen minutes.

(b) If poisons have been inhaled, loosen all tight fitting clothing and keep victim as quiet as possible. **NOTE:** *If the pesticide has contaminated an enclosed space, do not enter without a protective respirator.*

(c) If a poison was swallowed, do not induce vomiting if the victim is in convulsions, unconscious, or if the victim has swallowed petroleum products such as gasoline, kerosene, etc.

(d) Do not use ointment, grease, powders, or other remedies in first aid equipment on chemical burns.

NOTE: *This information provides some possible treatment options, but in the case of an emergency situation, cemetery staff are to follow specific instructions for treatment received from 911, a poison control center, or a medical professional.*

2. PROTECTIVE REQUIREMENTS AND MEDICAL EXAMINATION(S)

a. Basic Protective Requirements:

NOTE: *Pesticides are beneficial when properly used; misused, they can be very dangerous. All pesticides should be handled as potential poisons. Follow the instructions on the product labels and the general guidelines in the following sections for safe handling.*

(1) Cemetery staff must obtain and wear the proper Personal Protection Equipment (PPE) recommended on the product label.

(2) First aid equipment must be available.

(3) Comply with Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA), Part 170, Worker Protection Standards, for use of Personal Protective Equipment, including respirators.

(4) If any individual feels ill when handling a pesticide, work should cease and medical attention should be sought.

(5) Follow guidance presented in the MSDS for any pesticide spill.

b. Medical Examinations:

(1) Pesticide applicators should have an initial medical examination that should include, but not be limited to:

- a comprehensive medical and work history,
- physical examination,
- blood analysis for liver function,
- determination of a cholinesterase base line; and
- pulmonary function test.

(2) Follow-up medical examination(s) should be scheduled as necessary, with periodic examinations encouraged at least every six months, or at the end of each season, to ensure there has been no undue exposure to chemicals. **NOTE:** *Anytime symptoms of toxicity are exhibited, an immediate medical examination should be performed.*

(3) Records of medical examinations should be kept in accordance with Office of Personnel Management "Employee Medical File System Records" regulations published in the Code of Federal Regulations, title 5, part 293, subpart E, sections 293.501 through 293.511 (available electronically at <http://www.gpo.gov/fdsys/browse/collectiontab.action>). The NCA Records Management Officer can provide assistance on request.

3. LABELING AND PRODUCT INFORMATION

a. Pesticide Labeling:

(1) The product label is the key to information about any pesticide. **Do not use a product on any pest, plant, or disease other than those listed on the label.**

(2) Applicators should read the pesticide product label and matching MSDS multiple times, prior to and during use.

(3) The pesticide label states the most important facts about that particular pesticide for safe and effective use. The information on the label gives directions on how to mix and apply the pesticide, and guidelines for safe handling, storage, and protection of the environment. By law, product labels must include the following:

- Brand name;
- Common name;
- Chemical name;
- Use classification;
- Ingredients (general or restricted);
- Uses of pesticide;
- Directions for use and disposal;
- Safety information;
- Signal words (DANGER, POISON, WARNING, CAUTION);
- Net contents;
- EPA registration number;
- Establishment number; and
- Name and address of manufacturer or registrants

NOTE: *The importance of reading the label cannot be stressed too often. The information that appears on the label is put there for the user's information and protection. EPA provides an explanation of product label entries at <http://www.epa.gov/pesticides/label/>.*

b. Material Safety Data Sheets (MSDS): The MSDS contains information similar to that on the pesticide label. The MSDS must be kept in a central location easily accessible by all cemetery staff. Every MSDS is required by the Occupational Safety and Health Act (OSHA) to have the following information:

- Chemical Identity
- Manufacturer's name and Contact Information
- Hazardous Ingredients/Identity Information
- Physical/Chemical Characteristics
- Fire and Explosion Hazard Data
- Reactivity Data
- Health Hazard Data
- Precautions for Safe Handling and Use
- Control Measures

4. TRAINING AND CERTIFICATION

a. NCA requires that all individuals who apply restricted use pesticides be trained and certified as required by State and local (city, county, etc.) regulations. Current certification documents will be kept on file at the cemetery in accordance with State and local regulations.

b. Because the pest management field is constantly changing as new techniques, materials, and equipment are developed and new research results are translated into operational use, all pest management personnel require periodic retraining/recertification.

c. Certification as a pest applicator must be obtained from the certification agency in the State where the individual pest applicator is employed. Approved recertification maintenance courses are available in most States on a local or regional basis. These courses are designed to refresh and add to previously gained pest management knowledge, bring pest managers up-to-date with recent developments, and fulfill re-certification maintenance requirements. The MSN Agronomist and/or Central Office environmental staff can help identify training requirements and resources for cemetery pesticide applicators.

5. SELECTION AND PURCHASE

The IPM process begins with trained cemetery staff identifying the pest. If a pest cannot be identified, send any available photographs, pictures, drawings and environmental information to the MSN Agronomist, or if necessary, the State cooperative extension service advisor or equivalent. Pest identification is necessary for proper selection of any chemical pesticide(s). Chemicals should only be used to control pest problems if cultural, biological, genetic, and mechanical/physical controls fail. Chemicals will be applied only in accordance with label instructions.

a. Selecting Pesticides:

(1) Pesticide selection depends on several variables. Cemetery staff should consider the type of pest, the cost of the control, the location and extent of the problem, and potential negative side effects to non-target organisms. Types of chemical controls:

(a) **Insecticides** are used to control insects. An insecticide may kill an insect upon contact, or when swallowed after being applied to plants or surfaces and ingested by feeding insects.

(b) **Fungicides** are used to control fungi, which cause molds, rot and plant disease. For fungicides to work, they must come in contact with the fungi.

(c) **Miticides** are chemicals specifically used to control spider mites and ticks. The chemical has to contact the mite to be effective.

(d) **Nematicides** are used to control nematodes, tiny macroscopic thread-like worms that may feed on the stem, flower or roots of grasses and ornamental plants. **NOTE:** *In some cases nematodes are used as a treatment to control the larvae of harmful insects.*

(e) **Herbicides** are used to control unwanted plants. Non-selective herbicides kill all plant material, and are normally used when clearing an entire area of vegetation. Selective herbicides will usually kill either most broad-leaved plants or most grassy plants and are useful in established turfgrass areas, median strips, flower/tree/shrub beds, and along walls and fences. Timing can be essential in the use of herbicides:

1. **Pre-emergents** may be used in established turfgrass areas, flower/tree/shrub beds prior to germination of weeds, and will control specific weeds for approximately 6 to 12 weeks.

2. **Post-emergents** are applied after weeds appear and are very selective. They can control the weeds but leave desirable plants alone.

(f) **Horticultural oil sprays** are popular because they generally have no long-term effect on beneficial colonies of parasites or predators. Mites, adelgids, aphids, and scales can be smothered by this spray during the winter. The oil can be used in the winter as a dormant spray and as a summer spray for sucking insects. These sprays are for outdoor use only and should not be used in conjunction with any sulfur-containing materials or fungicide treatments.

(g) **Horticultural soap sprays** are popular because they have no long-term effect on beneficial insects or predators. These sprays kill aphids, adelgids, white flies, thrips, soft scale, mites, and mealy bugs. Horticultural soap sprays can be used indoors as well as outdoors, but may cause damage to certain trees (e.g., horse chestnuts, Japanese maples, mountain ash), gardenias, and some annuals and perennials. Prior to use, the chosen product should be tested on a few selected plants. Horticultural soap sprays require complete coverage for good control and are not compatible with many other chemicals.

(2) **Restricted Use Pesticides** – If a product or its use is classified as "Restricted," it may only be applied by a certified pesticide applicator or under the direct supervision of a certified applicator. These products should only be used in cases where all other management options have failed to reduce pest damage and to achieve NCA standards. A list of Federally restricted use pesticides and additional information about pesticide registration is available at the EPA website at <http://www.epa.gov/pesticides/regulating/restricted.htm>. State cooperative extension service agents can provide information about any additional State restrictions or requirements.

(3) MSN Agronomists will provide information and standard operating procedures for pesticide selection. The guidelines will change as new technologies are developed and introduced. The MSN Agronomist should ensure that cemetery staff have the most current guidance.

b. Purchasing Pesticides:

(1) If a chemical pesticide is selected to control a pest problem, cemetery staff must comply with State Department of Agriculture guidelines for purchase, storage, handling, etc. Consult the MSN Agronomist for technical advice on State regulations.

(2) Typical pesticide purchasing guidelines include, but are not limited to, the following (individual States may have more restrictive regulatory requirements):

(a) Before purchase, confirm that the product has been approved by EPA and State authorities for the intended use and that the label has a registration number showing it is currently registered with EPA (<http://www.epa.gov/pesticides/regulating/registering/index.htm>) and the appropriate State Regulatory Agency (<http://npic.orst.edu/map.htm>).

(b) Purchase only enough for the particular application or for one season to avoid a storage or disposal problem.

(c) Limit purchases to pesticides recommended by the MSN Agronomist or State cooperative extension service.

(d) If possible, purchase granular type formulations (they are safer to use than sprays or dusts because they drift less).

(e) Maintain a current inventory of all chemical pesticides purchased.

NOTE: A list of State Department of Agriculture contacts is available through the National Pesticide Information Center (a cooperative effort of the Environmental Protection Agency and Oregon State University) at <http://npic.orst.edu/state1.htm>. USDA maintains a website with contact information for State cooperative extension services at <http://www.csrees.usda.gov/Extension/index.html>.

6. REQUIREMENTS FOR STORAGE AREAS/BUILDINGS

Cemetery staff must comply with State Pesticide Regulatory Agency guidelines for storing chemical pesticides. Consult the MSN Agronomist for technical assistance with State requirements. Typical requirements for construction and maintenance of storage facilities and proper storage procedures include, but are not limited to, the following (this list does not include all regulatory requirements for all States):

NOTE: Storage requirements are different in each State. Check with the local fire department, and health and zoning boards for information concerning building requirements.

a. Construction Requirements:

(1) Pesticide storage and mixing areas must be designated by appropriate signage and separated from other work areas in accordance with State guidelines. Pesticides must be stored in secured areas that are fenced and locked when not in use. When feasible, such buildings/areas should be separate from other facilities. The use of electronic security systems is strongly encouraged.

(2) The distance between storage areas and mixing/loading areas should be as short as possible to minimize the risk of spills while transporting pesticides across the site.

(3) All pesticide storage buildings and shelving must be constructed of flameproof, non-absorbent material that is impervious to pesticides. (Wooden shelves, which are absorbent, must not be used inside pesticide storage buildings and areas.)

(4) Structures must have adequate moisture control and ventilation for the products that will be stored. Guidance is available on pesticide labels or from the MSN Agronomist and State cooperative extension service.

(5) Pesticide storage area flooring must be sealed concrete or other material that is impervious to pesticides and will contain all spills or leaks.

(6) Each storage area or building must be equipped with:

(a) A fire extinguisher; and

(b) A spill kit containing detergents, soap, hand cleaners, water, absorptive material (vermiculite, pet litter or sawdust) to soak up spills or leaks, shovels, a broom, and dustpan.

(7) Storage areas for pesticides must have a ventilation fan that meets specifications for air changes as specified on product labels or MSDS for the products being stored. Although there is no Federal guideline for number of air changes; some State cooperative extension services recommend six air changes per hour. Contact the appropriate MSN Agronomist or State cooperative extension service office for site-specific recommendations.

(8) The structure must be built to prevent off-site drainage. In the event of a fire in the structure, contaminated water should drain to a confined area.

(9) For new construction, where practical, locate the building down hill from, and at least 100 feet away from, wells, water sources, and all surface water (the distance should be greater for areas with sandy soil).

(10) State guidelines may require a spill containment pad around the periphery of the building. *Secondary containment* provides an impermeable floor and walls around the storage area to minimize spilled pesticide seeping into the ground if a bulk liquid pesticide storage tank should leak.

(11) The storage-building foundation and secondary containment floor must be well constructed and above the water table. The finished grade outside the structure should be at least 3 inches below the floor level, and sloped to provide surface drainage away from the building.

(12) Use spacing materials to keep large drums or bags off the floor to avoid wetting the contents.

(13) Shelves for containers should have a lip to keep the containers from sliding off.

(14) Provide adequate road access for deliveries and emergency equipment.

b. Area/Building Signage Requirements:

There MUST be warning signs on all sides of the storage building or area. The signs MUST:

(1) State "DANGER: PESTICIDE STORAGE AREA"

(2) Be readable from at least 25 feet, and

(3) Be in English, and any other language that is the primary language of individuals who enter the storage area.

7. STORAGE

All cemetery employees who will work with chemical pesticides must receive training in proper pesticide storage practices (see Training/Certification requirements in Section IV). Short-term storage of pesticides for seasonal use poses a lower risk than year-round storage, but any storage, regardless of length of time stored, poses potential risks. Some basic guidelines for storage are presented below:

a. Always check the manufacturer's recommendations for storage.

b. All pesticides should be stored properly after each use.

- c. Entrance(s) to storage areas must be locked when not in use.
- d. Provide a list of the pesticides stored at the cemetery to the local fire department.
- e. The storage area should be cleaned out periodically, unused, excess, and outdated pesticides disposed of properly, and repairs made as needed.
- f. Pesticides must be stored out of the weather and away from the sun or other sources of heat. Some pesticides can catch on fire if they get too hot or splash when the container is opened.
- g. Store dry products above liquids to prevent wetting from spills.
- h. Herbicides should be stored apart from insecticide and other pesticides. If an herbicide vaporizes, it can contaminate other pesticides and may injure plants when used.
- i. Material Safety Data Sheets (MSDS) must be available to all cemetery staff for all chemicals stored. **NOTE:** *NCA Handbook 0320, Emergency Preparedness Planning Procedures, requires that Cemetery Emergency Plans specify the location of two complete sets of the MSDS for hazardous materials, one readily available to employees in the work area, and an additional set kept in another accessible location.*
- j. All pesticides should be stored in the original containers. The label of each container should be in plain sight. The following information must be visible:
 - (1) Contents by chemical and common names;
 - (2) Fire hazard rating;
 - (3) Toxicity hazard;
 - (4) Storage and handling precautions;
 - (5) First aid for inhalation, ingestion, and/or contact with skin and eyes;
 - (6) Site/areas where it can be used; and
 - (7) EPA registration number.
- k. If pesticides must be transferred from the original container to another container, never store pesticides in any container used for food or drinks or without additional labeling. Pesticides stored in a soda bottle, food jar, or milk carton can cause serious accidental poisoning.
- l. Pesticide equipment should be stored in an appropriate and separate area. The equipment should be cleaned according to the manufacturer's recommendations after each use, and before storing.
- m. Protective clothing should be worn at all times while handling pesticides, including when applying products, cleaning the storage area and application equipment, and putting away the pesticides.

n. All cemetery staff must carry a respirator in a sealed plastic bag when they enter the pesticide storage area.

o. There will be no unsafe behavior (e.g., eating, drinking, smoking, sleeping) permitted in the pesticide storage area, and all appropriate safety precautions will be followed when applying pesticides.

p. Keep pesticides dry, in closed/sealed containers, and out of the way of activities that could knock over or accidentally open a container.

8. MIXING/LOADING PRECAUTIONS

Extreme caution should be used in mixing and handling pesticides. The mixing and loading of pesticides can result in exposure, spills, splashes, inhalation, etc. Groundwater contamination can result even from small spills in the mixing and loading area. Small quantities spilled regularly in the same place can build up in the soil and eventually reach groundwater or run off into surface water. Even with all precautions, minor spills and leaks are bound to occur from time to time. Contamination can be minimized by following some basic guidelines:

a. Mix and load chemicals on an impermeable containment pad, either outside or in a well-ventilated area where spills can be contained. The pad is intended to protect soil from contamination. Do not mix and/or load on gravel driveways or other surfaces that permit spills to sink quickly through to and contaminate the soil.

(1) The pad should be large enough to contain leaks from bulk tanks, wash water from cleaning equipment, and spills from transferring chemicals to the sprayer or spreader. Pad size also depends on the equipment used. The pad should provide space around parked equipment for washing and rinsing.

(2) Having several separate *rinsate* (rinse water) collection and storage tanks allows rinsate from different chemicals to be kept separately. Use rinsate for mixing subsequent loads, and spray the last rinsate load on the application area.

(3) All water that collects on the pad must be managed to prevent contamination of water or soil due to runoff from the pad. A roof over the area is essential. **There must be NO runoff** from the containment area because it is likely to be contaminated. Runoff can be a violation of the Clean Water Act, FIFRA, or RCRA.

b. Measure all quantities of concentrated pesticides with extreme accuracy.

c. Do not mix and/or load pesticides near drinking water and irrigation wells. Instead, use a separate tank to transport water to the mixing and loading site.

d. Install an *anti-siphon device* on wells or hose bibs to prevent reverse flow of liquids and contamination of the water supply.

e. Never place a nozzle or hose directly into a mixing container such as a spray tank. Keep the hose above the tank opening to maintain an air gap between the hose and the tank. Do not allow the delivery hose to drop below the highest possible water surface to avoid back-siphoning.

f. A certified pesticide applicator must supervise sprayer filling for restricted-use pesticides.

9. APPLICATION/DISPOSAL

a. Application:

- (1) Never work alone when handling dangerous chemicals.
- (2) Protective gloves must be worn, and should be washed before removal.
- (3) Do not smoke, eat, drink or apply cosmetics while handling pesticides.
- (4) Where a pest problem is more severe in a concentrated area, spot treatment should be used instead of broadcast spraying, to protect the environment.
- (5) Do not spray on a windy day. Any drift must be controlled to protect humans, pets, adjacent properties, wildlife, plants, crops, wells, and ponds. Federal laws place rigid controls and penalties on applicators who misapply pesticides. If chemicals are permitted to drift and cause contamination or injury, the applicator can be held liable. Drift is influenced by many factors, such as particle size, gravity, spraying pressure, evaporation rate, air movement, humidity, and temperature.
- (6) Pesticides break down at different rates. In some products the change occurs within hours and in others it can take days, weeks, or months. This is called a residual effect. The type of pest, disease or fungus being treated will determine if a quick kill or a longer residual effect is needed. The applicator must be sure of the pest being controlled and hit the specific target.
- (7) To apply the correct pesticide amount the applicator must have proper equipment in good condition and properly calibrated.
- (8) Use action thresholds established for the cemetery to determine the appropriate schedule for chemical control in order to apply pesticides when they will have the maximum effect on the target pest population. The application should be performed at the proper time and in recommended dosages to maximize effectiveness.
- (9) No unprotected individual may be in an area that is being treated with a pesticide. Ensure there is a waiting period for re-entry to the treated area.
- (10) Give appropriate notice to visitors and staff by posting signage for pesticide application in a publicly visible location, at the site of specific pesticide application(s), and at the boundaries of application areas (such as along roads or edges of burial sections).
- (11) The Cemetery IPM Coordinator should work with the MSN Agronomist to ensure that:
 - (a) Appropriate steps are taken to prevent negative impacts associated with pesticide use that might affect endangered or threatened species in or near the cemetery; and
 - (b) Appropriate State or local requirements for effluent limitations for application of pesticides are followed.

b. Disposal:

(1) Waste chemicals, pesticide containers, and container residue must be stored and disposed of in accordance with local (city, county, etc.), State, and Federal requirements prior to disposal. Follow label directions for disposal.

(2) Do not incinerate pesticide waste in VA-owned incinerators. Only approved landfills or treatment technologies that meet Resource Conservation and Recovery Act (RCRA), State, and local (city, county, etc.) specifications may be used for disposal of pesticide waste.

(3) Pressure-rinse or triple-rinse containers and spray tanks with water as soon as they are emptied.

(4) If possible, use returnable containers and mini-bulks and take them back to the dealer.

(5) Recycle plastic and metal containers whenever possible. Puncture containers and store them out of the weather until you can take them to a recycler.

(6) Thoroughly shake out bags, bind or wrap them to minimize dust; and then follow label directions for disposal.

10. RESPONDING TO SPILLS

a. In the event of a spill or leak in the pesticide storage area, follow the instructions contained in the MSDS for the spilled material.

b. Pesticide spills that contaminate soil and other materials may require cleanup beyond the capabilities of the cemetery staff and actions should be coordinated through the NCA Occupational Safety, Health, and Environment program. A list of emergency contact numbers and information for the individuals and authorities listed below should be included in the cemetery spill prevention plan.

c. NCA employees must notify their supervisor immediately of any spill of any pesticide. The supervisor will notify the Cemetery IPM Coordinator, who will follow MSN Agronomist guidance as to whether to notify others, including the MSN Director, Chief Agronomist, and/or the servicing VA Medical Center (VAMC) Industrial Hygienist or Safety and Fire Protection Specialist. The MSN Agronomist will refer to the list of pesticides submitted by that cemetery, the appropriate MSDS, and other references to determine appropriate action. If the spill is at the level of a Reportable Quantity, the National Response Center (800-424-8802) and local and State authorities must be contacted.

NOTE: *Each cemetery should have written procedures posted and kept up-to-date that list the specific names and numbers of individuals to be notified in case of a spill.*

11. RECORDKEEPING AND REPORTING

a. Federal, State, and local (city, county, etc.) pest or pesticide management regulations require the maintenance of records related to the application of pesticides, and reporting of certain events or actions.

b. NCA requires that records be maintained on the purchase and application of pesticides, and applicator certification and training. The records will be regularly reviewed by the local MSN Agronomist to ensure that IPM is being implemented appropriately at the cemetery. The records will include:

(1) **Inventory of Purchases:** Cemetery IPM Coordinators will maintain records of all pesticides purchased until one year after the product has been used in totality and appropriately disposed of. Copies should be provided to the MSN Agronomist and local fire department when any changes are made so that they are aware of any potential hazards.

(2) **Pesticide Application Log:**

(a) Cemetery IPM Coordinators will maintain a chronological record of all pesticide applications and non-chemical pest management operations. The record must document all pesticide applications performed by cemetery pest management personnel, as well as work done by contract services, or as part of outleases, land management, or forestry programs. Cemetery staff may use a State form for this purpose, or document the information specified in subparagraph (3) below in log format. Keep the records in accordance with Federal, State and local requirements.

(b) Each cemetery Pesticide Application Log will be reviewed at least annually by the local MSN Agronomist to ensure that IPM is being implemented appropriately.

(c) The Pesticide Application Log will be made available for State inspection and/or reporting to Federal and State agencies. A review of the log will be a regular part of a cemetery inspection.

(d) A Pesticide Application Log provides an historic record of pest management operations and pesticide applications for each building, structure, or outdoor site. Records must include the following information:

- Name of applicator (and certification number);
- Date of application;
- Type of plant(s), turf, or structure(s) treated;
- Target pest(s) controlled, population levels and action threshold;
- Acreage or number of plants treated;
- Address of property treated;
- Common name of pesticide(s) used;
- Type of applicator and Personal Protective Equipment used;
- Amount of pesticide(s) applied and concentration(s);
- Time of day of application;
- Wind direction, estimated velocity, and weather conditions;
- Date/time of notice to local chemical-sensitive individuals of planned applications; and
- Evaluation of treatment effectiveness.

(3) **Any associated IPM program audit materials;**

(4) **Pesticide Applicator Certification(s):** Copies of applicator certification(s) for NCA staff and contractors must be kept on-site for the term of certification.

(5) **Training:** Copies of all training completed by applicator personnel must be kept on-site as long as the individual's license/certification is valid or the position description is still in effect. Additional training and guidance will be provided by MSN Agronomists. Information should include title of training, content outline, and date of training. Any Continuing Education Credits provided should also be documented.

b. The Emergency Planning and Community Right-to-Know Act of 1986 (EPCRA) requires reporting data to the EPA for inclusion in the Toxic Release Inventory (TRI) if the cemetery exceeds specified thresholds for "manufacturing, processing, or otherwise use" of a listed chemical/toxic material. The Cemetery IPM Coordinator should consult with the NCA Environmental Engineer or Chief Agronomist if there is any question about whether the cemetery is subject to TRI reporting. **NOTE:** *The EPA sets TRI program requirements, and information is available on the EPA website at <http://www.epa.gov/tri/>. EPA publication "EPCRA Section 313 - Questions and Answers Addendum for Federal Facilities" is available electronically at http://www.epa.gov/tri/guide_docs/.*

c. The Superfund Amendments and Reauthorization Act of 1986 (SARA) and the EPCRA require notification of those present at the cemetery and appropriate Federal, State, and local authorities (as specified in the Cemetery Emergency Plan) if there is a spill or release of chemical pesticides at or above a "Reportable Quantity" as listed in the table of *Hazardous Substances and Reportable Quantities* published by the EPA in 40 CFR 302.4 (available electronically at <http://www.gpo.gov/fdsys/browse/collectiontab.action>)

APPENDIX A – SUMMARY OF RELEVANT STATUTES AND REGULATIONS

(listed in chronological order)

Migratory Bird Treaty Act of 1918, as amended (codified at title 16, United States Code (U.S.C.), Section 703, et seq.)

This Act protects migratory birds from being killed, hunted, captured, purchased, or traded; and also protects their nests and eggs. The United States Fish and Wildlife Service must issue a permit before a pesticide can be used to manage bird populations other than European Starlings, English Sparrows, and Rock Pigeons (also known as Rock Doves).

National Environmental Policy Act (NEPA) of 1969 (42 U.S.C. 4321 et seq.)

NEPA specifies requirements assessing the impact of pesticide use on the environment.

Occupational Safety and Health Act (OSHA) of 1970 (Public Law 91-596), as amended.

OSHA regulations are published in title 29, Code of Federal Regulations (CFR), Parts 1910.20 (Access to employee exposure and medical records), 1910.132 (Personal Protective Equipment), 1910.134 (Respiratory Protection), and 1910.1200 (Hazard Communication).

Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) of 1972, as amended (Public Law 92- 516, 7 U.S.C. Section 136 et seq.)

FIFRA provides the principal means for preventing adverse effects on the environment from pesticides through product registration and labeling, applicator certification, and application requirements. As amended by the Food Quality Protection Act of 1996, FIFRA requires that Federal agencies use IPM to manage pests at all facilities. Most states have been delegated the authority to enforce FIFRA by performing on-site inspection of Federal facilities, including VA national cemeteries.

Federal Water Pollution Control Act of 1972, as amended by the Clean Water Act of 1977 (33 U.S.C. 1251 et seq.)

This Act protects surface waters from contamination by pesticides in wastewater and in land runoff. Control is exercised through stringent effluent limitations imposed through the National Pollutant Discharge Elimination System (NPDES) permitting program. Application of pesticides over large areas must comply with the NPDES regulations.

Endangered Species Act (ESA) of 1973 (16 U.S.C. 1531, et seq.)

The ESA provides for the protection of threatened and endangered species of fish, wildlife, and plants and their habitats. The Act requires Federal agencies to ensure that no agency action is likely to jeopardize the continued existence of endangered or threatened species. Under the ESA, the EPA is required to ensure that pesticide use is not likely to jeopardize endangered species or to adversely affect critical habitats. Endangered species and critical habitat protection is implemented through the pesticide labeling process and the issuance of state specific bulletins.

Federal Noxious Weed Act of 1974 (7 U.S.C. 2801 et seq.)

This Act prescribes IPM systems to control or contain undesirable plants.

Resource Conservation and Recovery Act (RCRA) of 1976, as amended (42 U.S.C. 6901, et seq.)

RCRA outlines the hazardous waste management requirements for disposal of many excess or waste pesticides and for equipment and containers contaminated by pesticides. RCRA regulations identify the type, criteria, standards, and requirements for disposing of excess pesticides, pesticide containers, and the waste resulting from the cleanup of pesticide spills.

Emergency Planning and Community Right-to-Know Act (EPCRA) of 1986 (42 U.S.C. 1100, *et seq.*)

EPCRA provides for protecting and notifying communities in the event of a release of a toxic chemical. The list of toxic chemicals requiring notification includes several pesticides, however, VA national cemeteries do not usually use these pesticides. The Material Safety Data Sheet for each product should indicate if the pesticide waste is a RCRA-listed hazardous waste.

APPENDIX B – FEDERAL WEBSITES WITH RELEVANT INFORMATION

National Pesticide Information Center (a cooperative effort of the Environmental Protection Agency and Oregon State University) provides pesticide-related information at <http://npic.orst.edu/map.htm> and maintains a list of State Department of Agriculture contacts at <http://npic.orst.edu/state1.htm>

“Guidance for Presidential Memorandum on Environmentally and Economically Beneficial Landscape Practices on Federal Landscaped Grounds” (August 10, 1995, Federal Register Vol. 60, No. 154) can be found at the Office of the Federal Environmental Executive (OFEE) website at www.ofee.gov under “More Links.”

U.S. Department of Agriculture (USDA) requires each State to designate an IPM coordinator. Contact information for each state’s IPM coordinator and technical support for pest management issues is available at the Cooperative State Research, Education, and Extension Service website at <http://www.ipmcenters.org/intranet/directories/ipmdirectory.cfm>.

USDA also maintains a website with contact information for State cooperative extension services at <http://www.csrees.usda.gov/Extension/index.html>.

U.S. Fish and Wildlife Service lists information about Endangered Species as a link at <http://www.fws.gov/>. FWS endangered species regional office contact listing is available at <http://endangered.fws.gov/contacts.html>.

APPENDIX C – IPM SPECIFIC DEFINITIONS

Abrasion - A scrape, scratch, score, or cut that breaks the skin.

Absorb - To take in a substance (e.g., when a plant, animal/human, or soil takes in a pesticide).

Accumulate - Build up, store.

Active Ingredient - The part of the pesticide that either kills the pests, or prevents damage by them.

Antidote - A treatment to counteract the effect of pesticide poisoning.

Application - Using a pesticide to affect a specific target.

Artificial Respiration - First aid for someone who has stopped breathing, by blowing air into his/her lungs.

Atropine - An antidote for organophosphate and carbamate poisoning.

Biological Control - The use of beneficial organisms such as bacteria, nematodes, or fungi to control unwanted organisms.

Broadleaf Weeds - Undesirable plants with broad, and generally rounded, leaves; from the family *dicotyledonous*.

Carbamate - A synthetic organic pesticide containing carbon, hydrogen, nitrogen, and sulfur.

Carrier - The inert liquid or solid material added to an active ingredient to prepare a pesticide formulation.

Certified Applicator - Any individual who holds current State certification as a pesticide applicator.

Chlorinated Hydrocarbon - A synthetic organic pesticide that contains chlorine, carbon, and hydrogen (e.g., chlordane, lindane, methoxychlor).

Cholinesterase - A chemical enzyme found in animals that helps regulate the activity of nerve impulses.

Common Name - A well-known, simple name of a pesticide as accepted by the Pesticide Regulation Division of the Environmental Protection Agency, such as carbaryl, atrazine, and benomyl.

Compatible - When two or more chemicals can be mixed without affecting each other's properties, they are compatible.

Concentrate - An undiluted pesticide that usually contains a large percentage of the active ingredient(s).

Concentration - The amount of active ingredient in a pesticide formulation or mixture (usually provided as a percentage).

Control - To reduce damage; to keep down the number of pests in an area.

Decontaminate - To remove or break down the unwanted pesticide so it cannot do any harm or damage.

Degree of Exposure - The amount or extent to which an individual has been in contact with a toxic pesticide.

Deposit - The pesticide remaining on the leaves, skin, or other surface right after a pesticide application.

Disease Vectors - Organisms, such as mosquitoes or ticks, that carry disease-causing microorganisms from one host to another.

Dormant Spray - Horticultural oil spray application made before trees and other plant life begin to leaf out in the spring.

Dose, Dosage - Quantity of a pesticide applied.

Drift - The movement by wind and air currents of spray droplets or particles of a pesticide from the target area to an area not intended to be treated.

EPA Registration Number - A number assigned by EPA to a product when it is registered. The number must appear on all labels for that product as "EPA Reg. No." or "EPA Registration No." followed by the company number and product number. Sometimes a State alphabetical designation and distributor's number will also be shown.

Fungicide - Pesticide used to control organisms that cause molds, rot, and plant diseases (fungi). For fungicides to work, they must come in physical contact with the fungi.

Gas Mask - Type of respirator that covers the entire face and protects the eyes as well as the nose and mouth. A mask contains better filters and more absorbing material to cleanse the air than cartridge respirators, and is less likely to leak around the edges.

Hazard - A source of risk or danger; the chance that danger or harm will come to the applicator, bystanders, livestock, wildlife, or crops.

Herbicide - Pesticide used to control unwanted plants; can be selective or non-selective in results.

Inert Ingredients - Inactive part of a pesticide/formulation; material(s) in a pesticide mixture that would not prevent damage or destroy pests if used by itself.

Infestation - An abundance of pests found in an area or place where they are not desirable.

Ingest - To eat or swallow.

Ingredient Statement - The part of the label on a pesticide container that gives the name and amount of each active ingredient and the amount of inert ingredients/inactive material in the mixture.

Inhalation Toxicity - How poisonous a pesticide is to a human or animal when breathed in through the lungs.

Insecticide - A pesticide that is used to control or prevent damage caused by insects; kills by contact or ingestion.

Interval - The time period between two pesticide applications.

Label - The printed material attached to or part of a pesticide container giving information about the contents and proper use of the product.

Liability - Having legal responsibility for; state of being liable; obligation.

Limitation - A type of restriction; the most (of something) that is allowed.

Maximum Dosage - The largest amount of a pesticide chemical that is safe to use without resulting in excess residues or damage to whatever is being protected.

Nematicide - A pesticide used to control nematodes.

Nematode - A tiny, hair-like worm that causes damage by feeding on roots or other plant parts.

Non-Labeled - Use or method that is not written on the pesticide label and therefore is not legal.

Non-Selective - A pesticide or herbicide that controls a wide range of pests or unwanted plants, can sometimes be lethal to all exposed pests/plants.

Non-Target - Any plant, animal, or other organism that a pesticide application is not aimed at, but that may be accidentally injured.

Objectionable Accumulations - The presence of environmental deposits, mold, mildew, moss, algae, lichen, grass clippings, grass marks, tire marks and scuffs, and accumulations of dried bird droppings, etc., on headstones, markers, and niche covers.

Organism - Any living thing (plant, animal, fungus, bacteria, insect, etc.).

Organophosphate Pesticides - A family of pesticides that all contain phosphorous. They act by inhibiting a blood chemical called cholinesterase. Examples include malathion, diazinon, and parathion.

Percent By Weight - The amount of actual pesticidal ingredients in a mixture based on its weight compared to the weight of the whole mixture. Example: One pound of actual pesticide plus three pounds of other materials would equal 25% pesticide by weight in the mixture.

Personal Protective Equipment (PPE) - Clothes and equipment that guard against exposure, injury, or death when using poisonous pesticides. PPE includes gloves, aprons, shoes, coveralls, hats, respirators, and gas masks.

Pest - An unwanted organism (animal, plant, bacteria, fungus, virus, etc.).

Pesticide Application Log - A chronological record of all pesticide applications and non-chemical pest management operations.

Pesticide Chemical - Term used to describe a pesticide that is a chemical rather than a parasite, virus, or some other type of pest killer.

Poison - Any agent that can cause injury, illness, or death when absorbed by a living organism.

Post-emergents - Herbicides applied after weeds have germinated and are growing, generally used to control weeds not controlled by a pre-emergence herbicide.

Predator - Any animal or insect that attacks, feeds on, or destroys other animals, plants, or insects. Some predators can help to reduce pests that cause disease, damage, or harm.

Pre-emergents - Herbicides applied prior to weed germination, used for the control of unwanted grasses and certain annual broadleaf weeds.

Rate - The amount of a material delivered to a plant, animal, or surface. Usually measured as per acre; per 1,000 square feet; or per hour.

Recommended Dosage - How much of a pesticide to use to control a pest. This amount is not always the maximum allowed by law. Recommended dosage levels must always be written on the label.

Re-entry Interval - Period of time between a pesticide application and when individuals can safely go back into an area without protective clothing.

Registration - Approval by the Environmental Protection Agency and appropriate State Regulatory Agency of a pesticide for uses as stated on its label.

Residual Pesticide - A pesticide that breaks down slowly and can destroy pests or keep them from causing damage for long periods of time after application (days, weeks, or months).

Respirator - A face mask that filters out poisonous gases and particles from the air so that an individual can breathe and work safely.

Restricted use pesticide - A pesticide that, even when applied in accordance with warnings and directions for use, may cause unreasonable adverse effects on the environment or individuals. When a pesticide or its use(s) are classified as 'restricted' by the Environmental Protection Agency it may be applied only by or under the direct supervision of a certified applicator. (Title 7, United States Code, Section 136a(d)(1)(c))

Restrictions - Limitations on use.

Selective Pesticide - A pesticide that will control only specified pest species and is not effective for the control of other pest species.

Sensitive Areas - Places where pesticides could cause unintended harm if not used with special care and caution. Examples: houses, barns, parks, ponds, streams, etc.

Short-Term Pesticide - A pesticide that breaks down almost immediately after application into non-toxic by-products.

Stage of Development - Time period during the growth from newborn or egg to adulthood.
Example: An insect goes through many changes from egg to adult - any one of these changes is a separate stage of development.

Susceptible - Can be killed or injured by the pesticide at the rates used.

Symptom - A warning that something is wrong; an outward signal of disease or poisoning in a human, plant, or animal.

Systemic - A pesticide that is taken in by one part of a plant or animal and moved to another section where it acts against a pest.

Target - The area, buildings, plants, animals, or pests intended to be treated with a pesticide application.

Toxic - Poisonous, injurious to plants, animals, or humans.

Underground Water - Water located beneath the soil surface.

Victim - Someone who is injured, poisoned, or hurt in any way.

Weeds - A plant growing where it is not wanted, especially one growing in profusion so as to crowd out a desired plant or grass.

APPENDIX D – INSECT AND ANIMAL TURFGRASS PEST CONTROL

There are many kinds of insects and insect-like pests that can do considerable damage to turfgrass, including Japanese beetles (adult and grub form), June beetles, sod webworms, army worms, cutworms, chinch bugs, leaf hoppers, and ants. Animals such as moles, pocket gophers, skunks, and field mice frequently damage lawns.

1. ANIMALS

Since most animals usually invade turf in search of grubs and other insects, an adequate insect-control program will keep them out. Poison baits will control pocket gophers and mice. Traps in tunnels are a moderately effective means of mole control, as poison baits are not readily taken by moles. A new mole control product called Talpirid has proven effective for controlling moles on NCA properties.

2. INSECTS

a. Turfgrass is primarily subject to damage by insect pests commonly referred to as “grubs.” Grubs are the immature larval stage of several different species of beetles. They cause damage as they feed on the turfgrass roots. This can occur during spring and/or fall and depends on which of the several species of beetle larvae are present.

(1) *Immature larval stages of Japanese beetle, European chafer, northern masked chafer, southern masked chafer, Oriental beetle, and Asiatic garden beetle:* These species generally complete their life cycle in one year. Adults emerge from the soil and lay eggs on or beneath the soil surface. After the eggs hatch the larvae feed on the turfgrass roots, potentially causing extensive damage.

(2) *The immature stage of the beetles referred to as May beetles or “June” bugs* complete their life cycle in 2 or 3 years.

b. The first step in developing an effective control strategy for these common insect pests is determining whether the number of larvae in the soil is large enough to warrant application of an insecticide. Generally, a grub population in excess of 10 per square foot would trigger a need for treatment.

(1) Periodic population counts should be made in areas with a history of previous grub damage, turfgrass that borders wooded areas where high levels of adult beetle activity have been observed, areas where turfgrass injury symptoms appear, areas where significant mole activity is observed, or where skunks or raccoons are seen or leave evidence of digging up the turf in search of food.

(2) Counts should be made by laying back a 3 foot by 3 foot section of sod that has peeled back to expose the soil surface at the root soil interface of the turfgrass. This should be done in late May or September, when beetle larvae are most likely to be actively feeding near the soil surface. To get a more thorough count of all grubs in the area, pour a solution of sudsy water over the entire exposed soil surface. This will drive any grubs not fully visible up to the soil surface.

c. There are several recommended approaches for the control of grubs:

(1) The most common approach uses a moderately residual insecticide applied in a pre-emptive manner during the spring feeding period. This type of treatment controls actively feeding grubs and has sufficient residual action to control any larvae that surface for feeding from late August through September. Imidacloprid (Trade name Merit) and halofenozide (Trade name Mach 2) are both highly effective for controlling grubs when used in this manner. Application of these products can also be made in late summer prior to the heavy fall feeding period of newly hatched grubs.

(2) In situations where grub populations have progressed beyond reasonable expectations of control from Merit or Mach 2 and a 'rescue' treatment is warranted, the choice is trichlorfon (Trade names Dylox and Proxol). Trichlorfon is an organophosphate insecticide and should be handled with care to avoid any exposure to applicators or others.

NOTE: *The MSN Agronomist or State cooperative extension service can recommend the proper chemicals to use. Proper storage requirements and safe handling and application procedures must be adhered to at all times for all pesticides/insecticides. All chemical pesticides and fungicides must be applied by a State licensed applicator. Records must be kept of the day, time, weather, name of product applied and manufacturer, and quantity used, as specified in Section IV of this handbook.*

APPENDIX E – WEED CONTROL IN TURFGRASS AREAS

1. BACKGROUND

a. A weed is a plant growing where it is not wanted, or essentially, a plant out of place. Weed encroachment into an established turf usually results when the turf has become weak and thin due to environmental stress, damage by pests and diseases, improper cultural practices, or intense wear from foot or vehicle traffic. Weed control is the process of limiting a weed infestation so that turfgrass can grow properly. Weed control practices are not effective on a long-term basis unless the original cause of weed encroachment is corrected. When properly maintained, warm- and cool-season turfgrasses are highly competitive with weeds. Providing ideal agronomic conditions is the preferred method for managing weeds in turfgrass. When weed populations exceed NCA standards of appearance, chemical weed control can be practiced. There are two types of herbicides to control weeds.

(1) **Pre-emergence herbicides** are applied prior to weed germination and are used for the control of crabgrass, goosegrass, annual bluegrass, and certain annual broadleaf weeds. Pre-emergence herbicides are usually applied to the entire turfgrass area to rid it of broadleaf weeds.

(2) **Post-emergence herbicides** are applied after the weed has germinated and is growing, and are generally used to control weeds not controlled by a pre-emergence herbicide. Post-emergence herbicide can be applied on a "spot-treatment" or "as-needed" basis directly to the weed infestation. Weed species vary in their susceptibility to herbicides. The most important factor in selecting a post-emergence herbicide is the tolerance of the turfgrass to the herbicide.

b. Correct weed identification is necessary to select an appropriate herbicide. The herbicide label should contain information about what weeds can be controlled. Timing of application is important, for example, certain herbicides can only be applied to Bermuda grass when the grass is dormant.

NOTE: *Proper storage requirements and safe handling and application procedures must be adhered to at all times for all herbicides. All chemical herbicides must be applied by a State licensed applicator. Records must be kept of the day, time, weather, name of product applied and manufacturer, and quantity used, as specified in Section IV of this handbook.*

2. SELECTIVE BROADLEAF WEED CONTROL

a. **Cultural Practices:** The best way to avoid broadleaf weeds in turfgrass stands is by producing a healthy, vigorous, dense stand of the desired turfgrass species. Using appropriate cultural practices will reduce the need for chemical control measures (see current NCA Handbook 3420 – Turfgrass Maintenance in VA National Cemeteries, for detailed information on these practices).

(1) The most common cultural control technique is routine mowing, as only a limited number of broadleaf weed species can tolerate frequent mowing. However, many of the species that can tolerate frequent mowing are difficult to control and quite competitive once

established. The most difficult species of broadleaf weeds to deal with in turfgrass are those that have a low, spreading growth and can tolerate the mowing heights commonly employed for turfgrasses. Some of the most troublesome are clover, black medic, wild violet, ground ivy, knotweed, prostrate spurge, veronica, and chickweed.

(2) Other cultural practices that have a significant impact on weed encroachment are fertilization, irrigation, and aerification.

(a) Proper timing, quantity, and nutrient content of fertilizer products can encourage the growth of the desired turfgrass species while discouraging weed species. For example, cool season turfgrass species will benefit most with spring and fall applications of fertilizer. Mid-summer applications would encourage the growth of summer annual weeds.

(b) Established stands of perennial turfgrass should be irrigated infrequently (in sufficient quantity to penetrate to a minimum soil depth of 6 inches), and then allowed to dry before being irrigated again. Water applied in frequent light quantities will encourage the germination of weed seeds located near the soil surface and help them to become established.

(c) Core aerification can injure plants that are not actively growing, and can bring weed seeds to the surface where they will germinate. Core aerification should never be done in spring. Aerification should not be done during high temperature stress periods, or when common weeds are germinating. Applying a pre-emergent herbicide after aerification will help keep weed seeds from germinating.

b. Mechanical Control: If the number of weeds is small, removal by hand is recommended. It may be necessary to use a broadleaf herbicide to control an infestation of unwanted weed species.

c. Chemical Control:

NOTE: See paragraph *Application/Disposal Instructions in Section IV – Chemical Pesticides*, for detailed information about application procedures and required notification of staff, visitors, and neighboring individuals. Consult the product label and Material Safety Data Sheet (MSDS) for handling, storage, and safety information.

(1) *Herbicide Selection*: Current practice is to use pyridine-based herbicides (where practical and appropriate) to replace 2,4-D and other earlier products. Triclopyr and clopyralid - sold as Turflon, Confront, and Millennium, and under other trade names - are pyridine products available for use on turfgrasses. These products work well on commonly grown cool season turfgrasses. Warm season turfgrass species tolerance to these herbicides varies and should be confirmed prior to use.

(2) *Herbicide Application Techniques*:

(a) Scattered small patches of broadleaf weeds should be selectively controlled and removed by spot treating the affected area(s). Small hand-held or backpack style sprayers can hold 2 to 4 gallons of spray solution. The spray solution should be delivered in a single pass over the target area so that the foliage of the weeds is uniformly wet.

(b) If the broadleaf weeds affect a large area, tractor or utility cart-mounted spray equipment should be used to apply the selective herbicide.

(3) *Herbicide Application Timing*: Although selective broadleaf herbicides can be used anytime that the target weeds are growing and the turfgrass is mature and actively growing, applications at certain times will deliver the best results.

(a) Summer annual broadleaf weeds germinate during the spring, grow rapidly into early summer, flower and produce seed during the summer, and usually die as a result of the first killing frost in fall. If herbicide treatment is necessary for summer annual species, it should be completed well before the plants have a chance to produce seed. Common summer annual broadleaf weeds include pigweed, prostrate spurge, black medic, and yellow woodsorrel (this can be perennial in some areas).

(b) Winter annual broadleaf weeds germinate during late summer and early fall, grow rapidly through the fall, overwinter in a semi-dormant state, and resume active growth the following spring; then flower and produce seed and die during the warmer temperatures of summer. Treatment for winter species can be made during the late summer/fall growing period or in the following spring (prior to flowering and seed production). Common winter annual broadleaf weeds include chickweed, henbit, Virginia pepperweed, and corn speedwell.

(c) Perennial broadleaf weeds live two or more seasons and do not need to come back from seed each year. Treatment to control perennials should be made in early fall when plants are moving carbohydrates into their root systems as storage reserves for winter survival. The applied herbicides will move into the root system and facilitate a complete kill of the target weed plant. Common examples of perennials broadleaf weeds include Canada thistle, wild carrot, ground ivy (creeping Charlie), white clover, wild violet, and dandelion.

3. PRE-EMERGENCE CONTROL OF CRABGRASS AND OTHER ANNUAL GRASS WEEDS

Crabgrass is the most common weed in established stands of cool season turfgrass. Several other annual weed grasses are common across the country, including yellow and green foxtail, barnyardgrass, goosegrass, and annual bluegrass (*Poa annua*). Annual bluegrass is a winter annual and germinates around Labor Day; all of the others are summer annuals and germinate during the spring.

a. **Herbicide Selection/Performance Factors**: There are commercially available herbicide products that will effectively control the germinating seeds of crabgrass and other annual grass weeds. The best choice for each depends upon factors such as cost, formulations available, soil residual properties, turfgrass species tolerance, effectiveness, and user handling and safety.

(1) In order to perform effectively, all pre-emergence herbicides:

- ✓ must be active in the soil in order to kill weed seeds as they germinate;
- ✓ must remain near the soil surface where the weed seeds germinate and not penetrate into the soil where they could affect the turfgrass root mass;
- ✓ must remain effective during the primary germination period of the target weeds – but should not harm reseeding or overseeding operations; and
- ✓ must be tolerated by all commonly grown turfgrass species.

(2) Any pesticide product registered for general use under existing Federal and State guidelines has successfully cleared all environmental, ecological, and human safety test hurdles. All of the products listed below have been in use for some time and have been established as highly effective herbicides when properly used.

NOTE: Available products include benefin (trade name Balan), trifluralin+benefin (trade name Team and Team Pro), pendimethalin (trade name Pendulum and Pre-M), prodiamine (trade name Barricade), dithiopyr (trade name Dimension), and quinclorac (Trade name Drive). The first four products belong to the same chemical family – dinitroanilines – and clearly dominate this category of herbicide usage. Dithiopyr and quinclorac are not members of the dinitroaniline family.

b. **Application Timing:**

(1) Herbicide application(s) should be made 1 to 2 weeks prior to weed germination, which depends upon soil temperature. Soil temperatures are slow to rise in the spring. If the soil has been more moist than usual the warming process will be even slower, as water is a very poor conductor of heat.

(2) Several inexpensive soil thermometers should be placed at strategic locations around the property at a soil depth of 2 inches. When they record mid-afternoon temperatures of over 50 degrees Fahrenheit for 3 to 4 consecutive days, pre-emergents can be applied.

(3) If the herbicide is applied 4 to 6 weeks before germination, a significant percentage of the active ingredient will be wasted, since the active ingredient begins to degrade as soon as it is applied. Application should not be delayed until after weed germination.

For example, crabgrass begins to germinate in the spring after soil temperatures in the top 1 to 2 inches of soil have reached between 50 and 55 degrees Fahrenheit. The germination process will not begin just because there have been a few unseasonably warm days in March or April. Although all of the herbicides mentioned in the NOTE above will control a young one- to two-leaf stage crabgrass plant, only quinclorac can control relatively mature crabgrass plants.

c. **Formulation Options:** All of the herbicide products discussed in the NOTE above are commercially available from numerous sources and in several different formulations. They can be purchased in sprayable formulations, true liquids, wettable powders, flowables, or dry flowables blended with fertilizers.

(1) Uniform application to the target area is essential. Most users will find that a granular product, or fertilizer combination that includes the selected herbicide is easier to apply. Using fertilizer spreading equipment is generally more efficient and accurate than spraying.

(2) In most cases a single, properly timed herbicide application will control over 90% of the annual weed grass seeds that germinate during a normal spring season. **NOTE:** *For areas with consistent crabgrass problems, two sequential crabgrass control applications are recommended to ensure complete full season control.*

APPENDIX F – WEED CONTROL IN PLANTING BEDS

Planting beds (containing plant materials such as woody shrubs, ground covers, perennial and annual flowering plants, trees, and bedding plants) are an integral part of the landscape at most national cemeteries. Simply replacing/replenishing the mulching materials used in planting beds will not prevent unwanted vegetation, such as weeds emerging from the soil or from within the mulch itself, or turfgrass spreading into the bed by underground growth. Some manual labor will always be required to properly maintain planting beds, but there are several effective chemical tools that can reduce that need.

a. Preventative Control of Annual Weed Invasion: Several products that control annual or perennial seeds as they germinate are available that not only control annual grassy weeds such as crabgrass and foxtail, but also many annual broadleaf weeds.

(1) Pre-emergent herbicides should be applied to newly established planting beds, and to existing beds that have been cleaned of unwanted vegetation and re-mulched. The herbicide can be applied to the soil prior to the addition of mulch, to a mulched bed where no addition of mulch is planned, or on top of existing mulch prior to adding fresh mulch.

(2) Application of pre-emergent herbicides must occur 1 to 2 weeks prior to expected weed germination. Precise timing across the north to south latitudes will vary. Personal experience or recommendations from State cooperative extension authorities can provide the best application timing information for any location. **NOTE:** *Soil temperature, not air temperature, is the primary factor that influences the timing of weed seed germination.*

b. Herbicide Selection: The products most effective for use in planting beds contain one of several dinitroaniline herbicides (oryzalin (trade name Surflan), trifluralin (trade name Treflan) or pendimethalin (trade name Pendulum)), combined with a newer class of material known as isoxaben (trade name Gallery). Several pre-formulated products are available that combine these materials. They are sold under the family trade name Snapshot. Both a sprayable and a granular formulation are available. The sprayable version combines oryzalin and isoxaben as Snapshot DF, and the granular version combines trifluralin and isoxaben as Snapshot TG. The individual components of the sprayable combination can be purchased separately and mixed in a tank.

NOTE: *It is important to note that the dinitroaniline herbicides discussed above all are very strong dyes. The active ingredient in these herbicides will cause a yellow to bright orange stain on any surface. If mixed with water and sprayed, the solution will stain any surface that it contacts. **Care must be taken to avoid contacting any surface other than the actual target area.** On the positive side, this allows applicators to see exactly where they have already sprayed.*

c. Application Timing: To prevent unwanted weed encroachment during the growing season, all planting beds should be treated with Snapshot TG twice each growing season, once in the late winter/early spring, and once again in late August.

d. Elimination of Existing Unwanted Vegetation: Glyphosate (trade name Round Up) is a total vegetation control herbicide that has become the standard for removing unwanted vegetation. Although nonselective (it kills any green plant tissue that it contacts), it degrades immediately upon contact with soil surfaces and has no residual carryover effect that could damage subsequent planting(s) in a treated site.

(1) When glyphosate is used in planting beds the tank mix should include one of the pre-emergence herbicides discussed in subparagraph b. above.

(2) When glyphosate is used alone, it will only control growing weed species. Seeds lying dormant in the soil that may germinate later will not be controlled. Oryzalin and pendimethalin are most frequently used for mixing purposes. Both are approved for use on ornamental plants and have broad-spectrum weed effectiveness.