Yosemite National Park
Integrated Pest Management Plan

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July 2013

INTEGRATED PEST MANAGEMENT PLAN

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Contents

I. INTRODUCTION

This Integrated Pest Management (IPM) Plan for Yosemite National Park (YOSE) promotes the goals of the Servicewide IPM Program to reduce or eliminate health risks to people, prevent damage to structural resources and the environment from pests and pest related management strategies. The plan is intended to sustain the health and safety of park staff, visitors and residents, and to protect the cultural and natural resources of the park. This IPM Plan consolidates the consistent resource information and guidelines currently in use for pest management into one document.

The Superintendent has responsibility for pest management within the park and according to this plan designates the park Chief, Resources Management and Science or their designee, to serve as the park IPM Coordinator. This position will direct and implement the park IPM program as outlined by NPS-77, Natural Resources Management Guidelines (September 1991), by NPS 77-7 NPS IPM Manual and subsequent updates regarding IPM procedures, and NPS Management Policies 2006.

All pesticides used at YOSE will be in accordance with Servicewide policy found in NPS-77, Natural Resources Management Guidelines and subsequent updates issued through the Annual Pesticide Call from the Associate Director, Natural Resources Stewardship and Science, and Management Policies 2006. Pesticides proposed and approved for use in the park (except those used for personal use and purchased by park residents as per Management Policies 4.4.5.3) will be applied by or under the direct supervision of a certified pesticide applicator. Pesticides used by residents, contractors, concessioners, special-use permittees, agricultural lessees, or any non-NPS personnel in the park will conform to NPS policies and guidelines and must receive approval prior to purchase and use. It is a goal of YOSE, in compliance with NPS policy, that the lowest risk pest management strategy be developed and implemented for the specific site. This strategy may incorporate the use of educational materials, mechanical, physical, cultural, human behavior change, and reviewed and approved pesticides. Strategies may vary for different sites.

This Integrated Pest Management plan is an overarching document for YOSE that summarizes the guidance already in place on IPM strategies for the park. It is an umbrella document that does not supersede other completed planning efforts such as Yosemite's Invasive Plant Management plan and should be used in concert with such plans.

This IPM Plan is not a static document. Revisions to this plan could take place as science develops pertaining to pest identification, prevention and treatment or as situations change within the park. Standard Operating Procedures with associated action plans will be developed by park IPM staff as addendums to this plan focused on vector borne disease prevention, occupant education, and management. This IPM Plan will be posted to the park sharepoint and available to all employees and contractors.

Background

Yosemite National Park was established and is managed in accordance with a series of laws, regulations, and executive orders (see Vol. II, Appendix A). On June 30, 1864, Yosemite Valley and the Mariposa Big Tree Grove were granted to California by the federal government to "be held for public use, resort, and recreation" to be "inalienable for all time." On October 1, 1890, Congress passed an act establishing Yosemite National Park as a "forest reservation" to preserve and protect "from injury all timber, mineral deposits, natural curiosities, or wonders" within the park area and to retain them in their "natural condition". The act excluded Yosemite Valley and the Mariposa Big Tree Grove, leaving them under the jurisdiction of California, as provided for in the 1864 act. A joint resolution of Congress on June 11, 1906 accepted the transfer of Yosemite Valley and the Mariposa Big Tree Grove from the State of California to the federal government as part of Yosemite National Park.

Two primary purposes for Yosemite National Park were established in the 1864 act and subsequent legislation:

- To preserve the resources that contribute to Yosemite's splendor and uniqueness, including its exquisite scenic beauty, outstanding wilderness values, and a nearly full diversity of Sierra Nevada environments.

- To make the varied resources of Yosemite available to people for their enjoyment, education, and recreation, now and in the future.

In 1916, the Organic Act established the National Park Service by act of Congress to: Promote and regulate the use of the Federal areas known as national parks, monuments and reservations by such means and measures as conform to the fundamental purpose of the said parks, monuments and reservations, which purpose is to conserve the scenery and the natural and historic objects and the wildlife therein and to provide for the enjoyment of the same in such manner and by such means as will leave them unimpaired for the enjoyment of future generations. The National Park System General Authorities Act (1970) states: The authorization of activities shall be construed and the protection, management, and administration of national park areas shall be conducted in light of high public value and integrity of the National Park System and shall not be exercised in derogation of the values and purposes for which these various areas have been established, except as may have been or shall be directly and specifically provided by Congress.

II. Legal Authorities and Requirements

National Park Service (NPS) policy has established IPM as the preferred method for managing pests in parks and monuments. The YOSE IPM program is based on and directed by various policies, laws, regulations, executive orders, and presidential memorandum.

A. Federal Regulations

Executive Order 13514 Federal Leadership in Environmental, Energy, and Economic Performance October 2009 Section 2 (e) promote pollution prevention and eliminate waste by: (vii) implementing integrated pest management and other appropriate landscape management practices. http://edocket.access.gpo.gov/2009/pdf/E9-24518.pdf

Title 7 USC 136r-1 Federal Fungicide Insecticide and Rodenticide Act

SEC. 303. Integrated Pest Management states: "The Secretary of Agriculture, in cooperation with the Administrator, shall implement research, demonstration, and education programs to support adoption of Integrated Pest Management. Integrated Pest Management is a sustainable approach to managing pests by combining biological, cultural, physical, and chemical tools in a way that minimizes economic, health, and environmental risks. The Secretary of Agriculture and the Administrator shall make information on Integrated Pest Management widely available to pesticide users, including Federal agencies. *Federal agencies shall use Integrated Pest Management techniques in carrying out pest management activities and shall promote Integrated Pest Management through procurement and regulatory policies and other activities*". http://trac.syr.edu/laws/07/07USC00136r-1.html

The Food Quality Protection Act

On October 10, 2006 the Food Quality Protection Act mandated new procedural regulations for the registration review of pesticides. Under these rules, EPA will review each pesticide's registration every 15 years to assure it still meets the FIFRA standards for registration, and that as the ability to assess risk evolves and as policies and practices change, all registered pesticides continue to meet the statutory standard of no unreasonable adverse effects…Changes in science, public policy, and pesticide use practices will occur over time. Through the new registration review program, the Agency will periodically reevaluate pesticides to make sure that as change occurs, products in the marketplace can continue to be used safely … The public will always be assured that pesticide registrations are updated to meet current scientific and regulatory standards.

Food Quality Protection Act of 1996, 7 U.S.C.136 (amends both the Federal

Insecticide, Fungicide, and Rodenticide Act and the Federal Food Drug, and Cosmetic Act)

http://www.epa.gov/endo/pubs/fqpa.pdf]

The Food, Conservation, and Energy Act of 2008

Section 1201(a) of the Food Security Act of 1985 (16 U.S.C. 3801(a)) is amended by inserting after paragraph (15), as redesignated by subsection (a) (1), the following new paragraphs:

‘‘(16) INTEGRATED PEST MANAGEMENT.—The term ‘integrated pest management’ means a sustainable approach to managing pests by combining biological, cultural, physical, and chemical tools in a way that minimizes economic, health, and environmental risks.”

http://frwebgate.access.gpo.gov/cgi-bin/getdoc.cgi?dbname=110_cong_public_laws&docid=f:publ246.110

National Archives Records Administration

The Federal Records Act is the basic law regarding federal government recordkeeping responsibilities and activities (44 USC 2901-2909; 3101- 3107; 3301-3324). Records are defined in 44 USC 3301; 44 U.S.C. 2107 directs transfer of records appropriate for permanent preservation; 44 U.S.C. 2905 sets standards for the selective retention of records. The National Archives and Records Administration (NARA) has government-wide responsibility for records management, and retains the ultimate authority over disposal of records. NARA regulations are contained in 36 CFR Chapter XII, Subchapter B. Part 380 of the Departmental Manual contains DOI guidance on records management. 36 CFR 1228 (Subpart L) describes the transfer of records to the National Archives. www.archives.gov/about/laws/nara.html.

Standard Concession Contract Language; 44894 Federal Register/Vol.65, No. 139Wednesday, July 19, 2000 / Notices

Concession managers are directed to “use an integrated pest management program to manage weeds, harmful insects, rats, mice and other pests on Concession Facilities and that weed and pest management activities shall be in accordance with Applicable Laws and guidelines established by the Director”. See: www.concessions.nps.gov/docs/SimplifiedContract.pdf.

Public Contracts and Property Management, Facility Management, 2001 Code of Federal Regulations (C.F.R.) Title 41, Volume 2, 102.74.35, directs executive agencies to provide IPM services.

Standard Concession Contract Language Federal Register, July 19, 2000, directs concession managers to use an integrated pest management program to manage weeds, harmful insects, rats, mice and other pests on Concession Facilities and that weed and pest management activities shall be in accordance with Applicable Laws and guidelines established by the Director.”

Departmental Authorities:

Department of Interior Manual, Sec.517 Integrated Pest Management Policy: Including the Use of Pesticides and Biological Control Agents

1. *Purpose* - The purpose of this document is to incorporate Integrated Pest Management (IPM) in all Department pest management activities. As defined in **7USC136r-1,** “*Integrated Pest Management is a sustainable approach to managing pests by combining biological, cultural, physical, and chemical tools in a way that minimizes economic, health, and environmental risks*.”
2. *Scope* - This chapter applies to all Department and Bureau activities involving planning, procurement, prevention, design, detection, control, and management of native and nonnative pest species on DOI lands and properties.

http://elips.doi.gov/ELIPS/Browse.aspx?startid=1742

Department of Interior Manual, Sec.411, Chapter 15 DM, Museum Property Handbook (411 DM, Vol.1) Spaces and objects should be monitored for pest infestations, and pest control actions should be in accordance with the Departmental pesticide policy outlined in 517 DM. http://www.doi.gov/museum/policy/pdf/mphi-15.pdf.

NPS Authorities:

National Park Service Management Policies 2006, Section 4.4.5 Integrated Pest Management Program

The Service conducts an integrated pest management (IPM) program to reduce risks to the public, park resources, and the environment from pests and pest- related management strategies. IPM is a decision-making process that coordinates knowledge of pest biology, the environment, and available technology to prevent unacceptable levels of pest damage, by cost- effective means, while posing the least possible risk to people, resources, and the environment. Pest or pesticide use is also noted in Management Policies Section 4.4.4.1 Introduction or Maintenance of Exotic Species 4.4.4.1 4.4.1.2 Genetic Resources Management Principle; Partnerships, Sec 5.3.1.5 Protection and Preservation of Cultural Resources, 9.1.6.2 Response to Contaminants: http://www.nps.gov/policy/MP2006.pdf.

National Park Service Director's Order 77, Natural Resource Management

This Natural Resource Management Reference Manual #77 offers comprehensive guidance to National Park Service employees responsible for managing, conserving, and protecting the natural resources found in National Park System units: http://www.nature.nps.gov/rm77/.

National Park Service Director's Order 77- 7, Integrated Pest Management Manual

The Service offers practical guidance for specific pest species through an on-line manual found at: http://www.nature.nps.gov/biology/ipm/manual/ipmmanual.cfm.

National Park Service Director's Order 83, Public Health

The purpose of this Director's Order is to outline what the NPS will do to ensure compliance with prescribed public health policies, practices and procedures. This order establishes NPS policy with respect to all public health activities within areas of NPS jurisdiction, regardless of whether those activities are carried out by NPS or other Federal employees, or by other organizations, including the U.S. Public Health Service (PHS). The core PHP includes prevention, control and investigation of food-, water-, and vector-borne diseases in the national parks and can be found at: http://www.nps.gov/policy/DOrders/DOrder83.html

National Park Service Directors Order 50-B, Occupational Safety and Health

The purpose of Director's Order #50B: Occupational Safety and Health, is to provide NPS managers, supervisors and employees with direction for the implementation of a comprehensive risk management program throughout the NPS. Specific program objectives are to establish and implement a continuously improving and measurable risk management process that: (1) provides for the occupational safety and

health of NPS employees; (2) establishes effective site specific occupational safety and health programs at all NPS units; (3) requires other employers operating in NPS units to provide for the occupational safety and health of their employees; and 4) identifies strategies to minimize the loss of NPS human, physical, and fiscal resources due to preventable accidents, and (5) coordinates risk management and workers' compensation program management to achieve these objectives. The Director's Order can be found at: http://www.nps.gov/policy/DOrders/50B.htm

Other Federal IPM Related Authorities:

Noxious Weed Control and Eradication Act of 2004, 7 U.S.C. 7781-7786, Subtitle E

http://www.aphis.usda.gov/plant_health/plant_pest_info/weeds/downloads/7USC7781-S144.pdf

Executive Order 13148 Section 601(a), April 21, 2000, Greening the Government through Leadership in Environmental Management

www.epa.gov/epp/pubs/eo13148.pdf

Plant Protection Act of 2000, 7 U.S.C. 7701 et seq. (supersedes the Federal Noxious Weed Act of 1974, except Sections 1 and 15)

http://www.aphis.usda.gov/brs/pdf/PlantProtAct2000.pdf

Executive Order 13112 of February 3, 1999, on Invasive Species

http://frwebgate.access.gpo.gov/cgi-bin/getdoc.cgi?dbname=1999_register&docid=99-3184-filed.pdf

National Invasive Species Act of 1996, 16 U.S.C. 4701

http://el.erdc.usace.army.mil/emrrp/emris/emrishelp5/national_invasive_species_act_of_1996_legal_matters.htm

Nonindigenous Aquatic Nuisance Prevention and Control Act of 1990, 16U.S.C. 4701

http://www.oceancommission.gov/documents/gov_oceans/Aquatic.PDF

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

http://www.epa.gov/lawsregs/laws/esa.html

Occupational Health and Safety Act of 1970, 29 U.S.C. 651-67

http://www.osha.gov/pls/oshaweb/owasrch.search_form?p_doc_type=OSHACT

The National Environmental Policy Act of 1969, 42 U.S.C. 4321-4370f

http://www.cr.nps.gov/local-law/FHPL_NtlEnvirnPolcy.pdf

The National Historic Preservation Act of 1966, 16 U.S.C. 470 et seq.

http://www.achp.gov/docs/nhpa%202008-final.pdf

Federal Water Pollution Control Act of 1948, 33 U.S.C. 1251 – 1376, Chapter 758, P.L. 845, June 30, 1948, 62 Stat. 1155 (also known as Clean Water Act)

http://www.fws.gov/laws/lawsdigest/FWATRPO.HTML

Animal Damage Control Act of 1931, 7 U.S.C. 426-426c, 46 Stat. 1468

http://www.animallaw.info/statutes/stusfd7usc426.htm

Migratory Bird Treaty Act of 1918, 16 U.S.C. 701 et seq

http://epw.senate.gov/mbta.pdf

One Health Initiative

The One Health concept is an accepted worldwide strategy for expanding interdisciplinary collaborations and communications in all aspects of health care for humans, animals and the environment. One Health is a collaborative effort of multiple health science professions, together with their related disciplines –working locally, nationally, and globally –to attain optimal health for people, domestic animals, wildlife, and our environment.
http://www.onehealthinitiative.com/about.php

B. NPS Guidelines and Policy

According to NPS Management Policies, Section 4.4.5.1 (2006),

> *Pests are living organisms that interfere with the purposes or management objectives of a specific site within a park or that jeopardize human health or safety. Decisions concerning whether or not to manage a pest or pest population will be influenced by whether the pest is an exotic or a native species. Exotic pests will be managed according to both the policies in this section (4.4.5) and the exotic species policies in section 4.4.4. Native pests will be allowed to function unimpeded, except as noted below. Many fungi, insects, rodents, disease organisms, and other organisms that may be perceived as pests are, in fact, native organisms existing under natural conditions and are natural elements of the ecosystem. Also, native pests that were evident in pesticide-free times are traditional elements in park cultural settings.*
>
> *The Service may control native pests to conserve threatened, rare, or endangered species, or unique specimens or communities; preserve, maintain, or restore the historical integrity of cultural resources; conserve and protect plants, animals, and facilities in developed areas; prevent outbreaks of a pest from invading uninfested areas outside the park; manage a human health hazard when advised to do so by the U. S. Public Health Service (which includes the Centers for Disease Control and the NPS public health program); or to otherwise protect against a significant threat to human safety.*

According to NPS Management Policies, Section 4.4.5.2 (2006),

> *The Service conducts an integrated pest management (IPM) program to reduce risks to the public, park resources, and the environment from pests and pest-related management*

strategies. Integrated pest management is a decision-making process that coordinates knowledge of pest biology, the environment, and available technology to prevent unacceptable levels of pest damage by cost-effective means while posing the least possible risk to people, resources, and the environment.

The Service and each park unit will use an IPM approach to address pest issues. Proposed pest management activities must be conducted according to the IPM process prescribed in Director's Order #77-7: Integrated Pest Management. Pest issues will be reviewed on a case-by-case basis.

Controversial issues, or those that have potential to negatively impact the environment, must be addressed through established planning procedures and be included in an approved park management or IPM plan. IPM procedures will be used to determine when to implement pest management actions and which combination of strategies will be most effective for each pest situation.

The NPS policy establishing integrated pest management as the preferred method for managing pest species in the NPS has evolved from previous policies, executive orders, and a presidential memorandum (August 2, 1979). In accordance with NPS Management Policies:

> Integrated pest management procedures will be used to determine when to control pests and whether to use mechanical, physical, chemical, cultural, or biological means. The choice to use a chemical pesticide will be based on a review by regional and Washington Office coordinators of all other available options [e.g., mechanical, physical, biological, cultural, and regulatory] and a determination that these options are either not acceptable or not feasible. Chemical pesticides that are not specifically exempt from reporting (regardless of who the applicator is) will be used only with prior approval by the Director on an annual basis. (4:13, 14)

Additional guidelines relating to the park's IPM program are found in other chapters of NPS-77:

Chapter 2: Vegetation Management; Native Animal Management; Freshwater Resources Management; Endangered, Threatened, and Rare Species Management; Exotic Species Management; Hazardous Waste Management; and Public Health and Safety.
Chapter 3: Agricultural Use, Right-of-Way and Easements, and Backcountry Recreation Management.
Chapter 4: Environmental Compliance.
Chapter 5: Special Use Permits and Collections.

IPM and Pesticide Use

Proposed and actual use of pesticides is tracked in the NPS' intranet-based Pesticide Use Proposal System (PUPS) Database. Submission of pesticide use proposals, pesticide use logs, biological control agents, and genetically modified organisms (GMOs), are submitted by the Park IPM Coordinator to the Regional IPM Coordinator on an annual basis for review (approved or denied). The PUPS Database maintains a legal record of these actions, as required by the Federal Insecticide, Fungicide, and Rodenticide Act, Federal Records Act, and state regulations. Data from NPS PUPS are provided to the National Archives Records Administration on a tri-annual basis as required by 44 U.S.C. and 36 CFR. PUPS can be found at: http://nrintra.nps.gov/ipm/. This data also provides a Servicewide legal record of pesticide use for the NPS.

NPS policy specifies that pest management actions affecting NPS lands, waters, facilities, and properties are to be conducted based on the use of sound Integrated Pest Management (IPM) approaches. Mechanical, cultural, educational, chemical pesticides, biological control agents, and other methods, are some of the tools reviewed when preparing an IPM strategy. NPS policy requires that pesticides, biological control agents and GMOs, must be reviewed and approved prior to use.

The NPS does not have a pre-approved list of these tools and each proposal must be re-evaluated each calendar year and submitted annually through PUPS by the Park IPM Coordinator.

Procedures for Submitting Pesticide Use Proposals (PUPs)
Annual Pesticide Use Proposals, proposals for use of GMOs, or Biological Control Agents may be submitted by the Park IPM Coordinators through PUPS to the Regional IPM Coordinators for review at any time during the calendar year. Emergency requests can be submitted by phone to the Regional or Servicewide IPM Coordinator. All approvals expire on December 31 of each year.

Pesticides are an important IPM tool**.** Proposals to use pesticides are reviewed on two levels: first by the Regional IPM Coordinator and a second level of review by the Servicewide IPM Program Office, where additional consultation is conducted. A second level of review is required for proposals involving one or more of the categories listed below:

- Restricted-use pesticides;
- Aquatic applications or situations in which the applied pesticide could reasonably be expected to get into aquatic areas;
- Pesticide use that might affect threatened or endangered species and/or their habitat;
- Applications to more than 400 or more contiguous acres;
- Aerial application;
- New active ingredients or biological control agents not previously entered into PUPS;
- Pest management issues that may be politically sensitive.

Pesticides must be stored with their labels and associated Material Safety Data Sheets (MSDS). They should be kept in a binder and stored in the same location as the pesticides. A second copy must be made for NPS Dispatch. When applying pesticides, a copy of the label and MSDSs must accompany the applicator as well.

In Yosemite, pesticide handling and use is also covered in the park's Invasive Plant Management

Plan Update (2010). Appendix A covers further details on pesticide safety.

Yosemite also follows Director's Order 83 on Public Health (Appendix B) which provides guidance on all public health concerns including vector borne and zoonotic disease risk reduction.

C. State Regulations Covering Pesticide Use

The State of California requires Federal employees who apply restricted use pesticides within the park to be certified as a pesticide applicator (or to be supervised by a certified pesticide applicator). Certification is not required if employees only apply general use pesticides.

State pesticide applicator certification is valid for 2 years and to retain certification, the state requires applicators to obtain up to 20 hours (depending on category) of approved pest management continuing education during each two year period. For full information and a copy of the state pesticide regulations, contact the California Department of Pesticide Regulation, 830 K Street, Sacramento, CA 95814. Their telephone number is: (916) 445-3920 or (916)445-4300; for Pesticide Applicator Certification information call: (916) 445-4038. Or visit their website @www.cdpr.ca.gov

III. OVERVIEW OF THE NPS IPM PROGRAM

Integrated Pest Management coordinates all available biological, environmental and modern pest management technology in an attempt to prevent unacceptable levels of pest damage through the most economical means available and with the least possible pesticide hazards to people and the environment. This approach relies on cost-effective and site-specific pest management strategy, decision-making processes, and risk reduction systems to address the cause and symptoms of the problem for immediate and long- term resolution. Unlike any given single method of pest control, the IPM approach is more effective than traditional methods because it combines tactics like sanitation, monitoring, exclusion, habitat modification, and when necessary judicious use of specific pesticides. Obvious economic benefits can be expected from a fully operational and proactive IPM program. Some examples are:

- Reduced risk to people, resources, and the environment from pests and related management strategies.
- Management and removal of conditions conducive to pests.
- Improved preservation of cultural and natural resources and property.
- Early detection of pest issues allows for immediate action to rectify the issue.
- Scheduled periodic inspection allows efficient management and reduced costs.
- Reduced time needed to manage pest problems.
- Reduced risk of disease transmission to employees or visitors.
- Reduce unnecessary pesticide application.
- Reduced risk of adverse effects to staff or visitors from pesticides or pesticide carrier ingredients.
- Reduced potential for resource damage resulting from deterioration or structural fires caused by pest activity or related management strategies.
- Improved overall workplace health, reduced disease risk, and aesthetic appearances of museums, curatorial storage areas, offices, and residences.
- Reduced potential for tort and employee claims.
- Improved communication and working relationships with staff (and Concessions, Permittees, visitors and Neighbors).

A. Definitions

Pest – Pests are living organisms that interfere with the purposes or management objectives of a specific site within a park or that jeopardize human health and safety. The process of designing pest management measures may be influenced significantly depending upon the management zone where the pest is found and whether the pest is non-native or native.

Non-native/Exotic species - A species occurring in a given place as a result of direct or indirect, deliberate or accidental actions by humans.

Native species – A species that occurs and evolves naturally at a given location without human intervention or manipulation.

Integrated Pest Management (IPM) - A program to reduce risks to the public, park resources, and the environment from pests and pest-related management strategies. IPM is a decision-making process that coordinates knowledge of pest biology, the environment, and available technology to prevent unacceptable levels of pest damage by cost-effective means while posing the least possible risk to people, resources, and the environment.

Pesticide - Any substance or mixture of substances that is used in any manner to destroy, repel, or control the growth of any viral, microbial, plant, or animal pest or otherwise noxious or unwanted species. This reflects the definition of pesticide under the Federal Insecticide, Fungicide and Rodenticide Act. All pesticides proposed for use on NPS lands must be submitted through the NPS Pesticide Use Proposal System (PUPS, accessible at http://nrintra.nps.gov/ipm/).

Minimum Risk Pesticides – FIFRA 25B- The Environmental Protection Agency has determined these products do not require EPA registration as they are considered minimum risk. These pesticides do have to be proposed for use and amount applied tracked under PUPS.

Restricted Use Pesticide - EPA may classify a pesticide as restricted use because of its potential impact on health or the environment, or because of its formulation. Restricted use pesticides can be purchased and applied only by a certified applicator, or by a person under the direct supervision of a certified applicator (see below).

Certified applicator - Any individual who is certified under the Federal Insecticide, Fungicide and Rodenticide Act to apply restricted use pesticides. A certified applicator may be a private applicator or a commercial applicator.

Private applicator - An individual who is certified to use or supervise the use of restricted use pesticides for purposes of producing any agricultural commodity on property owned or rented by the private applicator (see also commercial applicator).

Commercial applicator -An individual who is certified to use or supervise the use of any pesticide which is classified for restricted use for any purpose or on any property other than

as provided under private applicator (see also private applicator).

Outbreak - A disease outbreak is the occurrence of cases of disease in excess of what would normally be expected in a defined community, geographical area or season. An outbreak may occur in a restricted geographical area, or may extend over several countries. It may last for a few days or weeks, or for several years (World Health Organization definition).

B. Park IPM Objectives

This IPM Plan includes the following objectives:

To provide for the health and safety of park employees, park visitors, concessioners, permittees and other park users and the protection of natural and cultural resources and park infrastructure from the harmful effects of pests.

Define the roles and responsibilities of persons involved in the pest management program and provide sufficient information to enhance program success.

Identify pest problems, action thresholds, measures to prevent the spread of pest problems, and responsive management actions to address pest problems.

Provide rational, safe, effective IPM alternative methods for pest management within NPS procedural policy guidelines which describe management actions necessary to modify habitats to reduce or limit the buildup of excessive high pest populations.

Establish the necessity of periodic site inspections and monitoring to document when responsive management actions are necessary.

Emphasize the needs for evaluating the post-treatment results of habitat modifications or pesticide treatments through periodic pest population monitoring and the need of written documentation for any management actions taken, data collected, and results obtained.

Minimize the reliance on pesticides and establish that pesticides will only be used if absolutely necessary and as approved by the PWR IPM Coordinator. If it is determined that a pesticide is a necessary and justified component of the IPM strategy, the most effective and lowest risk product will be incorporated into the IPM strategy and used when the specific pests is at the most vulnerable stage, and used at times posing the least possible hazards to persons, resources, or environment.

This Plan will provide guidelines for decision-making (section III. E.) to address IPM issues, both preventively and responsively, that achieves these objectives. This process will require close collaboration among park divisions and IPM Coordinators at the regional and national levels. Because technology and chemical and mechanical treatments are dynamic as is NPS policy in their uses, consultation with region and WASO IPM is essential. The WASO website for IPM is http://www1.nrintra.nps.gov/brmd/ipm/policy.cfm, which should be consulted for the present state-of-the-art, and accepted approaches to IPM issues. The site provides IPM policy documents, resources, and IPM plans of some parks. Additional technical

information from subject matter experts should also be reviewed and incorporated in to preparing the best management strategy. These guidelines, if followed, will greatly assist in preventing and managing pests in the park.

C. Roles and Responsibilities

Implementation of IPM practices has been a Service-wide goal since 1980. All operations in the park must support employee and visitor health, safety, and protection of park resources. Pest management activities which deal with all of these concerns are combined in a program crossing several disciplines and all park divisional lines. Many persons in the park, ranging from managers to residents, are involved in pest management activities at some time or another.

If the park pest management program is to be effective, it is important for the entire staff to participate as a problem solving team. Various roles and responsibilities for a park IPM program are described below.

All Site Occupants
All site occupants (employees, visitors, contractors, Commercial Services staff, etc) should be informed prior to visiting, residing, or working at YOSE of risks associated with rodents. This information should be maintained and updated on the park's webpage under "Planning Your Visit" and in Recreation.gov. All should be informed that rodent management must be conducted by park staff , that visitors are not permitted to trap, or otherwise manage rodents on their own in park units (36 CFR part 2 Sec.2.1-Preservation of Natural, Cultural, Archeological Resources); and should be directed to report signs of rodent activity to the site manager**.**

Superintendent: Responsibilities for the park IPM program are delegated to the park Superintendent and responsibilities for program implementation are delegated to both the Superintendent and to a designated park IPM Coordinator.

The Superintendent also:

- Has ultimate responsibility for the park IPM program, should make every possible attempt to provide staffing and funding to effectively carry out the program and to support the necessary training, pest monitoring, exclusion, and management needs.
- Outlines the park IPM Policy and IPM Program and informs employees, through written memoranda, about the needs, requirements, and importance for conducting the program in the park.
- Designates IPM inspection, monitoring, and pest management duties to at least one trained IPM Coordinator and may select Assistant IPM Coordinator(s) for outlying districts or sites. If trained persons are not available, training should be made available to person(s) holding IPM duties within six months of designation.
- Designates museum and curatorial storage duties to a trained Museum Curator and assign a second employee as a back-up who will be trained by the Museum Curator.

- Sets or modifies priorities and preferred pest control methods to meet existing needs or management objectives. Before initiating any pest control activity, the Superintendent must decide that pest management is necessary because: accepted injury or action thresholds are being exceeded and pests are causing or will cause unacceptable levels of resource damage; existing infestations provide potentials for human health hazards; or, without control, pest numbers can be expected to continually and unacceptably increase.
- Assigns the park IPM Coordinator and Museum Curator and other staff to review the park IPM Plan at least every 4 years for possible changes or additions.
- Establish a multi-disciplinary IPM committee made up of park representatives from each division with an IPM focus.
- Requests professional assistance from the NPS Public Health and Risk Management Programs, and the California Department of Public Health (Vector-Borne Disease Section) for:
    1. Inspecting, testing, and/or necropsy of animals or parasites for the possible presence of plague, rabies, hantavirus, or other vector-borne diseases.
    2. Collecting or identifying parasitic arthropods (fleas, ticks, mites, etc.) that may transmit diseases.
    3. Current information on the occurrences of pest-borne disease outbreaks near the park.
    4. Trapping and sampling of mice and other rodents for various vector-borne diseases including hantavirus.

Chief of Resources Management and Science (RMS): The Chief of RMS will, in collaboration with the Superintendent review IPM program actions, and consult with RMS branch subject matter experts, such as wildlife biologists, and historic architects, when necessary, and coordinate with Facilities Management and Commercial Services Program Managers as needed regarding employee education, and pest prevention and management efforts. Oversee with the IPM Coordinator, coordinate with the Park Facilities Manager in the preparation of RMS project statements and work orders that involve significant IPM plans, r operations, or structural modifications to address current or potential pest issues. Seek funding to support an ongoing and effective IPM program from appropriate funding sources.

Chief of Facilities Maintenance (FM): The Facilities Management Division plays an extremely vital role in park pest management, primarily through its numerous staff members that work throughout the park's developed areas and, therefore, are in a position to detect, report, and address IPM issues through procedures described in this plan.

FM staff will:

- Ensure all staff (VIPs, seasonals, and permanent employees) receive initial and annual training regarding diseases associated with potential pest species
- Be alert to conditions that lead to pest damage and signs of pest and pest damage when found during routine maintenance. Report such information to the IPM Coordinator (i.e., rodent feces on floors, counters, or shelves in buildings, termite damage, rodent burrows under structures, evidence of bird or bat roosts, etc.).
- Assure good sanitation in the office and shop buildings by thoroughly vacuuming the offices in the building at least weekly; keeping windows and doors closed; no food left out: and quickly reporting obvious pest damage/infestations, plumbing leaks, and other conditions supporting or encouraging pests.

Areas with rodent infestations should not be vacuumed; wet cleaning techniques should be used. When needed, shampoo rugs and upholstered furniture with a commercial disinfectant or with a commercial-grade steam cleaner or shampoo. Link: http://www.cdc.gov/rodents/cleaning/index.html

- Assure clean-up of heavy rodent infestations.
- Collect trash from exterior garbage receptacles, transport it to a secure pest proof waste management facility and report any pest activity associated with trash collection areas to the IPM specialist.
- Punctually schedule repairs and track in FMMS, all reported structural, utility, or vegetative (e.g., tree) problems that support or encourage pest infestations.
- Promptly remove all construction or other non-functional debris (rocks, lumber, etc.) lying in or around park structures or place it on elevated racks to discourage establishment of pests, and otherwise assure good area sanitation procedures.
- Assist in facility inspections regarding IPM issues, e.g., inspecting park housing for pest issues prior to it being rented or occupied for the season.
- Be responsible for implementing NPS Rodent Exclusion Manual techniques (Appendix D) for all NPS structures and facilities not assigned to concessioners.

Park IPM Coordinator: The IPM Coordinator is responsible for carrying out the requirements of the IPM plan in accordance with NPS policies and regulations regarding pest management. . Information describing the design, application, and evaluation of IPM programs (and regulations and policies governing them) are found in Chapter 2, Integrated Pest Management, RM 77, Natural Resources Management Guidelines (1991)(and associated updates to current day), Management Policies 2006with which the IPM Coordinator must ensure compliance. Details in the guideline include:

- NPS approval and review process for all pesticides proposed and applied in the park
- Overview of IPM
- Components of an IPM Program
- IPM Program Operations
- Roles and responsibilities

Additional guidelines relating to the park pest management program are found in other chapters of DO-77.

Other key responsibilities of the IPM Coordinator include:

- Overall program management.
- Pest inventory and monitoring, and awareness of risk of infestations of species new to the park.
- Management or oversight of IPM projects.
- Training and certification of personnel for application of pesticides.
- Documentation and record-keeping of IPM activity.
- Safety in chemical and mechanical removal of pests.
- Knowledge of laws and regulations applicable to IPM operations.
- Coordinating and submitting Pesticide Use Proposals (PUPS) for the use of chemicals and biological agents within the park.
- Coordinating IPM activities with other Divisions in the park.

Parkwide IPM Team: In Yosemite, a team representing multiple disciplines will meet monthly in order to maintain consistent communication, develop of IPM procedures and develop visitor education materials for park pests. The team will consist of NPS staff from all affected divisions (Resources Management and Science, Business and Revenue Management, Interpretation, Facilities Maintenance, Visitor Protection) and park partners (concessions or other partners where pests may be of issue).

Park Safety Officer: The Park Safety Officer serves an influential role in park pest management. During all safety inspections, the Safety Officer will watch for and report to the IPM Coordinator any evidence of pests, destructive or hazardous conditions caused by pests, and inappropriate pesticide storage. Health and safety hazards concerning pest infestations will be noted in Safety Inspection Reports.

The Safety Officer will:

- Coordinate with the IPM Coordinator and staffs to assure employees are provided with the latest information concerning health and safety matters related to pests.
- During safety inspections or monitoring of park resources, encourage employees to follow safety and health requirements related to pesticide use, and document and ensure correction of improper pesticide storage. Report such instances to the IPM Coordinator.
- Monitor applications of restricted-use or state-limited-use pesticide compounds for use of safe methods.

Park Public Health consultant and/or Officer: Will be responsible for incorporating Director's Order 83 (Appendix B), Public Health, Sections E. Illness Surveillance and Initial Response, and G. Vector –Borne and Zoonotic Disease, into the park's IPM program. The Public Health consultant will be the vector-borne disease coordinator for the park. The Public Health consultant will coordinate with local and state departments of health, and IPM program coordinator. Ensure educational materials are available for park staff and visitors, and conduct or coordinate preventive education and training sessions. Establish and maintain a passive surveillance program within the park. Coordinate active surveillance activities within the park. The Yosemite Park Public Health Consultant and/or Officer manages and coordinates a Cooperative Agreement with the California Department Public Health Vector Borne Disease Section to provide Vector Borne Disease Services to Yosemite.

Business and Revenue Division: The Concessions Management Branch will ensure concessioner compliance within concession land assignments of IPM facility exclusion treatment, and public messaging and develop a Concession Agreement that explains the concessioner's IPM responsibilities. (the same should be developed for park residents) The Fee Management Branch will perform routine review of campground facilities to identify pest issues and report to Facilities in addition to providing visitor information regarding pests and symptoms. The branch will continue enforcing human food and wildlife policies and provide educational information to all visitors regarding their cooperation in securing food and reporting pests.

Project Management Division: The Division of Project Management, along with Facilities Management, will integrate pest resistant design elements found within the NPS Rodent Exclusion Manual to all new and renovated facility designs. In addition, all new construction should be reviewed with IPM criteria.

Chief of Interpretation: The Division of Interpretation will inspect for, monitor, and correct (if possible) any conditions of inadequate sanitation or the availability of pest harborage in the Visitor Center, office spaces displays, and other interpretive areas. Curatorial spaces and materials must be regularly inspected for presence of pests. Educational information on pests and related risks will be provided to new and current staff so they may be informed and respond to park visitors. Interpretation staff will assist in monitoring for pest presence. Interpretation will assure stored boxes, papers, equipment, and other materials are placed on shelving or pallets off the floor to allow for cleaning, inspection, and pest management measures. Employees in the Division will constantly remind visitors to not feed the animals and to place food scraps and garbage in animal-resistant receptacles. Interpretation will be the messaging arm for the IPM program and coordinated with the Park IPM Coordinator, Public Health, Commercial Services to ensure all are conveying the same updated message to staff and the visiting public.

Other Employees: All persons (Contracting Officer, Housing Officer, Supervisors, Foremen, and private contractors, cooperative associations, etc., as appropriate) who may be involved in purchase, storage, and use of pesticides in the park are responsible for assuring proper IPM procedures and NPS and Departmental pesticide approval policies are followed. Note that pesticides must be approved by the Regional or WASO IPM Coordinator prior to purchase or application. These requests will be submitted through the park IPM Coordinator for review through the Pesticide Use Proposal System. Pesticide use must also be tracked and amount used reported to the Park IPM Coordinator by December 31st of each year. In addition, pesticide application must also follow the State of California regulations.

Park Residents: Park residents (including non-NPS residents) will receive training on risks associated with pests and on recognizing and reporting pests to the park IPM Coordinator. Residents are responsible for assuring their quarters and areas surrounding their quarters are kept clean and do not attract or harbor pests. Residents are responsible for promptly reporting structural deficiencies and other maintenance needs supporting pests to the IPM Coordinator and Division of Facilities Maintenance. Residents are not allowed to use pesticides (insecticides, rodenticides, herbicides, etc.) which have not been previously approved through the park IPM Coordinator. Park residents in cooperation with facilities maintenance should ensure an inspection of quarters for IPM issues prior to moving in.

Park Concessioner and Partners: Because these entities occupy park-owned structures, many of which are historical, they must be especially vigilant for pests, and report incidents to the IPM Coordinator immediately. As with park residents, the concessioner and partners are expected to keep buildings and spaces under their control clean and mitigate pest attractants. Employees should receive annual training in recognition of pests and their sign, and reporting procedures. If pesticides must be used, approval must come through the park's IPM Coordinator, and employees must be certified to apply the pesticide, and follow all application safety instructions. The Concession Agreement should identify the IPM responsibilities, requirements, and procedures. Detailed records of rodent complaints by guests and employees, sightings of rodents and their associated activity should be logged in a database and regularly reviewed. Guest complaints can provide complementary data to ongoing assessments to gauge the effectiveness of current rodent control efforts.

All Employees (including concessioner and park partner staff): All employees should be trained in pest identification and associated hazards as they arrive to the park and on an annual basis. Employees should follow all prevention directives and guidance on clean-up of rodent infestations and opening of structures closed over the winter.

D. Training

The Park IPM Coordinator will complete at minimum, NPS training course Basic IPM Principles or an equivalent training. In addition, the IPM Coordinator may maintain certification as a pesticide applicator. Training in Basic IPM Principles is recommended for all employees, because the more widespread this knowledge in the park, the more effective the IPM program will be.

All employees applying pesticides or other chemical pest management tools will receive appropriate training to be and remain certified by the state(s) in which they work in one or more categories as a Pesticide Applicator, or be directly supervised by a Certified Pesticide Applicator. Employees performing visual inspections/monitoring will receive at least eight hours of documented IPM training, including methods of conducting structural inspections.

Personnel performing rodent control work will receive at least 16 documented hours of technical instruction from a licensed pest management professional, including monitoring and inspection techniques, disease prevention, techniques for rodent control, sanitation, safety, and familiarity with appropriate pesticides.

Employees required to manage stinging insects (honey bees, wasps, yellow jackets, hornets) will receive at least four hours of training from a licensed professional pest management professional, including safe equipment use, insect and nest removal methods, bystander management, and emergency first aid procedures. Employees who must destroy colonies or nests of stinging insects will wear protective clothing which consists of a tight bee suit, hat, bee veil, and gloves.

The IPM Coordinator will keep files on training and certification of park staff members that qualify them in application, procurement, and safety of pesticides. It is the responsibility of this staff to keep training and certification files up to date through submission of training and certification documents to the IPM Coordinator.

E. IPM Decision Making Process

The following eleven-step decision making process (as derived from NPS IPM policy) will be used to develop and implement Integrated Pest Management strategies for Yosemite pest species. This initial process will be used to develop species by species action plans which could include case by case developed decision flow charts associated with management thresholds when applicable.

1. Establish site management objectives and short and long term priorities - The array of IPM issues in Yosemite is unique to the park; establishing priorities will be a collaborative process among park divisions and management teams. This document lays the groundwork for such a process through achievement of objectives given above.

2. Build consensus with stakeholders/occupants, decision makers and technical experts - Because many structures and areas in Yosemite are occupied by the park concessionaire and other park partners, it is essential that they fully understand the function and scope of IPM in the park, and learn how to recognize and report potential and existing problems. Occupants of buildings, whether they are visitors, employees, or residents must also be aware of IPM and their roles in the program's success. This is especially true when pesticides are determined to be the minimum tool for achieving IPM objectives. In addition, park decision-makers (Superintendent, specific site manager, others) and technical advisors such as the IPM coordinator, technical subject matter experts) will convene prior to implementing any management strategy to ensure they are in coordination with objectives and understand each other's responsibilities and concerns.

3. Document decisions and maintain records - The IPM Coordinator will be responsible for maintaining files that document the decision-making process that results in the management approach to IPM issues on a case by case basis. The building of these files is also the building of a library of experience that can be referred to in addressing future IPM issues. These files serve as legal records and should include: pest detection, monitoring, management decisions, management actions (habitat modification, training, pesticide application etc).

4. Know the resource (site description and ecology) - With biological communities that range in elevation from 2,000 to over 13,000 feet in elevation, the range of IPM issues, existing and potential is vast. This range of possibilities demands flexibility in decision-making within the bounds of accepted NPS IPM practices, and collaboration among subject matter experts in Yosemite and the rest of the NPS. The interface between humans and their development is equally diverse and presents challenges requiring innovative solutions. In some cases, our approaches to IPM may be untested and experimental.

5. Know the pest - Identify the potential pest species, understand their biology and conditions conducive to supporting them (air, water, food, shelter, temperature and light). Subject matter experts, especially in Wildlife Management, can be valuable in providing information on the array of species that become IPM issues in the park.

6. Monitor pests, pathways, and human and environmental factors, including population levels and phenological data - Knowledge of the conditions conducive to different pest species is a valuable tool in preventive management. One program of intensive management already exists in Yosemite: Human-Bear conflicts which are managed through an Action Planning process. The recent outbreak of Hantavirus in Yosemite has elevated the priority to monitor vector deer mouse populations. This emphasizes the need for the IPM program to be nimble and flexible as conditions and issues change.

7. Establish responsive management action levels - This is the action level at which a pest management action will be implemented through an approved IPM strategy. These levels however can vary widely given the array of species, situations, and factors under which IPM issues arise. Likewise, the decision-making process must have plasticity to take into account all variables that lead to IPM issues, and will determine how best they are addressed, within the policy guidelines of NPS IPM.

8. Review available tools and best management practices - Develop a management strategy specific to the site and identified pest(s). Tools can include: 1) no action, 2) physical, 3) mechanical, 4) cultural, 5) biological, and 6) chemical management. Given the complexity of factors that make up an IPM issue, both preventive and responsive, these tools will be combined and used in proportions appropriate to a case by case approach. This will require close collaboration among divisions, management teams, and IPM information and personnel at park, regional, and national levels in development of strategies that reflect best management practices in IPM. Such crafting will provide safer, more effective resolution of IPM issues.

9. Define responsibilities and implement the lowest risk, most effective strategy, in accordance with applicable laws, regulations, and policies - In Yosemite, the IPM Coordinator, the Chief of Resources Management and Science, and the Superintendent all have distinct roles in implementing a safe and effective IPM program through collaboration in development of strategies to address new, existing, and potential IPM issues. Other divisions may also be involved, especially Business and Revenue Management and Facilities Management, when issues occur in concessioner or NPS land assignments, respectively, and would be involved in strategy development.

10. Evaluate results - Determine if objectives have been achieved, then modify strategies if necessary using adaptive management. Implementation of IPM strategies must be followed by close monitoring for effectiveness. If treatment objectives are not reached, another strategy must be developed using the toolbox of treatments available within NPS IPM policies and standards that balance safety and effectiveness. Use all available NPS IPM information and guidelines at regional and national levels. Repeat as necessary until objectives are reached.

11. Education and provide outreach - Education is a cost-effective strategy in the park's IPM program. Education efforts will be designed to include all audiences that may be concerned about pest management. Through an effective education program, park staff will come to recognize potential pests and existing problems to be proactively dealt with, so actions can be taken before problems worsen.

Park staffs informed about the objective of the program are more likely to support it. They are also more likely to fulfill their responsibility to educate visitors and others concerned with management of national park areas of IPM practices and the benefits of implementing these approaches to specific pest problems. The public needs to understand the influence of pests on resources, both cultural and natural, and how these influences cross administrative and/or ownership boundaries.

F. Inspection and Monitoring

The IPM process can only work effectively through regular inspections and development of monitoring strategies for priority pest species when necessary.

The first step in managing pest problems is to identify the problem. Inspection enables discovery of pests or habitats supporting them. Inspections will precede any park pest control actions to identify pests, pest locations, treatments needed, and programs to monitor success of actions.

Monitoring is the regular observation of specific factors related to the pest population and habitat and is fundamental to a successful IPM program. It is needed to choose the time and place of treatments that are the most effective and least disruptive to the natural controls operating to suppress the pest organisms, and that are the least hazardous to human health and the environment. Monitoring is also important in evaluating pest management strategies. The monitoring program of the park will address the following eight areas:

1. The purpose of the monitoring.
2. Monitoring form
3. Name of person conducting monitoring
4. Target or potentially affected non-target populations sampled. Frequency of monitoring.
5. Appropriate sampling locations and number of sites to monitor.
6. Monitoring procedure.
7. Accuracy and detail of records for future decision making.
8. How monitoring will be used to evaluate treatments for effects on target and non-target organisms.

Additional guidelines for inspection and monitoring are found in NPS-77, Chapter 2.

Completed inspection and monitoring data will be maintained in permanent files by the NPS and Concessioner IPM Coordinators. Any structural repairs needed will be noted and forwarded to the Maintenance Division for repair.

G. Action Thresholds

Action Thresholds are criteria used to justify the initiation of pest controls. The principal objective of any IPM program is to suppress or manage pest populations to keep their numbers below an Action Threshold since it may not be practical or feasible in many cases to try and eradicate pests.

Usually "working" Action Thresholds are first established and then refined with information gained through monitoring programs. Criteria used to establish Action Thresholds are based on estimates or observations of:

- pest population numbers
- documented damage to structures or natural resources
- costs for repair or replacement of damage
- data generated by monitoring programs
- knowledge of pest biology (especially reproductive potential)

The Superintendent will review and may set or modify threshold values or preferred control methods to meet needs or management objectives. When action thresholds are identified as necessary, they will be incorporated into the Standard Operating Procedures and associated action plans.

IV. TREATMENT STRATEGIES

A pest management strategy is an overall approach for preventing or suppressing pest populations based on pest biology, ecological understanding, and human interactions. In order to develop appropriate pest management strategies, it is important to take a holistic view of the pest problem, recognizing the interactions between the pest and its natural enemies such as pathogens, parasites, predators, other natural controls such as weather, and human actions that may be influencing the pest population.

Several considerations must be made when selecting pest management strategies. Consideration must be given to designated use of the site, disruption of natural controls, hazards to human health, effects on non-target organisms, overall damage to the environment, seasonality (site use and conditions-for example monitoring regime for indoor rodents will be different at specific times of year), how effective treatments will be in reducing the pest population below the action level, define actions that can be taken to reduce conditions conducive to pests to reduce the problem and alleviate repeated treatment of the symptom (pest present and associated damage), how feasible it will be to effectively implement treatments, and how cost effective the treatment is over the short and long term.

The IPM concept is based on identifying and managing the cause of the pest issue not only managing the symptoms; and the fact that combined strategies for pest management are more effective in the long run than a single type of treatment. Such an approach requires collaboration among divisions, management teams, and park partners. The many variables that accompany an IPM issue require a defined site management objective all (decision maker, occupants, technical advisor) agree to development of strategies case by case, with guidance at the park, regional and national levels of the NPS.

The depth of this collaboration is dependent on the extent and complexity of the IPM issue. For example, a skunk under a building could be solved at the park branch or program level, whereas, a zoonotic disease outbreak would require complex strategies developed through wide collaboration from within and outside the park. All levels would have the same objective: reduce risk of disease to people and protect the resource.

When tackling an IPM problem, all potential sources of information should be sought. Technical sources are dependent on the nature of the problem. One such source which is used often by the NPS for insect and rodent management is the University of California IPM Online website at http://www.ipm.ucdavis.edu/index.html.

A. Park Treatment Strategies by Species

The treatment strategies listed below provide general guidance on prevention and management of Yosemite's primary pest species. Detailed action plans by species will be developed and inserted as appendices to this plan. Action plans will follow the Eleven Step IPM process including action threshold and monitoring protocol development.

As appendices, these action plans can be used separately as standard operating procedures that employees can use a reference and guidance. As new science and technology becomes available, these action plans can then be updated without having to change the body of this guidance document.

Pests in Yosemite National Park can be placed into groups based on the risk they present. Some species could fall under more than one of the groups, but below we have listed those of highest management concern. For example, ground squirrels are the most likely source of plague infection, but they can also cause harm to structures, and have undesirable interactions with humans, and management of these animals may present risk to other non-target species (i.e. proposed use of rodenticide presents a real risk to scavengers, people, pets). This list is not meant to be all-inclusive of potential IPM issues. Some species (e.g, scorpions, spiders, non-venomous snakes, lizards) found indoors, may be objectionable to visitors, but can be easily solved by field personnel simply by removing and relocating the pest – a low-level IPM treatment.

1. Vectors of Zoonotic Diseases

These species include those known to spread disease to humans.

The deer mouse (*Peromyscus maniculatus*) is the vector for hantavirus with transmission occurring when humans breathe in airborne particles contaminated by deer mouse feces or urine from an infected mouse. The mechanism of human infection is not well understood; only 15 – 20% of deer mice typically carry the disease and hantavirus infection in humans is rare, especially in spatially clumped outbreaks over a short period of time as occurred in Yosemite. Most of the several hundred annual cases nationwide are isolated.

Preventive Management: Protocols for minimizing the risk of transmission of hantavirus is contained in Yosemite National Park Directive #9: Hantavirus Risk Reduction Program (Appendix D) which is written for park residents, employees and concessioners, but is applicable to all situations which pose a risk to humans.

The NPS IPM Program has produced guidance on rodent exclusion in park structures titled *NPS Mechanical Rodent Exclusion Manual* (Appendix E). It can be found on the Office of Public Health website, and on the NPS IPM website http://www1.nrintra.nps.gov/brmd/ipm/policy.cfm.

These documents emphasize documented regular inspection /monitoring, and maintenance of human-inhabited structures to identify and schedule repairs to exclude rodent entry. Deer mice can fit through a hole or crack as little as ¼ inch, the size of a pencil. Such gaps should be plugged with cement; 16-19 gauge ¼ inch hardware cloth, steel wool, or copper mesh (e.g. Stuf-fit). Doors should be fitted with sweeps or thresholds that close any gaps when the doors are shut. Proper food storage and sanitation of kitchens and eating areas can reduce indoor attractants to mice.

Better understanding of deer mouse population dynamics can also lend insight to management of this species. Understanding annual fluctuations in population levels may potentially assist in informing educational or responsive management actions. Further information related to rodent population monitoring can be found in Appendix F.

Responsive Management: Yosemite provides rodent management (hanta virus) training annually to educate staff and residents on risk associated with rodents in doors and near human dwellings. Staff and visitors must be able to recognize and report indoor and perimeter signs of rodent activity. This would include mouse droppings, urine, nests, gnawing, and dead or live mice. Such activity indicates that there is an entry point to be repaired, or the mouse was accidentally allowed to enter the structure, such as through a door left open. In either case, any mice that have gained entry to the building must be trapped using snap traps. Use of glue boards or live traps or electronic zapper devices are not recommended because of increased risk of disease transmission as live trapped rodents continue to excrete urine/feces increasing the potential health risk of rodent borne disease to persons handling the traps as well as people occupying the structure. Live trapped rodents are under stress and may increase viral shedding potentially elevating the risk of disease to occupants. Rodents left in the live trap or on the glue-board for long periods of time may die of cannibalism, suffocation or starvation.

Rodent carcasses serve as food source for other pest species such as dermestid beetles and blowflies These insects create secondary pest problems as the dermestids feed on proteinaceous materials in museum collections. Multiple rodents caught at one time in a live trap may fight with each other in the trap causing bleeding, urination, fecal production which also increases risk of disease transmission to human occupants In addition a job hazard analysis, respirator fit testing at the least must be completed prior to managing and disposing of live rodents from traps and procedures should be performed in a humane manner and follow procedures as outlined in the American Veterinary Medical Association AVMA Guidelines for the Euthanasia of Animals: 2013 Edition. These are the reasons why snap traps are preferred in conjunction with monitoring and exclusion over other methods. Use of snap traps allows quick humane kill, carcass removal, and allows the individual conducting the monitoring to learn where the rodent access points are to focus exclusion efforts.

Fluctuations in outdoor mouse populations should be monitored to identify trends of elevated mouse populations.. This data can alert managers to be expecting influx of mice populations into human occupied areas so that exclusion can be implemented before populations increase. In such years, it may be necessary to conduct intensive trapping to reduce mouse populations in identified areas. Such trapping must, however, not substitute for maintaining the mouse-resistance of structures and proper sanitation.

There should be zero tolerance for unprotected contact between humans and deer mouse droppings, urine, or nests as potential sources of Hantavirus exposure. This may be difficult in structures seldom entered by humans or that, in their present state, are accessible by mice. In accordance with Appendix D, every effort must be made to exclude deer mice, and keep its interior free of mouse signs through following approved cleaning protocols.

Storage structures are often the most accessible by mice, and rodent-proofing may be difficult. Items should be stored in rodent proof containers until adequate rodent proofing can be conducted. Ongoing monitoring of rodent population and activity needs to be conducted and analyzed to prioritize exclusion efforts. Appendix D, the Yosemite Directive on Hantavirus Risk Reduction will be followed when entering areas that may be heavily infested.

People should be removed from structures with documented rodent activity. Snap trapping, documented monitoring, and exclusion should begin immediately in structures that house people, especially overnight, when sign of mouse activity is detected. Personnel assigned this task will be trained in snap trapping , reporting and monitoring, procedures for reporting areas in need of exclusion, proper handling and disposal of killed mice, and communications to convey risks to site occupants.

California ground squirrel (*Spermophilus beecheyi*), is the most common vector of bubonic or pneumonic plague in the state (California Department of Public Health, 2011A). Other vector species at higher elevations in the park include golden-mantled ground squirrel (*Spemophilus lateralis*), Belding's ground squirrel (*Spermophilus beldingi*), and yellow-bellied marmot (*Marmota flaviventris*). Wood rats (*Neotoma sp.*) and chipmunks (*Tamias sp.*) are also known plague vectors. Transmission occurs primarily when a flea bites an infected squirrel, and then bites a human or other mammal (California Department of Public Health, 2011B). Whether the disease is actively expressed varies among species. Black bears (*Ursus americanus*) will test positive for antibodies to the plague after they eat squirrels killed by the disease, but show no adverse effects and do not carry plague. This characteristic of black bears is used by park biologists to monitor for the presence of bubonic plague in the environment. Each captured bear has blood drawn, and sent to the California Department of Health. A majority of such tests return negative results, but the occasional positive result indicates the presence of the plague somewhere in a bear's range. Since 1984, 562 bears have been tested. Of those, 48 (8.5%) showed measurable levels of plague antibodies (Yosemite National Park, unpublished data), demonstrating plague presence in Yosemite. Park staff should be vigilant for localized die-off of squirrels as a sign of plague presence. Squirrels found dead should be collected by qualified personnel and sent to the California Department of Public Health for testing.

Transmission can also occur from exposure to body fluids of an infected animal. Such an exposure resulted in the death of an NPS wildlife biologist in 2007 at Grand Canyon, who contracted pneumonic plague during the necropsy of a mountain lion (Wong et al., 2009). Staff should wear prophylactic equipment (e.g, gloves, appropriate respirator) whenever handling dead or sick animals. NPS Reference Manual 50B, section 4.15 on Employee Handling of Wildlife (Appendix G) provides full guidance on safe handling of wildlife and should be followed at all times.

A common route of plague infection is from pets that are allowed to roam. While this is also against park regulations, the pets can be exposed to plague, and carry it back to their owners. The plague can then be transmitted to humans from the bite of a flea from their pets, or from inhaling plague bacteria coughed or sneezed by the sick pets (Castle et al., unpublished).

Preventive Management: There are large numbers of California ground squirrels in Yosemite's developed areas for three primary reasons: 1) The presence of human food either accidentally or purposely provided; 2) the establishment of burrows under pavement, building foundations, or other human structures, and 3) the scarcity of predators in developed areas.

In the first case, improved actions such as visitor education, enforcement of regulations, eating place sanitation, and garbage management can reduce the squirrels' access to human food, possibly resulting in fewer squirrels in developed areas. In campgrounds and backcountry, visitors should be advised to not sleep near rodent burrows. In the second case, squirrels should be trapped and removed, outside of the periods of reproduction and hibernation, and burrows filled in. Further burrowing can be discouraged by burying continuous panels of wire mesh around at least one foot deep around pavement and structure foundations. Squirrels can further be deterred by bending the deepest wire outward from a structure in an "L" form.

Responsive Management If a plague outbreak is detected in a developed area, people must immediately be moved out of the area. Squirrels must not be trapped and removed, because other, possibly infected squirrels would just move in. A better approach is to treat burrows with approved pesticide powder or fumigant to kill the fleas (Castle et al., unpublished). Public health authorities must be contacted, and visitors who recently stayed in the area of infection contacted, warned of possible plague exposure, and educated about plague symptoms and urgency of medical care. IPM personnel at the regional and WASO levels should also be involved in crafting strategies.

Another approach is to treat burrows with approved pesticide powder or fumigant to kill the fleas (Castle et al., unpublished). Public health authorities must be contacted, and visitors who recently stayed in the area of infection contacted, warned of possible plague exposure, educated about plague symptoms and urgency of medical care. IPM personnel at the regional and WASO levels should also be involved in crafting strategies.

In both preventive and responsive management, the IPM Coordinator should use *A National Park Service Manager's Reference Notebook on Plague* (Yersinia pestis) (Castle et al., unpublished).

Also the Stae of California has guidelines for local plague surveillance and control. (See Appendix H)

West Nile Virus

All bird species, but especially corvids (e.g., jays, ravens) are susceptible to West Nile Virus (WNV) infection, which can then be passed to humans by mosquitos (Hayes et al., 2005). Expression of this disease in humans can range from flu-like symptoms to neurological problems to death. There has been one record of an infected bird, a house finch (*Carpodacus mexicanus)* in west Mariposa County (Mariposa County Department of Health, personal communication, 2006).

Preventive Management: Mosquitos are a natural part of the park ecosystem, and there should be no efforts to suppress them in natural water bodies. Developed areas, however, can offer an abundance of human-created sites of standing water in which mosquitos can breed. Objects such as cans, buckets, and tires allowed to fill with rainwater serve as mosquito breeding sites, and should be emptied and oriented on a regular basis so they do not refill with water. Human-created water bodies (e.g., the Ahwahnee Pond should be equipped with bubbler or fountain devices that cause a continuous ripple on the water's surface. Mosquitos prefer still, standing water for breeding.

A testing and monitoring program to detect presence of WNV in the park should be conducted with the county. Birds found dead in the park are to be tested for presence of WNV as per attached protocols in Appendix.

Responsive Management: Install an early detection monitoring program (see comment DC41) for Yosemite. Provide basic information to educate, residents, employees, and visitors so they can assist in reporting dead birds and take action to avoid mosquito bites. Human-created breeding sites must be found and removed. The wearing of long sleeved pants, shirts, and head nets plus use of insect repellants can reduce the risk of mosquito bites.

Many rodent species (e.g., chipmunks, mice, wood rats) can be vectors for relapsing fever (Dworkin, et al. 2008). Cases of tick-borne relapsing fever have been documented in the park several times, and have always been associated with people staying in backcountry cabins that also harbor rodents. Transmission of the disease occurs from the bite of an infected louse or tick.

Preventive Management: As with deer mice, exclusion of rodents from human-occupied buildings is the most effective way to avoid disease exposure. This is especially important in all human occupied structures. Regular inspection and repair of rodent entry points must be conducted. Rodents must be excluded, because nests can be areas of high concentration of lice and ticks. Once all rodent entry points are plugged, trapping and monitoring should begin in the structure, and continue until all resident rodents are removed, refer to the NPS Rodent Exclusion Manual for specific guidelines.

Responsive Management: Sites that are confirmed sources of relapsing fever infections or found to harbor rodents must be vacated until rodent proofing, removal of all rodents and their sign and nests, and thorough cleaning of interior spaces can occur.

Ticks (Ixodidae): Most often found outdoors, hanging from vegetation as they quest for a passing mammal, ticks can be vectors for diseases such as Rocky Mountain fever, relapsing fever, and, notably, Lyme disease. Although the proportion of ticks in Yosemite that carry Lyme disease and tick-borne relapsing fever is relatively small (Yosemite National Park, unpublished data), all tick bites should be treated as possibly infectious, monitored, and medical help sought if the distinctive rash around the bite develops, or other symptoms such as fever, aches, and chills, as rashes do not occur with every case.

Preventive Management: Visitors and employees can reduce their exposure to ticks by tucking pants in to shoes/socks, wearing long pants and long-sleeved shirts tucked into pants. If employees are working in areas where ticks are abundant, consideration should be given to using an approved insect repellant. Hiking or working partners should periodically do visual searches of each other for ticks. The wearing of light-colored clothing makes this easier and more effective.

Responsive Management: Employees and visitors should be provided with educational material to help them protect themselves from ticks and associated disease risks. Employees should be trained annually about ticks and how to properly remove them. In years of high tick infestations, information should be provided to the public about precautions, possible disease symptoms, and proper tick removal. Ticks are a natural part of the park environment, and there should be no efforts to reduce their natural populations.

Stinging Insects: Colonies of bees, hornets, or wasps (Sphecidae and Vespidae) can present a threat to humans when they become established in areas of human use. Individual scorpions can also enter buildings and present a stinging threat. Contrary to popular notion, the stings of local species of scorpions are no more dangerous than a bee sting. Nonetheless, the sting of any of these taxa can cause an allergic reaction in some people, resulting in life-threatening symptoms, requiring immediate medical treatment.

Preventive Management: Hornets and wasps are attracted to human foods, so outdoor eating areas should be kept clean of food debris, food wrappers and containers, and other items that provide food residue. Animal-resistant trash cans are not insect proof, so should be emptied and steam-cleaned often to avoid attracting hornets. Hornet traps, set, then emptied and re-baited on a regular basis can reduce the risk of stung humans. These traps can be especially effective in reducing numbers of hornets by being set in the spring to capture emerging queens before they can establish colonies. Hornets and wasps often establish nests inside walls and other components of structures. It is, therefore, important that buildings be tight, without gaps that allow entry by hornets and wasps. Paper and mud wasps should have their nests removed by bee suit-garbed personnel during their construction.

Responsive Management: Hornet or wasp nests that become established in developed areas where activity by humans is likely to incite an attack should be removed by qualified personnel, while wearing a full bee suit. Removal can be accomplished by using approved aerosol pesticide that can be applied from a distance (i.e. squirts out in a stream).

During application, the area should be cleared of all visitors and employees, and kept closed until elimination of the nest and its occupants is confirmed. If the nest was inside a wall or another part of a structure, the gap that allowed entry must be closed with wood or caulking.

Raccoons (*Procyon lotor*) can quickly locate human food sources, and are numerous in developed areas. Raccoons have been known to carry disease or harm park visitors.

Under our policy to keep human food out of the diet of wildlife, raccoons are a persistent problem. Improved sanitation in outdoor eating areas and exclusion of raccoons from under buildings has helped reduce raccoon incidents, but visitors are still known to feed them. Raccoons can also be carriers of rabies, but this has never been documented in Yosemite. People have been bitten by raccoons in Yosemite, and must then undergo treatment for rabies as a precaution.

Preventive Management: Outdoor eating areas and campgrounds are the most common places that undesirable interactions between humans and raccoons occur. Such interactions are almost always caused by the presence of human food, provided accidentally or by feeding the raccoons. Outdoor eating areas must be kept clean, by immediately cleaning off tables, and disposing of food and wrappers in an animal-proof receptacle. Signs against feeding wildlife should be abundantly visible. This should be followed up by visitor contact, and enforcement of regulations against feeding raccoons.

Responsive Management: Once raccoons discover a food source, they will continue to return. Food availability problems must be removed. Also, hiding places to which raccoons retreat that are near to outdoor eating areas should be blockaded.

For example, raccoons have been a perennial problem at the Pizza Deck at Curry Village, where they both obtain food, and gain refuge under the deck. Wire fencing was installed under the deck, which reduced, but did not eliminate the problem.

Fleas (Pulicidae): Substantial infestations of fleas can be found in residences where cats or dogs are kept as pets. Otherwise, fleas in buildings are usually rather sparse, having arrived on rodents or other animals infesting the building. Fleas can be vectors of disease, such as relapsing fever, mentioned above, although such events are rare.

Preventive Management: Pet owners should not allow their pets to roam freely. This is against park regulations. This also increases the chances that the animals will become infested with fleas. As noted for ground squirrels, above, free-roaming pets can also return ridden with plague-carrying fleas, which can then be transmitted to humans directly from the sick pet or from the fleas. Adequate enforcement of the park's pet policy can reduce the chance of human habitations becoming flea infested. Pet owners should be encouraged to use flea combs on pets before allowing them to re-enter buildings during flea season.

Responsive Management: Infested homes or other structures can usually be ridded of fleas by frequent vacuuming and use of flea traps. Pets infested with fleas should be dusted with approved flea powder or have a topical flea medication applied and kept indoors. Flea collars are not sufficiently effective.

2. Threat of Injury

While many wildlife species can inflict wounds on people, several species, because of their size, and/or attraction to developed areas deserve special attention.

Mule Deer (*Odocoileus hemionus*) appear docile, and quickly become habituated to people, especially when fed. Bucks, especially during the rut, can become aggressive and dangerous.

In 1982, a child was gored to death by a buck while feeding it. Even does, can rear up and lash out with their hooves.

Preventive Management: Public education against approaching and feeding ~~of~~ wildlife is the cornerstone of gaining compliance with park regulations. Education, as noted above, is the most cost-effective way to mitigate human-wildlife conflicts, but should also emphasize the legal consequences of disregard for park regulations.

Responsive Management: People who disregard park regulations should be cited. Areas of undesirable interaction between deer and humans should be liberally signed and patrolled.

Mountain Lions (*Felis concolor*): Although there has never been a death or even injury from a lion in Yosemite's history, fatalities have recently occurred in other parts of the species' range in North America. We must, therefore, be vigilant of lion activity, especially in and adjacent to developed areas, and have thoughtful plan to deal with such issues. Currently we issue information about lions to all visitors, and post warnings in areas where lions have recently been active.

Preventive Management: The primary prey of mountain lions is mule deer, and, as noted above mule deer are often found in developed areas, with their presence encouraged by the availability of natural and human-provided foods. Raccoons are non-native to Yosemite Valley, and subsist primarily on human foods. Their occurrence is relevant to mountain lions because they attract lions into developed areas where dangerous interactions can occur. Two lions that were preying on raccoons in Curry Village had to be killed in 2004, after they showed a high level of habituation and displayed stalking behavior toward humans. It is, therefore, important that storage of food and handling of garbage does not result in unnatural concentrations of potential lion prey in developed areas.

Education of visitors about the presence of lions, avoiding attacks, and responding to lion confrontations are important, as reflected by the draft Superintendent's Directive - Management of Mountain Lion Threats to Human Safety. This document also provides additional preventive measures to limit the risk of human injury from mountain lions.

Responsive Management: The Yosemite National Park Directive #21 – Management of Mountain Lions provides guidelines for a gradation of responses to interactions between lions and humans, based on the determination of the level of threat. These responses range from public education to lethal removal of lions.

Black Bears, like mountain lions, have been known to prey on humans, but have only caused minor injuries in Yosemite. Nonetheless, we must manage black bears under the assumption that more serious incidents could occur here. The two main components of Yosemite's intensive Human-Bear Management Plan are to protect the safety and property of humans, and to protect black bears from becoming so conditioned to human food that they become a threat, and must be killed. The park's Human-Bear Management Plan (2002) provides both preventive and responsive management guidelines.

Preventive Management: Yosemite has the largest and most intensive Human-Bear Management Program in the NPS. Its emphasis is on removing human foods from the diet of black bears. When bears gain access to human foods, they continue to seek it out in the park's developed areas, losing their fear of humans. Mitigation of threats to both humans and bears, therefore, requires strict compliance with food storage regulations by park visitors, residents, and employees. This high level of enforcement comes through frequent patrols of developed areas to detect and correct human food available to bears.

Responsive Management: Bears that frequent developed areas are hazed out of them by Wildlife biologists and technicians. These bears are also captured, tagged, and often fitted with radio collars to track their activity. Records are kept on bears known to have obtained human food, caused property damage, show human habituated behavior, and/or aggressive behavior toward humans. Bears are now rarely relocated, except as a last effort to change its behavior, because relocated bears most often return to the area of capture, or eventually cause problems in other areas. As stated above, many such bears eventually become so bold and aggressive that they present a threat to human safety, and must be killed by park biologists.

Northern Pacific Rattlesnakes (*Crotalus oreganus oreganus*) occasionally appear in developed areas, where they present a threat to humans. It is possible that they are attracted to such areas, because their main prey, California ground squirrels, is found in such abundance in these areas due to the attraction of human food.

Preventive Management: Because much of the park is rattlesnake habitat, the snakes inevitably come into developed areas. Overabundance of California ground squirrels, the main prey of mature rattlesnakes, in developed areas are also an attractant to the snakes. Visitors should be educated about the presence of rattlesnakes, and the precautions they can take (e.g., don't put your foot or hand where you can't first see; look before stepping or sitting; know the warning, buzzing rattle of the species).

Responsive Management: Personnel trained in snake capture, and equipped with necessary snake-handling tools will be dispatched to reported locations of rattlesnake occurrence in developed areas. Snakes will be captured and moved to a more remote location, where humans would be unlikely to encounter them.

3. Nuisance Animals

Currently, incidents involving the below animals are handled by wildlife biologists and technicians in the Bear Management Team who have equipment and experience necessary for capture and removal of these animals. Facilities Management of the NPS and the park concessioner are often involved after removal to block entry points.

Striped Skunks (*Mephitis mephitis)* and Spotted Skunks (*Spilogale gracilis*) sometimes wander into or under buildings, and must be removed before their pungent spray affects office workers, residents, or visitors. Skunks can also be carriers of rabies, although this has never been documented in Yosemite.

Preventive Management: Crawlspaces should be tightly sealed, and doors and windows should be kept securely closed, especially at night. Structural gaps in buildings can also allow entry by skunks and should be patched. Human and pet food attractants can lead to skunks entering buildings and should be kept secure.

Responsive Management: If a skunk is found in a building, qualified Wildlife Management, Protection, or concessioner staff should be contacted to set traps. People should be evacuated and kept out of the area of the skunk to keep it from spraying, which would result in long-term olfactory irritation. Trapped skunks will be relocated to more remote areas of the park.

Ringtails (*Bassariscus astutus*) are a species that commonly enter buildings. This is not a problem until they find their way into the building interior, where they eat human food and create sanitation problems. Otherwise, ringtails that stay out of buildings or in the walls and crawlspaces of buildings are efficient controls of mice.

Preventive Management: Gaps in buildings that allow entry of ringtails must be patched, especially those that let ringtails enter building interiors. No food should be left out, because it can attract any ringtails that have managed to penetrate the building.

Responsive Management: If a ringtail is found in a building, qualified Wildlife Management or Protection staff should be notified. Please note, however, that the problem can be solved by merely leaving a door or window open, and "coaxing" the animal toward it. The gap that allowed the ringtail to enter the building must be located and patched to prevent further entry by animals.

Various Species of Bats and Birds commonly get trapped in buildings and require assistance in finding their way out or establish roosts that are in inconvenient locations. Bats can carry rabies and histoplasmosis, and must be handled by qualified personnel, with proper equipment. Other species of birds, such as Stellar's jay, scrub jay, raven, and black-headed grosbeak can become conditioned to human food either through purposeful feeding by humans, food scraps, or food supplies left unprotected. Feces of both bats and birds accumulate under roost sites and cause a public health concern.

Preventive Management: The exterior of buildings should have no gaps, crevices, or holes that would attract bats or birds. Mitigation of these entry points should not occur during the maternity or hibernating period for bats, or during egg-laying, incubation, and raising of young to fledging for birds.

Responsive Management: Mitigation of nest and roosts should only occur if the locations cause health and safety problems, or threaten to cause damage to a building. Stellar jays commonly build their stick nests on light fixtures, over doors, or other building protrusions. If the nest site is likely to cause problems, each day's deposit of sticks should be removed to discourage nesting. A large bat roost was removed at the Ahwahnee by contracting a bat specialist who humanely excluded the bats, and removed a large amount of accumulated guano that affecting olfactory comfort of guests.

The following nuisance animals fall into a different category because their infestations are handled by Facilities Management personnel, contract exterminators, or, in the case of museums, by curators. While these species pose little threat to human health and safety, and structures, there presence is undesirable. Museum pests, however, can cause substantial damage to valuable documents, art, specimens, and artifacts if not eradicated.

Ants (Formicidae) of many species can infest buildings, especially those that contain food. Ants can be placed into two general categories, based on their food preference: sweet-loving and grease-loving. It is necessary to know what type of ant is the target of control, so that appropriate baits can be used. The main damage caused by ants is the spoiling of infested food stuffs.

Preventive Management: To keep ants out of buildings, caulk cracks and crevices around foundations and other sites that provide entry from outside. Ants prefer to make trails along structural elements, such as wires and pipes, and frequently use them to enter and travel within a structure to their destination, so look for entry points in these locations. Prior to caulking, some pest management professionals may apply products containing silica aerogel (sometimes combined with pyrethrins in professional products such as EverGreen Pyrethrum Dust) into wall voids before sealing them up.

Indoors, eliminate cracks and crevices wherever possible, especially in kitchens and other food-preparation and storage areas. Store attractive food items such as sugar, syrup, honey, and pet food in closed containers that have been washed to remove residues from outer surfaces.

Rinse out empty soft drink containers or remove them from the building. Thoroughly clean up grease and spills. Remove garbage from buildings daily and change liners frequently, steam cleaning should be accomplished periodically.

Look for indoor nesting sites, such as potted plants. If ants are found in potted plants, remove the containers from the building, then place the pots for 20 or more minutes in a solution of insecticidal soap and water at a rate of 1 to 2 tablespoons of insecticidal soap per quart of water. Submerge so the surface of the soil is just covered by the water-soap solution. Indoor ants can be temporarily controlled by cleaning them up with a sponge, following the line of ants to their entry point in the building and then sealing it up.

Responsive Management: If an indoor ant infestation is found, the steps given above should be effective. If not, then consider borate based bait. As with carpenter ants, borax based baits are effective at eliminating the ant colony, if provided consistently over a period of time, until no more ants are coming to the bait.

Cockroaches (Blattidae) are found in many park buildings, where they forage on particles and films of food on surfaces. People often associate cockroaches with unsanitary conditions, but even “clean” food preparation areas contain enough residual crumbs and food film to attract the animals. It is, therefore, necessary to practice good sanitation in kitchens, especially in dark, hidden areas, such as under tables, stoves, carts, and cabinets.

Cockroaches can contaminate food by walking on dirty floors or other surfaces, then walking across food meant for human consumption. This should not be tolerated, because cockroaches are known to spread a wide variety of bacterial diseases.

Preventive Management: Cockroaches thrive where food and water are available to them. Even tiny amounts of crumbs or liquids caught between cracks provide a food source. Important sanitation measures include the following:

Food should be stored in insect-proof containers such as glass jars or re-sealable plastic containers. Keep garbage and trash in containers with tight-fitting lids and use liners. Keep trash cans away from doorways. Remove trash, newspapers, magazines, piles of paper bags, rags, boxes, and other items that provide hiding places and harborage. Eliminate plumbing leaks and correct other sources of free moisture. Increase ventilation where condensation is a problem. Vacuum cracks and crevices to remove food and debris. Be sure surfaces where food or beverages have been spilled are cleaned up immediately. Vacuuming also removes cockroaches, shed skins, and egg capsules. Removing cockroaches reduces their numbers and slows development. Vacuumed cockroaches and debris should be destroyed. Because bits of cuticle and droppings may cause allergies, it is recommended that the vacuum cleaner have a HEPA (high efficiency particulate absorber) filter or triple filters. . The use of sticky glue boards are a good way to monitor for the presence of cockroaches and in situations where the number of cockroaches are low, this can also be used as a control technique.

Responsive Management: Managing cockroaches is not easy. You must first determine what species you are dealing with, there are some native “forest” cockroaches that occasionally will invade buildings but will not survive, then you must find where the roaches are located. The more hiding places you locate and manage, the more successful your control program will be. Remember that cockroaches are tropical and most like warm hiding places with access to water. Some locations may be difficult to get to. Reduction of food and water sources and hiding places is essential. If cockroaches have access to food, baits (which are a primary control tool) have limited effect. Sprays alone will not eliminate cockroaches. An IPM approach that integrates several strategies is usually required.

If you know the species of cockroach, you will be better able to determine where the source of infestation is and where to place traps, baits, or insecticides. Note locations of suspected infestations and concentrate control and preventive measures in these areas. The keys to controlling cockroaches are sanitation and exclusion: cockroaches are likely to reinvade as long as a habitat is suitable to them (i.e., food, water, and shelter are available), so the conditions that promoted the infestation must be changed. In addition to sanitation and exclusion, baits can be effective against most species of cockroaches. Pesticide spray products are registered for use on cockroaches and may temporarily suppress populations, but they usually do not provide long-term solutions and are not generally recommended. Commercially available devices that emit ultrasound to repel cockroaches are not effective**.**

4. Structural Pests

Termites (Isoptera): These taxa can cause serious structural damage to buildings, unless detected and treated. Termites nest underground and/or in wood and primarily eat wood that is in contact with the ground. They also, however, build tubes to reach wood that is not in contact with the ground, and these tubes can be used to detect termite activity. Termites are of special concern when they feed on buildings of historic significance.

Preventive Management: Species of termites found in Yosemite are most often native members of forest habitats, important in the decomposition of down and dead wood. When buildings are placed in the habitat of these colonial insects, however, they can become infested with termites, threatening their structural and historical integrity. Wood structures should be built so that no wood contacts soil or such wood is pressure treated with less toxic borax-copper solutions. Older buildings, such as log cabins, however, often do not meet these standards. Some termites in the Sierra Nevada are attracted to moist wood. Therefore, buildings, where wood is near the ground, should be kept dry by fixing leaking plumbing and management of runoff from the buildings. Buildings should be inspected periodically for termite infestations, to minimize damage and the size of the colony that must be exterminated to protect the structure.

Responsive Management: Because termites are a natural part of the forest habitat, they should not be disturbed until they actually infest a building. Once infestation occurs, it is important to determine the species of termite, because treatment can vary among species. Treatments include placement of pesticide-treated wood near the termite infestation.

The termites carry the toxic wood back to the nest, resulting in its eradication. Widespread or persistent termite infestations may require more direct application of approved pesticides. Conditions that are conducive to termites need to be identified (i.e. soil against wood, leaky plumbing etc) and corrected to prevent re-infestations.

Carpenter Ants: Unlike termites, carpenter ants do not eat the wood that they burrow into. They do, however, cause structural damage by removing wood, bit by bit, to establish their galleries in structural components of buildings. Piles of wood particles or frass are indicative of carpenter ant activity. The main nest is usually not in the affected building, but in a log or stump up to 50 meters away, which can be found by following the trail of ants from the building to the main nest. . It is important to spend time finding the main nest, as there can also be as many as 23 satellite nest associated with a single infestation.

Preventive Management: As with termites, carpenter ants spread from naturally down and decaying wood and stumps near buildings, which are an important natural component of the forest habitat that is often near buildings. It should, therefore, not be removed, unless found to be the source of a current infestation (see below). The chance of infestation can be reduced by denying the ants access to any foodstuffs in the building through sanitation of eating areas and trash cans (i.e. empty daily receptacles that receive any food or its residues; leaving no food out).

Responsive Management: If a building becomes infested,-borate-based baits can be used in the building, but the main nest must be eradicated to prevent recurring infestations. This can be accomplished by following the trail of ants from the affected building to the main nest, and placing bait stations at intervals along the trail. Borate- baits are effective because they are carried back to the nest(s), and eventually kill the whole nest. These baits also have low toxicity to non-target animals when used appropriately. Secondarily, the log or stump containing the main colony could be removed to an area distant from structures, and remaining ants treated with baits.

Carpenter Bees (*Xylocopa californica*): Most carpenter bees, *Xylocopa spp,* are large and robust insects resembling bumble bees. They are usually about 1 inch long and colored a metallic blue-black with green or purplish reflections. They differ from bumble bees in that their abdomen is shiny with fringes of hairs on some segments. Males of some species are lighter colored, ranging into golden or buff hues. Female carpenter bees bore into sound wood or sometimes into decaying wood to make nests. Nests usually consist of tunnels 1/2 inch in diameter and 6 to 10 inches deep that are partitioned into several chambers, each containing an egg and a supply of food (pollen). Carpenter bees may use old tunnels for their nests, which they sometimes enlarge; several bees may use a common entry hole connecting to different tunnels. Over a period of time, tunnels may extend as far as 10 feet into wood timbers. Tunnels are vacated after the brood's larval and pupal stages complete their development. Development from egg to adult may take about 3 months. Carpenter bees overwinter as adults, often in old tunnels, and there is only one generation a year.

The nests weaken structural wood and leave unsightly holes and stains on building surfaces. Sound, un-decayed wood without paint or bark is usually selected for nests. Carpenter bees also frequently attack dead wood on trees or lumber from southern yellow pine, white pine, California redwood, cedar, Douglas fir, cypress, mimosa, mulberry, ash, and pecan trees.

They avoid most harder woods. The presence of carpenter bees around buildings and wooden structures can be annoying or even frightening; however, males cannot sting and females rarely attack.

Preventive Management: Prevention is the main approach to managing carpenter bees. If possible, susceptible exterior parts of a building should be constructed out of hardwoods not normally attacked by the bees for nests. On all buildings, fill depressions and cracks in wood surfaces so they are less attractive. Paint or varnish exposed surfaces regularly to reduce weathering. Fill unoccupied holes with steel wool and caulk to prevent their reuse. Wait until after bees have emerged before filling the tunnels. Once filled, paint or varnish the repaired surfaces. Protect rough areas, such as ends of timbers, with wire screening or metal flashing.

Responsive Management: Carpenter bees are generally considered beneficial insects because they help pollinate various plants. Under most conditions they can be successfully controlled using the preventive measures described above. If infestation is high or risk of damage is great, insecticides may be used to augment other methods of control.

To do this, treat active nests (those containing eggs, larvae, or pupae) with liquid or dust formulations of insecticides or desiccant dusts. After the brood is killed, repair holes with steel wool and wood filler, then repaint or varnish the repaired surfaces.

Woodpeckers (Picidae) of any species can damage structures, but this is a problem in Yosemite that is restricted to several species. Northern flickers and white-headed woodpeckers sometimes peck holes in wood-sided structures to nest. The holes do not compromise the structural integrity of buildings, but provide entry for water, insects, and rodents. Acorn woodpeckers, however, can cause substantial damage to a structure. This species establishes granaries which could be inside live or dead trees into which numerous holes are pecked and used to store individual acorns. Buildings are also often used as granaries, causing large amount damage to the siding, rafters, window frames, and other exposed wood. Besides damaging the historic integrity of buildings, this activity, like that of the other woodpecker species, provides routes for further damage.

Preventive Management: New construction should be composed of woodpecker resistant materials to the greatest extent possible (e.g. cement-fiber siding, metal, fiberglass). In the case of historic structures, such materials cannot be used in place of wood, and woodpecker damage should be expected, and its repair factored into structure maintenance. Owl decoys and ultrasonic repellant devices are not effective.

Responsive Management: Ongoing damage can be mitigated by use of bird netting; if it is determined that such material does not unacceptably alter the structure's appearance. As said above, damage of historic buildings may have to be endured, with monitoring to avoid damage that threatens the structural integrity of the building, or results in further environmental damage, such as from water intrusion.

Museum Pests include a variety of invertebrates that feed on paper, glue, animal hides, feathers, and other organic materials. Museum curators must be ever-vigilant for the signs of pest infestations in the park collections, because, over time, valuable materials can be destroyed. Species in this category include silverfish, firebrats, carpet beetles, larder beetles, tobacco beetles, clothes moths, and the larvae of these species. Signs of these pests include visible damage to materials, powdery debris, or feces. Prevention is the best protection of museum materials, including a tight building and storage equipment, no food, and thorough housekeeping. Incoming materials should be quarantined or treated for pests. Curators should stay abreast of current prevention and treatment standards of their profession, and report infestations and recommended treatments to the IPM Coordinator. Guidelines are set forth in *Yosemite National Park Museum & Archives Integrated Pest Management Policy* (Hay et al., unpublished)(Appendix H). The NPS Museum Management Program issues guidance for parks in its museum handbook series http://www.nps.gov/museum/publications/MHI/mushbkI.html

Preventive Management: Introduction of museum pests usually comes through the arrival of new, infested material to the museum. Currently, Yosemite curatorial staff freeze arriving materials to kill pests. Tight storage cabinets also keep pests out of museum materials. Frequent surveys of materials can detect infestations. Borate- based traps are set for silverfish. Most of the vulnerability of museum materials is in the envelopes of museum buildings. Unless these are tight, infestation of museum materials is always a threat.

Food should not be allowed in museum spaces because even tiny crumbs can attract pests

Responsive Management: Refreezing of materials can eliminate infestation of individual artifacts. Severe infestations may be treated with baits or direct pesticide application, if severe.

Invasive non-native plant control is directed by a separate Invasive Plants Management Plan (2010). Control will be done in collaboration with the IPM Coordinator when herbicides are used. In such cases, pesticide protocols given will be strictly followed.

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APPENDIX A

Pesticide Safety

APPENDIX A - Pesticide Safety

If pesticide use is determined to be necessary, approval of the pesticide will be obtained from the IPM Coordinator, and the following safety measures will be complied with:

Certification: Applicators of pesticides will acquire and maintain certification through training appropriate for the pesticides they will use. The IPM Coordinator will keep a file of certified pesticide applicators, with supporting documentation to ensure that requested pesticide applications are carried out by qualified personnel (how many, who, what training, list of certified applicators). Applicators are responsible for keeping their training record up to date, through submission of supporting documents to the IPM Coordinator for inclusion in their certification file.

Pesticide Information: Pesticide labels contain directions to protect workers and reduce exposure to non-applicators. Violation of those directions is a violation of FIFRA. Existing labels on incoming chemical containers will not be removed or defaced and, under OSHA's Hazard Communication Standard (29 CFR 1910.1200), workers will be provided with training, protective equipment, and information (Material Safety Data Sheets, MSDS) about the hazardous substances they may handle. Information will be made available to the public by posting treated areas. Public information will include: pesticides used, areas treated, and safe entry times. Listing and records will be kept for all pesticides used or stored in the park. Copies of the labels and MSDS sheets will be stored with the pesticides and in the office of the park IPM Coordinator.

Occupant Notification: If application of a pesticide is to occur in an occupied building, residents or staff in the building will be notified as to when and what chemical is planned to be used. This allows people with known sensitivities to chemicals to vacate the building.

Some pesticide labels contain a re-entry interval precaution. This statement tells how much time must pass before people can reenter a treated area without appropriate protective clothing and/or equipment. Re-entry intervals are set by both the EPA and some states. Reentry intervals set by states are not always listed on the label and therefore are the responsibility of the park staff to determine if one has been set. If re-entry limitations have been established for applied pesticides, the areas of treatment will be posted on all sides and entryways stating the type of pesticide applied, date of treatment, and date of safe re-entry. If no re-entry statement has been set, then all unprotected persons must wait at least until sprays have dried or dusts have settled before re-entering without protective clothing. This is the minimum legal re-entry interval.

A list of park employees who are sensitive to pests or pesticides will be maintained in the park IPM Coordinators office and in pesticide storage areas. Prior to application of any pesticides, these individuals will be notified for their safety.

Pesticide Storage: Pesticide storage facilities will be locked, fireproof, and ventilated, and proper warning signs will be posted. Pesticides will be stored separately from all other substances, and the directions provided on the label or labeling will be followed. In addition, each type of pesticide will be stored on separate shelves. Insecticides and herbicides, for example, will be stored in separate rooms because of the potential for explosive or other violent chemical reactions when these types of pesticides are mixed. Storing pesticides with cleaning fluids, paints, solvents, or other chemical substances unnecessarily increases the opportunities for accidents, fires, etc. Structures used for the storage of pesticides will be posted, and copies of labels, MSDS, and inventories will be kept in the storage facility. Pesticides will not be stored in or moved into unapproved or unmarked containers. Park fire crews will be made aware of the types and locations of pesticides, at least annually. It is recommended an annual fire inspection be conducted of pesticide storage facilities.

- Safe storage of pesticides in personal residences in the park is critical for the protection of residents, their children, and domestic animals. Residents will be informed of the following recommended guidelines for storing pesticides in the home.

- Do not purchase pesticides for use in or around your residence, garden, or yard which have not been approved through the park IPM Coordinator.

- Keep all pesticides locked up, where children cannot find them.

- Do not store pesticides in the same cupboards with food, animal feed, seed, or water.

- Do not store pesticides beneath the kitchen sink where they are in reach of children.

- Store pesticides in dry, cool, well ventilated places, away from sunlight and at temperatures above freezing.

- Mark all entrances to pesticide storage areas with a sign: “Pesticides Stored Here Keep Out.”

- Store and keep all pesticides ONLY in original and originally labeled containers.

- Clean up spilled and leaking pesticides immediately.

- Indelibly write the date of purchase on pesticide containers.

- Many pesticides are flammable. Take adequate precautions against potential fire hazards.

- Keep all safety data and other information that comes with pesticides and forward a copy of the label to the park IPM Coordinator.

- Do not mix storage of herbicides and insecticides; store on separate, labeled shelves.

- Keep the National Poison Control Center hotline number handy: 1-800-222-1222

- Pesticides must be stored with their labels and associated Material Safety Data Sheets (MSDS). They should be kept in a binder and stored in the same location as the pesticides. A second copy must be made for NPS Dispatch. When applying pesticides, a copy of the label and MSDSs must accompany the applicator as well.

Pesticide Spills: The key to preventing pesticide spills is proper equipment maintenance and knowledge of safe handling and application techniques. In the event of a spill, the steps of contain, control, and clean will be applied in as safe a manner as possible.

1. Control the spill

Without exposing anyone unnecessarily to chemicals, immediate steps need to be taken to stop the flow of the material being spilled. Proper protective equipment must be used to control leaks, or extricate injured personnel from accident scenes.

Isolate the spill area and keep people at a distance of at least 30 feet. In some instances, evacuation upwind from the spill may be warranted. Oversight must be maintained at the spill site until the chemical is cleaned up, so park staff will be on site until relieved.

In large spills, it may be necessary to get help. In such a situation, contact Park dispatch by calling 911. Park dispatch will then contact the park's fire department and HazMat Team. They will determine if the spill is serious enough to enlist help from outside the park. Another resource for emergency information is the Chemical Transportation Emergency Center (CHEMTREC) in Washington, DC, at (800) 424-9300. Have the product label available for technical information.

In some cases it may be necessary to notify local police, fire department, hospitals, and/or public health officials.

2. Contain the spill

It is imperative that the spill be contained in as small of an area as possible. Every practical step should be taken to keep the spill from spreading by using hand tools, absorbent materials, and other resources available.

Do not allow spilled materials to enter any water body, including sewer, even if the spill is insignificant. If this happens, the state or regional Health Department must be contacted, so authorities can notify downstream users of any potential hazards.

Sand, vermiculite, clay, sawdust, or absorbent pads spread over entire spill areas can absorb liquid spills. Such materials should be kept readily available in areas where toxic materials are being stored or used. Due to fire hazards, do not use sawdust or sweeping compounds on spill materials that are strong oxidizers.

Dry chemical spills can be contained by misting the area lightly with water or covering with plastic. Care must be taken when disposing of all material, even clothing, used in spill management, as noted in the clean up section below. These materials can also be obtained in the park’s hazard waster accumulation areas.

3. Clean up the spill

Absorbent material should be spread over the entire spill. Additional absorbent should be added until the spill is soaked up. If possible, dry materials can be cleaned up and reused, unless they are contaminated with soil and/or debris. If the latter, they should be placed in a heavy-duty plastic bag for disposal. These materials are stored in the park's hazard waste accumulation areas.

Decontaminate the area by cleaning with a mixture of full strength household bleach and hydrated lime. This mixture is worked into the spill area with a coarse broom. The mixture is then cleaned up by adding absorbent material, such as sand, and soaked up, scooped up and placed in heavy-duty plastic bags for disposal. Repeat this process several time, ensuring the area has been thoroughly decontaminated. Do not hose down the area with water.

If soils are contaminated, the most effective way to remove a pesticide is to remove the top 2 to 3 inches of soil, cover the area with a layer of lime, and cover that layer with fresh topsoil.

Equipment cleanup is as important as cleaning the spill. This must be done while wearing proper protective equipment. Clean all equipment with chlorine-dish soap solution. Porous equipment (leather, brooms, etc) cannot be decontaminated effectively as well as clothing that is badly contaminated should be placed in heavy duty plastic bags and disposed of properly.

If spill material is useable, it may be applied at or below the labeled rate. If this is not an option, the material must be disposed of in accordance with state hazardous waste disposal regulations.

All spills will be documented as to date, size, corrective actions taken, and any agencies contacted for assistance or regulatory compliance.

Spill kits will be available and containment materials will be on hand wherever pesticides are stored, mixed, or applied.

Disposal : All pesticides, rinsates, and pesticide containers will be disposed of as per pesticide label directions and regulations established by EPA (40 CFR 116 117, 165, 170 172), and the Resource Conservation and Recovery Act. (40 CFR 261.30 33).

There are several approaches which will limit the amount of excess pesticide to be discarded. NPS policy limits the quantity of pesticide which can be purchased. The pesticide label or labeling also contains information about disposal of pesticides and pesticide containers. Mixing only sufficient pesticide to do the immediate job will eliminate surpluses. However, if small quantities of mixed pesticides remain, they and any rinsate from the container or spray equipment may be applied to the treated area according to the label instructions. At the completion of any application where a spayer has been used, the sprayer will be triple rinsed and the rinsate will be applied according to the label instructions.

If pesticides cannot be disposed of in the manner described above, they may be surplused, given to another agency, or disposed of according to federal and state laws and regulations. Donation of surplus chemicals will be documented and records kept for three years.

Use of Reputable Contract Exterminators may be preferred, in some cases, because it removes the need to keep pesticides in the park, the applicators are likely to be trained in the most effective detection and eradication methods, must maintain current certification, have, in some cases, equipment for non-chemical extermination, and minimize exposure of park staff to pesticides during application. Nonetheless, use of a contract exterminator must be approved by the IPM Coordinator.

APPENDIX B

Director's Order # 83 Public Health

National Park Service

DIRECTOR'S ORDER #83: PUBLIC HEALTH

Approved: /s/ Donald W. Murphy (signed original on file)
(for) Director

Effective Date: October 21, 2004

Sunset Date: October 21, 2010

This renewed edition of Director's Order #83 is essentially the same as the edition that was scheduled to sunset August 3, 2007. The only revision is in Section B.6, which now allows park unit managers to consider for front country use suitable alternate wastewater systems (such as composting and evaporative toilets), in consultation with the assigned Regional Public Health Consultant or Park Environmental Health Officer/Sanitarian.

Index

I. Background and Purpose

The National Park Service hosts nearly 300 million visitors to the national parks each year. To provide for visitor enjoyment of the parks, the NPS operates (directly or indirectly) water supply systems, waste management systems, food service operations, bathing beaches, swimming pools and overnight accommodations. In most cases, there are Federal, State and/or local codes--designed to protect the public health--that govern the conditions under which these facilities and services are provided. To ensure these facilities and services are operated in a safe and healthful manner and according to existing public health laws and regulations, the NPS Public Health Program (PHP) conducts health risk and environmental compliance assessments. The PHP provides technical assistance to parks on request. PHP staff provides training to NPS personnel in the recognition and management of health risks, and provides health awareness information in the form of factsheets, messages in the

Operational Notes section of the Ranger Morning Reports, and on its NPS internet website (http://www.nps.gov/public_health/) and the InsidePublicHealth intranet website (http://www.nps.gov/public_health/intra/).

The purpose of this Director's Order is to outline what the NPS will do to ensure compliance with prescribed public health policies, practices and procedures. This order establishes NPS policy with respect to all public health activities within areas of NPS jurisdiction, regardless of whether those activities are carried out by NPS or other Federal employees, or by other organizations, including the U.S. Public Health Service (PHS). The core PHP includes prevention, control and investigation of food-, water-, and vector-borne diseases in the national parks.

This Director's Order, and Reference Manual 83 (RM83), supersede and replace Director's Order-83 dated August1998 and any other previously issued policy or procedural statements that may be at variance with the policies and procedures stated herein. It applies to all facilities and services provided in the parks, whether by the NPS directly, or by concessioners, leaseholders, or permittees.

II. Authority

The authority to issue this Director's Order is contained in 16 U.S.C. 1 through 4 (the National Park Service Organic Act), and Part 245 of the Department of the Interior Manual.

III. General Policy

A. It is the policy of the NPS to protect the health and well-being of NPS employees and park visitors through the elimination or control of disease agents and the various modes of their transmission to man and to ensure compliance with applicable Federal, State and local public health laws, regulations and ordinances. Implementation of this policy will be tempered by the Organic Act's requirement that the NPS conserve the scenery and natural and historic objects and the wildlife therein in such manner and by such means as will leave them unimpaired for the enjoyment of future generations.

B. The Associate Director, Visitor and Resource Protection, will issue RM83 to provide more detailed information on the public health policies, practices, procedures and standards that park managers must adhere to in providing facilities and services to the public.

C. Based on the unique circumstances and conditions of National Park Service sites, the Public Health Consultant (PHC) has the discretion to recommend adaptations to these requirements considering specific site conditions and relevant authority under the law.

IV. perational Policies and Procedures

A. Drinking Water

NPS unit managers will reduce the risk of waterborne diseases and provide safe drinking water to employees, the visiting public, and park partners by assuring that drinking water systems are properly operated, maintained, monitored, and deficiencies promptly corrected. Water systems will be regulated in accordance with 1) the Safe Drinking Water Act, as amended (42 U.S.C. 7401 et seq.), or 2) the Primacy Agency (e.g. the agency designated by

Federal law as having oversight responsibility). Additional guidance for non-public or other unregulated water systems is provided in RM83(A1).

A.1 All parks that operate public drinking water systems will have certified operators as required by the primacy agency. Parks that operate only non-public drinking water systems will have appropriately trained operators.

A.2 NPS unit managers will develop training plans and assure that operators receive any required and/or appropriate training.

A.3 NPS unit managers will assure that required records are maintained in permanent files for periodic review by the regional Public Health Consultant (PHC) or Primacy Agency representatives, and that reports are submitted on a timely basis as requested by the PHC and/or the Primacy Agency.

A.4 Bacteriological and chemical sampling will be performed in accordance with Federal, State and local laws/regulations. In the absence of Federal, State and local regulation, systems will comply with the requirements of RM83 (A1).

A.5 All water samples will be tested in laboratories certified by the Primacy Agency.

A.6 All surface water sources and any groundwater sources under the direct influence of (GWUDI) surface water, as determined by the Primacy Agency for public systems will be provided with approved filtration. Non-public surface water sources and groundwater sources under the direct influence of (GWUDI) surface water, as determined by the PHC, will be provided with approved filtration.

A.7 All public drinking water systems will be continuously disinfected. Acceptable disinfecting methods are those which provide a measurable disinfectant residual in the distribution system. The PHC may specifically exempt non-public systems after a complete sanitary survey of the system is made.

A.8 For park-operated, public drinking water systems utilizing a chemical disinfectant, one (1) disinfectant residual sample will be measured and recorded per day from representative points. Parks operating non-public drinking water systems or receiving water from municipalities should contact the PHC for residual monitoring guidance.

A.9 Sanitary surveys for State regulated, public drinking water systems will be conducted in accordance with Primacy Agency requirements. The PHC may conduct sanitary surveys of unregulated and/or non-public water systems.

A.10 All parks operating drinking water systems will have a documented cross connection control program on file for review by the Primacy Agency and/or the PHC (See RM83(A2)).

A.11 Water for all NPS water hauling operations, whether conducted by the park or a private contractor, will be obtained from an approved water source that meets the requirements of the Safe Drinking Water Act.

A.12 All parks will comply with the public notification requirements of the Safe Drinking Water Act.

A.13 When drinking water system modifications or new construction is proposed, parks will contact the Primacy Agency to determine if plans and specifications should be submitted for approval. A copy of the plans and specifications will be provided to the PHC upon request.

A.14 Potable water for backcountry operations must be 1) obtained from an approved public system, 2) boiled, or 3) filtered and disinfected.

B. Wastewater

NPS unit managers will reduce the risk of waterborne diseases and provide safe wastewater disposal by ensuring wastewater systems are properly operated, maintained, monitored, and deficiencies promptly corrected. Wastewater systems will be in compliance with 1) the Clean Water Act, as amended (33 U.S.C. 1251 et seq or 2) the Primacy Agency (e.g. the agency designated by Federal law as having oversight responsibility). Additional guidance for non-public or other unregulated wastewater systems is provided in RM83(B1).

B.1 NPS unit managers will ensure operators are adequately trained and certified in accordance with operator requirements of the Primacy Agency. Park managers will designate, in writing, primary operators, and backup operators who have adequate training and skills to operate the system(s). Parks that operate only individual, on-site wastewater systems will have appropriately trained operators.

B.2 NPS unit managers will develop training plans and assure that operators receive any required and/or appropriate training.

B.3 NPS unit managers will assure that required records are maintained in permanent files for periodic review by the PHC or Primacy Agency representatives and that reports are submitted on a timely basis as requested by the PHC and/or required by the Primacy Agency.

B.4 When wastewater system modifications or new construction are proposed, parks will submit plans and specifications to the Primacy Agency for approval. A copy of the plans and specifications will be provided to the PHC.

B.5 All wastewater facilities will be installed, operated and monitored in accordance with Primacy Agency requirements.

B.6 Typical front country wastewater systems include flush toilets, vault toilets, and chemical toilets (used only for temporary purposes). Where conditions are suitable, alternate wastewater systems, such as composting and evaporative toilets may be considered for front country use. Park unit managers must contact the assigned Regional Public Health Consultant or Park Environmental Health Officer / Sanitarian for guidance and advice when planning to install, upgrade, or make substantive changes to any wastewater system. All wastewater systems must be installed and operated according to the manufacturer's instructions and in compliance with Primacy Agency requirements.

B.7 Suitable backcountry waste systems include flush toilets; composting toilets; barrel toilets; evaporator toilets; incinerator toilets and pit privies. Pit privies should only be used as a last resort where other types of facilities are not possible. The Park Sanitarian or the PHC should conduct the siting of pit privies.

B.8 All new vault toilets will incorporate the U.S. Forest Service Sweet Smelling Toilet (SST) design features. Vault toilets will be pumped as necessary. The U.S. Forest Service In-Depth Design and Maintenance Manual for Vault Toilets is provided in RM83(B2).

B.9 All toilet facilities will be cleaned and re-supplied as often as necessary to maintain a high degree of sanitation. The U.S. Forest Service guidance manual Cleaning Recreation Sites is provided in RM83 (B3).

B.10 Adequate sanitation facilities will be required for remote areas such as river rafting, horseback riding, back country biking, backpacking and similar activities in accordance with RM83(F).

B.11 Septic tanks shall be inspected annually to determine the amount of accumulated scum and sludge. Records of septic tank measurements, inspections, and pumping will be available for review by the PHC. Septic tank risers will be provided for inspection holes to facilitate inspection and pumping. Septic tanks will be pumped when the scum and or sludge levels in the tank dictate (generally every 3-5 years). The bottom of the scum should never be closer than 3 inches to the bottom of the outlet device, and the top to the sludge layer should never be less than 8 inches from the bottom of the outlet device.

B.12 Septic tank drain fields shall be surveyed annually during a high use period to identify system failures such as odors and surfacing wastewater. The drain field should be kept clear of trees and bushes, which may send roots into the drain field piping system resulting in clogging and causing premature failure.

B.13 Personnel who routinely come into contact with sewage, work in, or inspect wastewater treatment facilities, lagoons, etc. will have a current immunization for tetanus.

B.14 Wastewater treatment plant personnel will not eat, drink or smoke when performing maintenance or inspecting equipment, which may be contaminated with human sewage.

B.15 In the event of a major wastewater leak or spill, the PHC will be notified within one business day. Facilities and equipment contaminated with sewage as a result of leaks, spills, and sewage system backflow will be thoroughly washed down with water and detergent. Further guidance is provided in RM83 (B4) - Raw Sewage Spill Notification and Cleanup

C. Food Safety and Sanitation

NPS unit managers will reduce the risk of foodborne illness to employees, the visiting public, and park partners by ensuring that all food service facilities are operated in accordance with the most recent edition of the FDA Food Code, unless specifically exempted by PHC, and DO48. Food operations include but are not limited to NPS operations, concessioner operations, special events, incidental business permit operations and emergency incidents. The FDA Food Code is provided in RM83(C1).

C.1 All permanent food service facilities will be inspected according to schedules established by the PHC and concession program manager.

C.2 Temporary food service operations (stationary and non-stationary facilities) will meet the same general requirements as permanent facilities by complying with the FDA Food

Code and consulting with the regional PHC to determine additional recommendations and alternative compliance options to the Food Code. See RM83(C2) for additional guidance on temporary food service operations and RM83(F) for backcountry operations.

D. Recreational Waters

NPS unit managers will reduce the risk of waterborne diseases by ensuring that recreational water sites are properly operated, maintained and monitored in accordance with state or local regulations. Deficiencies will be promptly corrected with applicable state/local regulations. In the absence of applicable state or local regulations, the following NPS policies will apply.

D.1 Bathing Beaches. NPS unit managers will reduce the risk of waterborne diseases by ensuring designated bathing beaches are properly operated, maintained and monitored. Deficiencies will be promptly corrected, in compliance with the Beaches Environmental Assessment and Coastal Health Act of 2000 and applicable state/local regulations. In the absence of applicable state or local regulations, the following NPS policies will apply. Bathing beaches can be located at lakes, rivers, oceans, hot springs, and other bodies of water. Additional guidance is provided in RM83(D1). The complete Beaches Environmental Assessment and Coastal Health Act of 2000 can be accessed at: http://www.epa.gov/ost/beaches/beachbill.pdf.

a. Bathing beach monitoring is required for each designated beach. Designated beaches are those that the Park has identified (using signs, brochures etc.) as available to the public for contact recreational water activities. Monitoring is recommended for other areas that are heavily used (40 or more people per 100 linear feet of shoreline). Specific requirements of the monitoring program include:

(1) Conducting a sanitary survey;

(2) Preparing a bathing beach monitoring protocol. This protocol includes the names of areas to be sampled; sampling station locations; a map or sketch of each area showing the location of each sampling station; bacterial standard used; and the name of the laboratory doing the bacterial analyses;

(3) Sampling for enterococcus or Escherichia coli bacteria levels; and

(4) Issuing swimming advisories when bathing beach waters exceed the bacterial standards.

b. A copy of the bathing beach monitoring plan and current bathing beach sanitary survey report will be sent to the PHC for review and concurrence approximately 1 month before the beginning of the recreational season.

c. Samples will be collected in conformance with the most recent edition of Standard Methods for the Examination of Water and Wastewater.

d. Analyses will be done in conformance with the most recent edition of Standard Methods for the Examination of Water and Wastewater. Parks that have their own laboratory should meet state certification requirements. Parks that do not do their own sample analyses will use a certified microbiological laboratory.

e. Parks will submit bacteriological sampling results to the PHC.

f. When the applicable bacterial density standard is exceeded, Park managers will report the bacterial density results to the PHC and the applicable state agency. Advise the PHC, applicable state agency and the local news media that a health advisory regarding the affected area will be posted. The advisory will notify the public of the potential health risks from swimming at the designated beach. The affected beach will be re-sampled immediately by taking two samples each day at each sampling location where the bacterial standard was exceeded. Re-sampling will be continued until the bacterial standard is not exceeded for two consecutive days. The PHC can waive this re-sampling requirement. Resume routine monitoring and notify the PHC, the local public health agency and the news media of the decision to reopen the beach. All signs should be removed.

D.2 Swimming Pools. NPS unit managers will reduce the risk of waterborne illness by ensuring that NPS and concessioner swimming pools are properly constructed, operated, maintained, monitored, and deficiencies promptly corrected in accordance with applicable state or local regulations. In the absence of applicable state/local regulations, the NPS has adopted "The National Pool and Spa Institute's ANSI Standard for Public Swimming Pools" as policy. A copy of this standard is provided in RM83(D2).

D3. Spa and Hot Tubs. NPS unit managers will reduce the risk of waterborne diseases by ensuring that NPS and concessioner run spas and hot tubs are properly constructed, operated, maintained, monitored, and deficiencies promptly corrected in accordance with applicable state or local regulations. In the absence of applicable state/local regulations, the NPS has adopted "The National Pool and Spa Institute's ANSI Standard for Public Spas" as policy. A copy of this standard is provided in RM83(D3).

E. Illness Surveillance and Initial Response

NPS unit managers will reduce the risk of waterborne, foodborne and vectorborne diseases by designating, in writing, a person responsible for implementing and coordinating the Illness Surveillance and Initial Response Program. Responsibilities include maintaining reporting logs, notifying PHC's or WASO Public Health when a suspected outbreak is occurring, and coordinating, at the park level, the appropriate response. When a Sanitarian or Environmental Health Specialist is located in the park, that person should be designated as the Illness Reporting Program Coordinator. A copy of the written designation will be provided to the PHC. Additional guidance is provided in RM83(E).

E.1 When a foodborne, waterborne, vectorborne or occupational illness is suspected, the Illness Surveillance and Initial Response Coordinator will contact the PHC for advice and support. At the direction of the PHC, request assistance from applicable local, state, or Federal public health agencies that are staffed with trained public health professionals. Depending upon park jurisdiction, federal agencies will respond only at the request of local health departments.

E.2 NPS unit managers will take any appropriate steps to restrict or close, in whole or in part, any establishment, facility, or operation when evidence suggests an outbreak of disease may be occurring, or recurring. These steps may include the closure of the entire park or portion thereof where conditions warrant. This authority may be found in 36 CFR 1.5. Such a decision should be made after careful consideration of all facts, and in consultation with the

PHC, the Illness reporting Coordinator, and involved local/state/federal health officials.

E.3 NPS unit managers and/or the Public Affairs Officer will decide when or if a news media release is appropriate.

E.4 The Illness Surveillance and Initial Response Coordinator, and where appropriate, dispatch centers, district rangers, and NPS unit managers will maintain a list of applicable telephone numbers for PHC's and applicable local and state health agencies.

E.5 The park concession office will be notified when an illness investigation is conducted in a concessioner's facility.

E.6 Persons who complain of illness while in a park will be referred to a health care provider for evaluation, and possible laboratory confirmation.

E.7 For guidance on collecting, storing, shipping and analysis of samples, the Illness Reporting Coordinator will consult with the PHC or local/state/federal consultants contacted for support.

E.8 The Illness Surveillance and Initial Response Coordinator will keep the NPS unit manager informed of the status of the investigation. A written summary of the investigation should be submitted to the NPS unit manager, with a copy to the PHC within 30 days. The report should include pertinent information such as the number of ill persons, symptoms, diagnosis (confirmed or suspect), duration of outbreak, action taken, conclusions, and recommendations to prevent similar outbreaks from occurring.

F. Backcountry Operations

NPS unit managers will reduce the risk of waterborne, foodborne and vectorborne diseases by ensuring that all backcountry water, wastewater and food operations (NPS, concessioner, special events, incidental business permits and emergency incidents) are operated in accordance with current Public Health regulations and policies. Additional guidance is provided in RM83(F).

F.1 Potable water for backcountry operations must be 1) hauled from an approved public system, or 2) boiled, or 3) filtered and disinfected.

F.2 Adequate sanitation facilities are required for remote activities such as trail maintenance, fire fighting, ranger stations, river rafting, horseback riding, backcountry biking, backpacking, and similar activities.

F.3 NPS Park Managers will ensure that all backcountry food service operations (stationary and non-stationary facilities) meet the same general requirements as permanent facilities by complying with the FDA Food Code and consulting with the PHC to determine additional recommendations and alternative compliance options to the FDA Food Code.

G. Vectorborne and Zoonotic Disease

G.1 NPS unit managers will reduce the risk of transmission of vector-borne and zoonotic diseases to park visitors and employees through education, surveillance, and control efforts

when necessary. Control procedures will reduce risk while minimizing adverse impact on natural and cultural resources. The NPS will follow an integrated pest management approach in addressing vector-borne disease issues as outlined in Director's Order 77-7.

G.2 At minimum, parks shall establish a point of contact at the local public health and/or vector-borne disease control agency in order to keep up to date on potential and current trends in vector-borne disease prevalence in and around the park. Some parks may need to assign an individual to coordinate vector-borne disease issues based on an elevated risk and the recommendation of the PHC.

G.3 The designated park staff member responsible for addressing vector-borne and zoonotic disease issues will have the responsibility to implement the recommendations of the PHC. Whenever possible, this individual should be the park Integrated Pest Management (IPM) coordinator or the park sanitarian. The duties and responsibilities may include:

- Coordinate with local and state departments of health, PHC, and IPM program coordinator.
- Ensure educational materials are available for park staff and visitors, and conduct or coordinate preventive education and training sessions.
- Establish and maintain a passive surveillance program within the park.
- Coordinate active surveillance activities within the park.

G.4 Guidance and information will be provided on specific diseases by the Zoonotic, Vector-borne and Environmentally Transmitted Disease (ZED) Steering Committee, a collaborative effort of the Biological Resource Management Division, Public Health and Risk Management Programs. Further information on ZED can be found at http://www.nps.gov/public_health/zed/zed.htm.

----------*End of Director's Order*----------

Appendix C

Cooperative Agreement
Yosemite National Park
And
California Department of Public Health
Vector Borne Disease

COOPERATIVE AGREEMENT NO. P13AC00320

between the

U. S. DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE
YOSEMITE NATIONAL PARK

and the

PUBLIC HEALTH FOUNDATION ENTERPRISES, INC.

This Cooperative Agreement is entered into between the Department of the Interior, National Park Service, Yosemite National Park, hereinafter known as the "NPS", and the Public Health Foundation Enterprises, Incorporated, a 501(c)3 non-profit corporation, hereinafter known as "PHFE,". Throughout this Cooperative Agreement the NPS and the PHFE may be referred to jointly as "the parties."

CFDA #: 15.944 Natural Resource Stewardship

PROJECT TITLE: Vector-Borne Disease Prevention Program for Yosemite National Park

ARTICLE I – BACKGROUND AND OBJECTIVES

Public Health Foundation Enterprises (PHFE) is a 501(c)(3) non-profit corporation that provides management and operational support to the State of California Department of Public Health. In this Cooperative Agreement, PHFE will provide such supporting functions, while oversight and direct services will be provided by the State of California Department of Public Health.

The mission of the California Department of Public Health (CDPH) Vector-Borne Disease Section (VBDS) is to protect the health and well-being of Californians from arthropod- and vertebrate-transmitted diseases and injurious pests. (Authorizing statutes: California Health and Safety Code Sections 116108-116120, 116102, et. seq., and 116180; Government Code Section 12582) VBDS provides leadership, information, and consultation on vector-borne diseases to the general public and agencies engaged in the prevention and control of vector-borne diseases. VBDS staff, located in four regional offices and headquartered in Sacramento, include the provision of the following services:

- Develop and implement statewide vector-borne disease surveillance, prevention, and control programs
- Design and conduct scientific investigations to further knowledge of vector-borne diseases in California
- Coordinate preparedness activities for detection and response to introduced vectors and vector-borne diseases
- Conduct emergency vector control when disease outbreaks occur

Yosemite National Park attracts over 4 million visitors annually and is staffed by approximately 1,200 NPS and 1,600 concessioner employees. The park is a natural, wild environment that features developed

facilities to support a safe and enjoyable visitor experience. This environment can present significant potential exposures to vector-borne diseases (e.g. hantavirus, plague, Lyme disease, and West Nile virus infection), which are transmitted to humans by biting arthropods and wild rodents and are important causes of human morbidity and mortality.

At Yosemite National Park, the presence and potential transmission of various vector-borne diseases is well-documented. The following vector borne disease and surveillance data provided by the California Department of Public Heath, Vector-Borne Disease Section (VBDS) would underscore the need for continuous monitoring and surveillance:

1. as of 1984, there have been 63 animals that have tested positive for plague or exposure to plague bacteria (i.e., antibody positive) in Yosemite National Park,
2. there has been one human plague case associated with Yosemite National Park (1959) and approximately five additional human plague cases associated with the surrounding counties,
3. since 1975, there have been six TBRF human cases associated with Yosemite National Park, and
4. between August 2006 and September 2008, 12 animals (rodents) tested positive for exposure to *Borrelia hermsii* (the agent that can cause relapsing fever).

In 2012, an outbreak of hantavirus in Curry Village resulted in nine visitor infections, three of which resulted in fatalities. Three other human hantavirus cases, associated with the Tuolumne Meadows area, have also been documented. In recent years, cases of Lyme disease and other tick-borne diseases have been reported among park employees and visitors.

With this Cooperative Agreement, NPS and PHFE will collaborate on a five-year program to enhance the delivery of vector-borne disease services at Yosemite National Park. The primary elements of this program will include the following activities: (1) risk reduction, disease prevention and control, (2) visitor and employee education and training, (3) surveillance and (4) research. Initial projects will be developed in collaboration with NPS, PHFE, and collaborating partners, and priority will be given to projects requested by NPS or developed in response to outbreaks or case reports. Funded activities will include short-term projects (e.g. technical assistance, consultation), as listed in Attachment A, as well as on-going multi-year projects (through the ending period of this Cooperative Agreement) issued through Amendments to this Cooperative Agreement. Potential projects might include rodent testing and surveillance, visual inspections of structures for rodent infestations, development and delivery of training programs for employees, and development of educational materials for visitors.

The public purpose of this Cooperative Agreement will be the decreased risk of contracting vector-borne diseases through increased health education, vector surveillance and public health research.

ARTICLE II – LEGAL AUTHORITY

NPS is authorized by 16 U.S.C. §1g to enter into cooperative agreements that involve the transfer of National Park Service appropriated funds to state, local, tribal governments, other public entities, educational institutions, and private nonprofit organizations for the public purpose of carrying out National Park Service programs pursuant to 31 U.S.C. 6305.

ARTICLE III – STATEMENT OF WORK

A. **The PHFE agrees to :**

1. Collaborate with the State of California Department of Public Health and other prospective partners in seeking continued support and participation in the project entitled "Vector-Borne Disease Prevention Program for Yosemite National Park."
2. Collaborate with the NPS to develop appropriate public health projects for reducing the risk of vector-borne disease transmission in Yosemite National Park.
3. Work together with the NPS to implement and evaluate programmatic activities as listed in Attachment A.
4. Work with the State of California Department of Public Health to provide preventive education materials and to organize and lead personal protection and technical trainings for NPS employees, concessioner employees, partners, and visitors.
5. Meet at least annually with NPS to assess accomplishments of existing or recently accomplished projects and to identify and plan for anticipated activities and needs for the next year.

B. **The NPS agrees to:**

1. Collaborate with PHFE to develop appropriate public health projects for reducing the risk of vector-borne disease transmission in Yosemite National Park.
2. Work together with PHFE to implement and evaluate programmatic activities as listed in Attachment A and to share best practices with NPS officials and non-NPS agencies and organizations.
3. Assign David Miyako as the Agreements Technical Representative
4. Assign Matthew Weinburke as the Project Manager.
5. Facilitate consultation with regional and national NPS public health personnel knowledgeable about local public health issues, park management, and park infrastructure.
6. Assist PHFE and its partners in securing access to park properties and applying for permits, as needed.
7. Review and comment on reports and other documents prepared by PHFE describing activities for this program.
8. Collaborate with PHFE in developing and conducting trainings or meetings with NPS employees, concessioner employees, NPS partners, or NPS visitors.
9. Assign an NPS project officer responsible for program development and fiscal oversight.
10. Meet with PHFE at least annually to assess status of current activities and to identify needs and activities for next year.

ARTICLE IV – TERM OF AGREEMENT

This Agreement shall become effective on May 15, 2013 through May 15, 2018.

ARTICLE V – KEY OFFICIALS

A. Key officials are essential to ensure maximum coordination and communications between the parties and the work being performed. They are:

1. For the NPS:

   a. Agreements Technical Representative
   David Miyako, Management and Program Analyst
   Yosemite National Park
   9039 Village Drive
   P.O. Box 577
   Yosemite National Park, CA 95389
   Telephone: 209-471-9699
   Email: david_miyako@nps.gov

   b. Contracting Officer:
   Lilette Baltodano, Financial Agreements Officer
   National Park Service
   Pacific West Region
   333 Bush Street, Suite 500
   San Francisco, CA 94104
   Telephone: 415-623-2251
   Fax: 415-623-2384
   Email: lilette_baltodano@nps.gov

   c. Project Manager/Technical Contact:
   Matthew Weinburke, Public Health Officer
   Yosemite National Park
   9039 Village Drive
   P.O. Box 577
   Yosemite National Park, CA 95389
   Telephone: 209-379-1209
   Email: matthew_weinburke@nps.gov

2. For the PHFE:

   a. Giancarlo Cosavalente, Contracts Manager
   Public Health Foundation Enterprises, Inc.12801 Crossroads Parkway S, Suite 200
   City of Industry, CA 91746
   Telephone: 562-222-7837
   Fax: 562-699-9638
   Email: gcosavalente@phfe.org

   b. For CDPH (Program Manager)

   Vicki Kramer, Ph.D.
   Chief, Vector-Borne Disease Section California Department of Public Health
   1616 Capitol Ave., MS 7307 P.O. Box 997377 Sacramento, CA 95899-7377
   Telephone: 916-552-9730
   Fax: 916-552-9725
   Email: vicki.kramer@cdph.ca.gov

B. Communications – The PHFE will address any communications regarding this Agreement to the ATR with a copy to the Contracting Officer, and to the Superintendent of the area.

Communications that relate solely to routine operational matters described in the current work plan may be sent only to the Technical Advisory and ATR.

C. Changes in Key Officials – Neither the NPS nor the PHFE may make any permanent change in a key official without written notice to the other party reasonably in advance of the proposed change. The notice will include a justification with sufficient detail to permit evaluation of the impact of such a change in the scope or work specified within this Agreement. Any permanent change in key officials will be made only by modification to this Agreement.

ARTICLE VI – AWARD AND PAYMENT

A. NPS will provide financial assistance to PHFE in the amount of $50,000 for the work provided herein.

B. The FY13 chargeable appropriation and funding source for this Cooperative Agreement is as follows:

1. Cost Center: PPPWYOSES0
   Functional Area: PPMPRHS1Z.H00000

C. PHFE shall request payment in accordance with the following:

1. **Method of Payment.** Payment will be made by advance and/or reimbursement through the Department of Treasury's ASAP system.
2. **Requesting Advances.** Requests for advances must be made submitted via the ASAP system. Requests may be submitted as frequently as required to meet the needs of the Financial Assistance (FA) recipient to disburse funds for the Federal share of project costs. If feasible, each request should be timed so that payment is received on the same day that the funds are dispersed for direct project costs and/or the proportionate share of any allowable indirect costs. If same-day transfers are not feasible, advance payments must be as close to actual disbursements as administratively feasible.
3. **Requesting Reimbursement.** Requests for reimbursements must be submitted via the ASAP system. Requests for reimbursement should coincide with normal billing patterns. Each request must be limited to the amount of disbursements made for the Federal share of direct project costs and the proportionate share of allowable indirect costs incurred during that billing period.
4. **Adjusting payment requests for available cash.** Funds that are available from repayments to, and interest earned on, a revolving fund, program income, rebates, refunds, contract settlements, audit recoveries, credits, discounts, and interest earned on any of those funds must be disbursed before requesting additional cash payments.
5. **Bank Accounts.** All payments are made through electronic funds transfer to the bank account identified in the U.S Treasury ASAP system by the FA recipient.
6. **Supporting Documents and Agency Approval of Payments.** Additional supporting documentation and prior Agency (NPS) approval of payments may be required when/if a FA recipient is determined to be "high risk" or has performance issues. If prior Agency payment approval is in effect for an award, the ASAP system will notify the FA recipient when they submit a request for payment. The Recipient must then notify the NPS Contracting/Agreements Officer identified on the Assistance Agreement that a payment

request has been submitted. The NPS Contracting/Agreements Officer may request additional information from the recipient to support the payment request prior to approving the release of funds, as deemed necessary. The FA recipient is required to comply with these requests. Supporting documents may include invoices, copies of contracts, vendor quotes, and other expenditure explanations that justify the reimbursement requests.

D. In order to ensure proper payment, it is required that Recipient register with the System for Award Management (SAM), accessed at http://www.sam.gov. Failure to register can impact payments under this Agreement and/or any other financial assistance or procurement agreements Recipient may have with the Federal government.

E. Any award beyond the current fiscal year is subject to availability of funds; funds may be provided in subsequent fiscal years if project work is satisfactory and funding is available.

ARTICLE VII – PRIOR APPROVAL

The PHFE shall obtain prior approval for budget and program revisions, in accordance with OMB circular A-110 as codified by 2 CFR § 215.25.

ARTICLE VIII – PROPERTY UTILIZATION

All tools, equipment, and facilities furnished by the Park will be on a loan basis. Tools, equipment, and facilities will be returned in the same condition received except for normal wear and tear in project use. Property management standards set forth in 2 CFR §§ 215.33-35 apply to this Cooperative Agreement.

ARTICLE IX- LIABILITY

PHFE AGREES:

A. To indemnify, save and hold harmless, and defend the United States against all fines, claims, damages, losses, judgments, and expenses arising out of, or from, an act or omission of the PHFE, its officers, employees, or representatives arising out of or in any way connected to activities authorized pursuant to this Agreement. This obligation shall survive the termination of this Agreement.

B. To purchase public and employee's liability insurance at its own expense from a responsible company or companies with a minimum limitation of One Million Dollars ($1,000,000) per person for any one claim, and an aggregate limitation of Three Million Dollars ($3,000,000) for any number of claims arising from any one incident. The policies shall name the United States as an additional insured, shall specify that the insured shall have no right of subrogation against the United States for payments of any premiums or deductibles due thereunder, and shall specify that the insurance shall be assumed by, be for the account of, and be at the insured's sole risk. Prior to beginning the

work authorized herein, PHFE shall provide the NPS with confirmation of such insurance coverage.

C. To pay the United States the full value for all damage to the lands or the property of the United States used by PHFE, its officers, employees, or representatives.

D. To provide workers' compensation protection to PHFE officers, employees, and representatives.

E. To cooperate with the NPS in the investigation and defense of any claims that may be filed with the NPS arising out of the activities of the PHFE, its agents, and employees.

F. Additional Insurance Coverage:

a. PHFE shall purchase and maintain during the term of this Agreement extensions of the Comprehensive General Liability Coverage which provide Product Liability and Contractual Liability.

b. PHFE shall provide the following coverage with respect to vehicles owned and/or operated by PHFE: Comprehensive Automobile Liability and Uninsured Motorist Coverage as required by the State of California.

ARTICLE X - REPORTS AND/OR DELIVERABLES

A. Financial Reports: PHFE shall submit one original and two copies of the SF-425 Federal Financial Report on an annual basis and submitted to, Contracting Division, National Park Service, Pacific West Regional Office, 333 Bush Street, Ste 500, San Francisco, CA 94104, and to the Agreements Technical Representative listed in Article V, 9039 Village Drive, Yosemite NTPK, CA 95389.

a. The recipient will report program outlays and program income on a cash or accrual basis.

b. Reports are due 30 calendar days after the end of each federal fiscal quarter which ends on December 31, March 31, June 30, and September 30. A Final report is required to be submitted 90 days after the end of the agreement period and will include all financial transactions for the life of the award.

c. In addition, a Final Financial Report will be submitted 90 calendar days after the end of the award period, at expiration, or upon termination. Transactions which occurred after the award expired will also be included in the final reports. These expenses shall include wrap-up activities incurred during the project period and where the transaction occurred after the award expired. Transactions for the entire award period will be included in this final report and will reflect the transactions for the entire award amount.

d. All financial and programmatic records submitted by recipients, supporting documents, statistical records, and other grants-related records shall be maintained in accordance with 43 CFR §12.82 or §12.953, as applicable.

B. PHFE will provide an annual performance reports in accordance with 2 CFR § 215.51.

C. The Secretary of the Interior and the Comptroller General of the United States, or their duly authorized representatives, will have access for the purpose of financial or programmatic review and examination to any books, documents, papers, and records that are pertinent to the Agreement at all reasonable times during the period of retention in accordance with 2 CFR § 215.53.

D. The Secretary of the Interior and the Comptroller General of the United States, or their duly authorized representatives, will have access for the purpose of financial or programmatic review and examination to any books, documents, papers, and records that are pertinent to the Agreement at all reasonable times during the period of retention in accordance with 2 CFR§ 215.53.

ARTICLE XI – MODIFICATION AND TERMINATION

A. This Cooperative Agreement may be modified only by a written instrument executed by the parties.
B. This Cooperative Agreement may be terminated pursuant to 2 CFR § 215.60-62.

ARTICLE XII – CLOSEOUT PROCEDURES

A. This Cooperative Agreement shall be closed out in accordance with the procedures stated in 2 CFR §§ 215.70-73 or 43 CFR §§ 12.90-92, as applicable.
B. The recipient shall submit, within 90 calendar days after the end date of the award, all financial, performance, property, and other reports as required by the terms and conditions of the award. NPS may approve extensions when requested by the recipient.
C. Unless NPS authorizes an extension, the recipient shall liquidate all obligations incurred under the award not later than 90 calendar days after the end date of the agreement.
D. The recipient shall promptly refund any balances of unobligated cash that NPS has advanced or paid and that are not authorized to be retained by the recipient for use in other projects.
E. The recipient shall account for any real and personal property acquired with Federal funds or received from NPS in accordance with 2 CFR §§ 215.31-37 or 43 CFR §§ 12.71-74, as applicable.

ARTICLE XIII – GENERAL AND SPECIAL PROVISIONS

A. General Provisions
OMB Circulars and Other Regulations – The following OMB Circulars and other regulations are incorporated by reference into this Cooperative Agreement:

1. Administrative Requirements:

   a. 2 CFR Part 215 (OMB Circular A-110), "Uniform Administrative Requirements for Grants and Agreements with Institutions of Higher Learning, Hospitals, and other Non-Profit Organizations"

2. Determination of Allowable Costs:

   a. 2 CFR Part 230 (OMB Circular A-122), "Cost Principles for Non-Profit Organizations."

3. Audit Requirements:

   a. OMB Circular A-133, "Audits of States, Local Governments, and Non-Profit Organizations."

4. Code of Federal Regulations/Regulatory Requirements (as applicable):

   a) 43 CFR Part 12, Subpart E, "Buy American Requirements for Assistance Programs"

   b) 43 CFR Part 43, "Government-wide Requirements for a Drug-Free Workplace"

   c) 2 CFR Part 1400, "Non-Procurement Debarment and Suspension," previously located at 43 CFR Part 42, "Government-wide Debarment and Suspension (Non-Procurement)"

   d) 43 CFR Part 18, "New Restrictions on Lobbying"

   e) 2 CFR Part 175, "Trafficking Victims Protection Act of 2000"

   f) FAR Clause 52.203-12, Paragraphs (a) and (b), "Limitation on Payments to Influence Certain Federal Transactions."

   g) 2 CFR Part 25, Central Contractor Registration and Data Universal Numbering System"

   h) 2 CFR Part 170, "Reporting Subawards and Executive Compensation"

5. Buy American Act: Pursuant to section 307 of the Omnibus Consolidated Appropriations Act of 1997, Public Law 104-208, 110 Stat. 3009, Recipient agrees to follow the requirements in 43 CFR Part 12, Subpart E, Buy American Requirements for Assistance Programs: In the case of any equipment or product that may be authorized to be purchased with financial assistance provided using funds made available in this Act, it is the sense of the Congress that entities receiving the assistance should, in expending the assistance, purchase only American-made equipment and products.

6. Non-Discrimination: All activities pursuant to this Agreement shall be in compliance with the requirements of Executive Order 11246, as amended; Title VI of the Civil Rights Act of 1964, as amended, (78 Stat. 252; 42 U.S.C. §§2000d et seq.); Title V, Section 504 of the Rehabilitation Act of 1973, as amended, (87 Stat. 394; 29 U.S.C. §794); the Age Discrimination Act of 1975 (89 Stat. 728; 42 U.S.C. §§6101 et seq.); and with all other federal laws and regulations prohibiting discrimination on grounds of race, color, sexual orientation, national origin, disabilities, religion, age, or sex.

7. Lobbying Prohibition: 18 U.S.C. §1913, Lobbying with Appropriated Moneys, as amended by Public Law 107-273, Nov. 2, 2002 - No part of the money appropriated by any enactment of Congress shall, in the absence of express authorization by Congress, be used directly or indirectly to pay for any personal service, advertisement, telegram, telephone, letter, printed or written matter, or other device, intended or designed to influence in any manner a Member of Congress, a

jurisdiction, or an official of any government, to favor, adopt, or oppose, by vote or otherwise, any legislation, law, ratification, policy, or appropriation, whether before or after the introduction of any bill, measure, or resolution proposing such legislation, law, ratification, policy, or appropriation; but this shall not prevent officers or employees of the United States or of its departments or agencies from communicating to any such Members or official, at his request, or to Congress or such official, through the proper official channels, requests for legislation, law, ratification, policy, or appropriations which they deem necessary for the efficient conduct of the public business, or from making any communication whose prohibition by this section might, in the opinion of the Attorney General, violate the Constitution or interfere with the conduct of foreign policy, counter-intelligence, intelligence, or national security activities. Violations of this section shall constitute violations of section 1352(a) of title 31. In addition to the above, the related restrictions on the use of appropriated funds found in Div. F, § 402 of the Omnibus Appropriations Act of 2008 (P.L. 110-161) also apply.

8. Anti-Deficiency Act: Pursuant to 31 U.S.C. §1341 nothing contained in this Agreement shall be construed as binding the NPS to expend in any one fiscal year any sum in excess of appropriations made by Congress, for the purposes of this Agreement for that fiscal year, or other obligation for the further expenditure of money in excess of such appropriations.

9. Minority Business Enterprise Development: Executive Order 12432 – It is national policy to award a fair share of contracts to small and minority firms. NPS is strongly committed to the objectives of this policy and encourages all recipients of its Cooperative Agreements to take affirmative steps to ensure such fairness by ensuring procurement procedures are carried out in accordance with 43 CFR § 12.944 for Institutions of Higher Education, Hospitals and Other Non-Profit Organizations, and 43 CFR § 12.76 for State and Local Governments.

10. Assignment: No part of this Agreement shall be assigned to any other party without prior written approval of the NPS and the Assignee.

11. Member of Congress: Pursuant to 41 U.S.C. § 22, no Member of Congress shall be admitted to any share or part of any contract or agreement made, entered into, or adopted by or on behalf of the United States, or to any benefit to arise thereupon.

12. Agency: The Partner is not an agent or representative of the United States, the Department of the Interior, NPS, or the Park, nor will the Partner represent its self as such to third parties. NPS employees are not agents of the Partner and will not act on behalf of the Partner.

13. Non-Exclusive Agreement: This Agreement in no way restricts the Partner or NPS from entering into similar agreements, or participating in similar activities or arrangements, with other public or private agencies, organizations, or individuals.

14. Survival: Any and all provisions which, by themselves or their nature, are reasonably expected to be performed after the expiration or termination of this Agreement shall survive and be enforceable after the expiration or termination of this Agreement. Any and all liabilities, actual or contingent, which

have arisen during the term of and in connection with this Agreement and in connection with this Agreement shall survive expiration or termination of this Agreement.

15. Partial Invalidity: If any provision of this Agreement or the application thereof to any party or circumstance shall, to any extent, be held invalid or unenforceable, the remainder of this Agreement or the application of such provision to the parties or circumstances other than those to which it is held invalid or unenforceable, shall not be affected thereby and each provision of this Agreement shall be valid and be enforced to the fullest extent permitted by law.

B. Special Provisions

1. Public Information and Endorsements

   a. PHFE shall not publicize or otherwise circulate, promotional material (such as advertisements, sales brochures, press releases, speeches, still and motion pictures, articles, manuscripts or other publications) which states or implies Governmental, Departmental, bureau, or government employee endorsement of a product, service, or position which PHFE represents. No release of information relating to this Agreement may state or imply that the Government approves of PHFE's work products, or considers Recipient's work product to be superior to other products or services.

   b. The PHFE will ensure that all information submitted for publication or other public releases of information regarding this project will carry the following disclaimer:

      "The views and conclusions contained in this document are those of the authors and should not be interpreted as representing the opinions or policies of the U.S. Government. Mention of trade names or commercial products does not constitute their endorsement by the U.S. Government."

   c. PHFE will obtain prior NPS approval from the regional public affairs office for any public information release which refers to the Department of the Interior, any bureau or employee (by name or title), or to this Agreement. The specific text, layout, photographs, etc. of the proposed release must be submitted to the ATR who will forward such materials to the public affairs office, along with the request for approval.

   d. The PHFE agrees to include the above provisions of this Article in any subaward to any subrecipient, except for a subaward to a state government, a local government, or to a federally recognized Indian tribal government.

2. Publications of Results or Studies

   No party will unilaterally publish a joint publication without consulting the other party. This restriction does not apply to popular publication of previously published technical matter. Publications pursuant to this Agreement may be produced independently or in collaboration with others; however, in all cases proper credit will be given to the efforts of those parties contribution to the publication. In the event no agreement is reached concerning the manner of publication or

interpretation of results, either party may publish data after due notice and submission of the proposed manuscripts to the other. In such instances, the party publishing the data will give due credit to the cooperation but assume full responsibility for any statements on which there is a difference of opinion.

3. Prohibition on Text Messaging and Using Electronic Equipment Supplied By the Government While Driving

   Executive Order 13513, Federal Leadership on Reducing Text Messaging While Driving was signed by President Barack Obama on October 1, 2009 (ref.: http://edocket.access.gpo.gov/2009/pdf/E9-24203.pdf). This Executive Order introduces a Federal Government-wide prohibition on the use of text messaging while driving on official business or while using Government-supplied equipment. Additional guidance enforcing the ban will be issued at a later date. In the meantime, please adopt and enforce policies that immediately ban text messaging while driving company owned or rented vehicles, government-owned or leased vehicles, or while driving privately owned vehicles when on government business or when performing any work for or on behalf of the federal government.

ARTICLE XIV – ATTACHMENTS

The following attachments are hereby incorporated into this Cooperative Agreement. In the event of any apparent conflict between the terms of the Cooperative Agreement and the attachments, the terms of the Cooperative Agreement, including its designations and modifications, will prevail.

A. Project Plan
B. Budget
C. Reporting Schedule
D. Standard Form 424, Application for Federal Assistance (incorporated by reference)
E. Standard Form 424A, Budget for Non-Construction (incorporated by reference)
F. Standard Form 424B, Assurances for Non-Construction (incorporated by reference)
G. Standard Form 425, Federal Financial Report (incorporated by reference)
H. Certification Regarding Lobbying from Grants.gov(incorporated by reference)

ARTICLE XV – AUTHORIZING SIGNATURES

IN WITNESS WHEREOF, the parties hereby execute this Agreement on the date set forth below.

FOR THE PUBLIC HEALTH FOUNDATION ENTERPRISES, INCORPORATED

Nancy C. Kindelan for Patti — 5.24.13

Nancy C. Kindelan
Chief Executive Officer

Date

FOR THE NATIONAL PARK SERVICE

Lilette J. Baltodano — 5/29/13

Lilette J. Baltodano
Financial Agreements Officer

Date

Attachment A

Project Plan – FY13 "Vector-Borne Disease Prevention Program for Yosemite National Park"

1. Assess New Boys Town Tent Cabins for rodent harborage, signs of rodent infestation, and areas of potential rodent ingress by the end of May 2013.

Centers for Disease Control (CDC) and California Department of Public Health (CDPH) supported the closure of Signature Tent cabin structures based on their conclusion that the outbreak appeared to be associated with guests occupying these structures. The new structures will be ready for occupancy by mid April 2013.

2. Conduct a rodent exclusion assessment to include identifying rodent harborage, signs of rodent infestation, and areas of potential rodent ingress in select Curry Village and select Tuolumne /High Sierra Complex tent cabins (including structures at the Ranger Camp) by the end of September 2013.

Guest and employee housing and workplaces should continue to be evaluated for potential rodent infestation, and existing rodent exclusion activities should take place on an ongoing basis. CDC and CDPH stated that reducing rodent access to tent cabins is a high priority. Select employee and guest tent cabins at Curry Village and at the Tuolumne/High Sierra Complex areas (including the structures at the Ranger Camp) should be evaluated for rodent harborage, signs of rodent infestation, and areas of potential rodent ingress.

3. Conduct an assessment of Yosemite National Park's (YNP) rodent population control program to include deer mouse hantavirus seroprevalance trapping and testing in Curry Village and Tuolumne Meadows by the end of September 2013.

CDC and CDPH stated that an active mouse control program should be maintained in developed areas year-round, with an increase in the intensity of activity in response to increased mouse activity. This would include an assessment of areas where exclusion is not possible, such as Housekeeping camp. The assessment would include an evaluation of long-term rodent population monitoring being conducted by the concessionaire. As resources allow, it would be useful to compare the deer mouse (*Peromyscus* species) hantavirus sero prevalence testing in Tuolumne Meadows and/or Curry Village with the testing conducting in 2012 and the previous years. A priority will be given to Curry Village for sero prevalence testing due to the 2012 hantavirus illness exposures linked to this location. As resources allow, it would also be useful (ecological analysis) to compare an area with active rodent population reduction measures to an area without active measures.

4. Assess the concessioner's record-keeping program at Curry Village and other select areas by the end of September 2013.

As a follow up to the 2012 YNP hantavirus outbreak, CDC and CDPH recommended that the concessioner conduct an ongoing assessment and documentation program. Elements should include registering rodent-related complaints, rodent exclusion activities, and conducting an on-site follow-up of whether mitigation efforts were effective. Initial contact with the concessioner should be made in April to ensure appropriate record keeping and other measures are in place.

5. Assess the public education efforts conducted by the park and by the concessioner by the end of May 2013.

Efforts to make the public aware of hantavirus transmission and prevention should continue. CDPH would assess both the park's and concessioner's public education efforts at select lodging sites, entry

kiosks, interpretive facilities, and other locations. CDPH would also evaluate hantavirus prevention information on the YNP website.

6. Evaluate the effectiveness and scope (i.e. participating rate and type of training) of park, concessioner, and partner employee hantavirus training by the end of September 2013.
All employees should continue to be regularly briefed about hantavirus transmission and risk reduction measures in relation to their job duties and living situation. There are two types of training being conducted at Yosemite: Basic and Advanced. The basic training is awareness training, with a discussion on light infestation cleanup. The advanced training is a higher risk training targeted to employees that perform heavy infestation cleanup.

7. Assess park, concessioner, and partner employees' safety and risk reduction, specific to hantavirus, by the end of September 2013.
Employees should continue to be provided with the materials necessary to perform safe clean-up procedures. All employees should document receipt of hantavirus training, and document that they have read and understand the YNP Hantavirus Risk Reduction Directive #9.

8. Provide vector-borne disease prevention information to YNP, including information on plague, tick borne relapsing fever (TBRF) and Lyme disease by July 2013. Information will include recommendations for risk reduction. According to CDPH-Vector Borne Disease Section (VBDS), the following data would substantiate the need for further vector borne disease prevention measures: a. as of 1984, there have been 63 animals that have tested positive for plague in YNP, b. as of 1959, there has been one human plague case associated with YNP and approximately five additional human plague cases associated with the surrounding counties, c. as of 1975, there have been six TBRF human cases associated with YNP, and d. between August 2006 and September 2008, 12 animals (rodents) tested positive for Borrelia hermsii (the agent that can cause TBRF).

Attachment B

FY13 Budget

Category	Quantity	Unit Price	Total Cost	Description
Biologist	1 FTE x 4 months	5,605	22,420	Scientists and biologists to conduct testing and sampling in Curry Village and Tuolumne Lodge Area
Student - Trainee	1 FTE x 3 months	2,415	7,245	
Travel	10 days, 4 FTE	200	8,000	Required travel for onsite inspections
Supplies and Equipment	1	lump	7,872	PPE, Needles, Specimen containers, bait, trapping and sampling supplies
Subtotal			**$ 45,537**	
Administrative fee (9.8%)			4,463	
Total			**$ 50,000**	

Attachment C

Financial Reporting Schedule

Item	Date
SF-425 Federal Financial Reports	30 calendar days after the end of each federal fiscal quarter which ends on December 31, March 31, June 30, and September 30.
Final SF-425 Federal Financial Report	90 calendar days after the end of the award period, at expiration, or upon termination.
Annual performance reports in accordance with 2 CFR § 215.51	Annually, due on December 31 of each year
Annual Meeting per Article II.A.5.	Annually

APPENDIX D

Yosemite National Park Directive # 9 Hantavirus Risk Reduction Program

National Park Service
Yosemite National Park

Yosemite National Park Directive # 9: Hantavirus Risk Reduction Program

Approved: */s/ Don L. Neubacher* (original signature on file)

Effective Date: August 1, 2013

Table of Contents

1. Background and Purpose

The purpose of this Directive is to protect all Yosemite National Park (YOSE) employees, volunteers (VIP), concessioners, and visitors from all hazards associated with hantavirus exposure.

Several hantaviruses that are pathogenic to humans have been identified in the United States. Hantavirus Pulmonary Syndrome [i] (HPS) is a severe, sometimes fatal, respiratory disease in humans caused specifically by infection with Sin Nombre Virus, which is the primary causative agent of HPS in the U.S., including Yosemite National Park.

The best, currently available, approach for hantavirus disease control and prevention is risk reduction through environmental modification and hygiene practices that deter rodents (mice and rats) from colonizing work environments and homes, as well as safe cleanup of rodent waste and nesting materials. All persons should limit their exposure, and avoid contact with all mice and rats in Yosemite National Park. The precautions described in this directive are broadly applicable to limiting this exposure.

The **universal precautions** method is strongly recommended for all employees when engaged in any activity that may expose the employee to hantavirus. All persons should treat all mice and rats as potentially infected/infectious hosts of HPS causing hantaviruses.

2. Authority

a. NPS Directors Order #83, Public Health NPS Directors Order #50B, Section 1, Safety Program Management

b. OSHA, General Duty Clause Section (5)(a)(1) OSHA

c. Center for Disease Control and Prevention (CDC), http://www.cdc.gov/hantavirus/

d. CDC, MMWR July 26, 2002, Vol. 51, No. RR09

e. California Department of Public Health, Vector Borne Disease Section, http://www.cdph.ca.gov/HealthInfo/discond/Pages/HantavirusPulmonarySyndrome.aspx

f. Yosemite National Park Respiratory Protection Policy (January, 2008)

g. NPS Rodent Exclusion Manual, Mechanical Rodent Proofing Techniques (March, 2005)

h. NPS Directors Order #50B, RM 50B- Occupational Safety and Health Program

3. Policy

It is park policy to provide a safe place of employment, free from recognized hazards that may cause serious physical harm or death.

4. Scope

This is a park wide policy that applies to all YOSE employees, volunteers (VIP), and contractors potentially exposed or exposed to a hantavirus infection in the course of their duties.

5. Definitions

a. Hantavirus

Hantaviruses are a group of viruses that may be carried by some rodents. Some hantaviruses can cause a rare but deadly disease called HPS. Although there are several hantaviruses that exist in California, HPS in the western U.S. is caused by a specific hantavirus, called Sin Nombre Virus (SNV). In California, only deer mice (*Peromyscus maniculatus*) carry and shed SNV. Infected rodents shed hantavirus in their urine, droppings, and saliva. Any person can become infected through contact with hantavirus-infected rodents or their urine and droppings.

b. Hantavirus Pulmonary Syndrome

Infection with hantavirus can progress to HPS, which can be fatal. HPS is a febrile illness characterized by respiratory compromise usually requiring supplemental oxygen and clinically resembling Acute Respiratory Disease Syndrome (ARDS). Symptoms include fever, chills, myalgia, headache, and gastrointestinal symptoms. Most HPS patients become infected by breathing air contaminated with rodent urine, droppings, or saliva, such as when cleaning out a rodent-infested space. This most commonly occurs in small, confined spaces where there is little air circulation. To date, no cases of HPS have been reported in the United States in which the virus was transmitted from one person to another.

Although it is more accurate to call the virus Sin Nombre Virus, for purposes of standardization and uniformity, this directive will further refer to the virus as hantavirus.

6. Responsibilities

a. Roles and Responsibilities

i. The superintendent of YOSE is responsible for the overall implementation of this policy, and for providing necessary program funds.

ii. Division chiefs are responsible for ensuring all managers and supervisors, within their divisions, are aware of this policy, and have all of the necessary resources involved to implement and maintain the YOSE Hantavirus Program.

iii. Managers are responsible for ensuring that potentially exposed employees have received hantavirus awareness training as required in this program. Employees should also receive any other pertinent program, such as Respiratory Protection and Hazard Communication, before beginning clean-up activities, and these employees should be provided the required personal protective equipment.

iv. Supervisors and work leaders will also ensure that employees are properly equipped and trained to safely perform rodent activity assessments when entering a seasonally-closed building which has not been previously cleaned. Supervisors and work leaders will also ensure that employees, engaged in cleaning activities, use proper personal protective equipment as directed by this policy.

v. The Safety and Occupational Health Manager is responsible for developing and maintaining the YOSE Hantavirus Program, for prescribing adequate personal protective measures and equipment for all employees having potential exposure, and for providing hantavirus awareness training to employees.

vi. The Environmental Health Officer is responsible for coordinating and implementing the park-wide Hantavirus Directive with park concessionaires and other park partners. The Environmental Health Officer ensures that YOSE employees, park concessioners, and partners utilize adequate personal protective measures and equipment. The Environmental Health Officer also ensures that hantavirus training is completed.

vii. Park employees working at YOSE facilities are responsible for following the procedures of this policy in accordance with instructions and the training they have received. Upon training completion, all YOSE employees will be responsible for assessing rodent activity in park facilities and performing light infestation cleanup in accordance with the protocol in this policy.

viii. Building and Grounds supervisors are also responsible for identifying and assigning employees who will perform heavy rodent infestation clean up.

7. Procedures

a. Exposure Assessment: General

i. All employees should assess the situation to determine if an infestation is light or heavy. A risk assessment for a specific hazard can be completed by using the Severity, Probability, Exposure (SPE) model. Appendix A provides an overview of the SPE model, appendix B provides two hantavirus case scenarios using the SPE model, and appendix D provides an SPE model risk assessment for hantavirus.

ii. An infestation is considered light if there are few droppings in one area, a few nests, and one to two live or dead rodents. All employees should be able to follow the light infestation procedure in 7(c) in order to properly remove the light infestation.

iii. An infestation is considered heavy if piles of feces or numerous nests or live or dead rodents are observed. All heavy infestations will be removed by trained personnel.

b. Exposure Assessment: Seasonally Closed Unoccupied Building or Structures

i. An assessment by a trained YOSE employee shall be made during the entry of seasonally closed unoccupied buildings and/or confined spaces in order to determine the level of rodent activity. All affected employees are responsible for performing these assessments, and are required to follow the YOSE Hantavirus Assessment protocol below for hantavirus exposure.

ii. **WARNING:** Inhalation of airborne particles is the primary exposure route. When an employee begins assessing or cleaning, it is important that employees **do not** stir up dust by sweeping or vacuuming up droppings, urine, or nesting materials.

iii. If only minimal intrusion into the structure is necessary at the time the building is opened, (i.e., an employee needs to pick up a tool, and this activity will not stir up any dust), it is under these circumstances likely safe to enter the building briefly to conduct this type of activity. If more involved activities are necessary that may stir up dust or debris, or if the building will be occupied for a period of time by one or more individuals, then cleaning of rodent materials will be necessary.

iv. Open all doors and allow for natural ventilation for 30 minutes, using cross ventilation whenever possible. Ventilation will aid in the removal of any aerosolized virus inside the structure.

v. In order to assess the seasonally closed building for rodent infestation, put on a P-100 respirator, and enter the structure/building. All employees using a P-100 or other Respirator Protection Program required respirator shall be medically cleared and respirator fit tested in accordance with the YOSE Respirator Protection Program.

vi. Assess the rodent activity. Look for rodent droppings, urine stains, dead rodents, and nesting material. Do not perform any activity creating dusty conditions during the assessment. Determine whether it is a light of heavy infestation and treat accordingly. If structure shows signs of light infestation (as in most cases), follow the light infestation clean up procedures in section 7(c). If the structure shows signs of heavy infestation, follow the heavy infestation clean up procedures in section 7(d).

vii. Upon completion of assessment, wash hands and face with warm soap and water to prevent potential dermal exposure.

c. Light Infestation Cleanup Procedures: All YOSE Employees, volunteers (VIP), and contractors should follow the following guidelines for cleanup procedures for a light infestation

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i. Put on rubber, latex, nitrile or vinyl gloves. A respirator and goggles can be used, but is not required. The use of a respirator requires medical clearance and annual fit testing. Respirators are not considered protective if facial hair interferes with the face seal or fit testing has not been performed in the previous year, since proper fit cannot be assured. Respirator use practices should be in accordance with Yosemite National Park's Respirator Fit Program, and should be supervised by a knowledgeable person. See section 7d (ii) for further details.

ii. Do not sweep or vacuum droppings, urine or nesting materials, as contaminated dust will become airborne.

iii. Saturate dead rodents, rodent droppings, and urine stained area with a disinfectant filled spray bottle. A general purpose commercial disinfectant can be used if it is prepared according to the label, and it is not pre-diluted. Almost any agent commercially available in the U.S. is sufficient, as long as the label states that it is a disinfectant certified by the Environmental Protection Agency, as indicated on the product label. A chlorine solution freshly prepared by mixing 1 ½ cups of household bleach in 1 gallon of water (1:10 solution) can be used in place of a general purpose commercial disinfectant. Chlorine is corrosive. When using chlorine solution, avoid spilling the mixture. Chlorine solutions should be prepared fresh daily in order to be effective. Wait 10-15 minutes after saturating the area before cleanup.

iv. Use a paper towel to pick up the urine and droppings, and dispose of the waste in the garbage. Place a disinfected dead rodent or rodent nest in a plastic bag, seal, place in a second plastic bag, and discard. Avoid cleaning activities that create airborne dust particles.

v. After the rodent droppings and urine have been removed, disinfect items that might have been contaminated by rodents or their urine and droppings.

vi. Disinfect carpets with an approved disinfectant (see 7c (iii) for guidance on disfectants).

vii. Disinfect reusable gloves before removing or discard disposable gloves appropriately. Dispose of respirator if made for single-use or clean and disinfect if multi-use.

viii. Wash hands immediately with warm soap and water upon leaving work area.

d. Heavy Infestation Cleanup Procedures: Employees must be properly trained to perform a heavy infestation cleanup

i. If the building has been closed and unoccupied, ventilate by opening doors and windows for a minimum of 30 minutes before beginning any work. Use cross ventilation whenever possible. Leave area during this period.

ii. Persons performing the cleanup should wear machine washable coveralls or disposable suits (e.g.Tyvek suits), disposable shoe covers (e.g. Tyvek Booties), rubber, latex, vinyl, or nitrile gloves, protective goggles, and a tight-fitting negative pressure respirator equipped with N-100 or P-100 rated filters. As an alternative to wearing disposable shoe covers, persons can wear gumboots or workboots that can be washed and disinfected. A Power Air Respirator (PAPR) could be used if the user has been properly trained and approved by the YOSE Safety, Health, and Environmental Office. **(Important: Federal law requires employees be medically evaluated, trained and fit-tested annually for the use of this type of respiratory protection.)**

iii. Spray dead rodents, droppings, and urine with a disinfectant (see above for disinfectants in section 7c [iii]) until completely saturated. Remember to avoid creating dusts or aerosols and do not vacuum or dry sweep up any materials until they have been completely saturated with the disinfectant solution for at least 10 minutes.

iv. Using paper towel or dispensable rags, wipe up and remove the material. Unless burned, all waste material shall be double-bagged and sealed. Discard as normal solid waste.

v. All PPE shall be decontaminated using a disinfectant at the end of the work shift before it is removed. However use soap and water rather than disinfectant to clean the face and any other exposed skin. If necessary, disinfect goggles and respirators after they have been removed. If disposable Tyvek suits or coveralls are not used, immediately remove and launder work clothing

with regular clothing detergent. UV or sunlight is also key to breaking down or destroying the virus; leaving equipment exposed to sunlight is helpful.

vi. Wash hands, face, and any other exposed skin with warm soap and water upon completion of job.

vii. **WARNING:** Persons developing a high fever or respiratory illness within 45 days of last potential exposure should notify their supervisor immediately and seek medical attention. Inform the physician of the potential occupational risk of hantavirus infection.

8. Program Requirements

a. Hantavirus Exposure

i. Although hantavirus in California is found only in deer mice and is excreted in the deer mouse's urine, feces, and saliva, YOSE employees must take a universal precautions approach, and assume all rodent (rat and mice) excreta, urine, and saliva may contain hantavirus or other rodent borne pathogens. YOSE employees must recognize that these fluids are potentially harmful, and take precautions against contact and/or exposure.

ii. Occupational exposure to hantavirus is most often through inhalation of infectious airborne particles. However, other potential exposure routes include dermal/direct contact with the virus through breaks in the skin, membranes, and the eyes. All employees should treat all mice and rats as potential hosts of HPS causing hantaviruses, and each mouse or rat as though it were infected and infectious.

iii. WARNING: Symptoms of hantavirus infection occur from 1 to 6 weeks after exposure. Early symptoms include fatigue, fever, muscle aches, headaches, chills, dizziness, and abdominal pain. Approximately 10 days following initial symptoms, additional symptoms appear, including cough, shortness of breath, and respiratory distress. If a person exhibits these symptoms and has been in contact with rodents or their body fluids (feces, urine, etc.), they should contact a physician immediately and inform them of potential rodent exposure.

b. Prevention of Rodent Infestation

i. The most significant and effective method to prevent exposure to hantavirus is to eliminate or minimize contact with rodents. Making homes and workplaces unattractive to mice will lessen employee risk of exposure to the virus.

ii. Eliminate rodents by reducing the availability of food sources and nesting sites used by rodents inside homes, cabins, and other buildings. Store garbage inside homes in rodent proof metal or plastic containers with tight fitting lids. If storing garbage outside, ensure that proper rodent and bear proof containers are used within YOSE.

iii. Wash dishes and cooking utensils immediately after use, and immediately store them in an area not accessible to rodents. Keep area as clean as possible to prevent rodent harborage.

iv. Do not leave pet food in feeding dishes. Dispose of trash and clutter.

v. Continuously use spring-loaded rodent traps in buildings. Keep all food (including pet food) and water covered and stored in rodent proof containers with tight fitting lids.

c. Reduce Rodent Shelter and Food Sources Within 100 Feet of Homes

i. When possible, place woodpiles 100 feet or more from buildings, and elevate wood at least 12 inches off of the ground.

ii. Store grains and animal feed in rodent-proof containers.

iii. Near buildings, remove food sources which might attract rodents or store food and water in rodent-proof containers.

iv. Store hay on pallets to keep hay free of rodents. Elevate 12 inches if possible, and use traps continuously.

v. Dispose of garbage and trash in rodent-proof containers that are elevated at least 12 inches off of the ground.

vi. Haul away trash and other items that may serve as rodent nesting sites.

vii. Cut grass, brush, and dense shrubbery within at least 30 feet of buildings. Do not use dense ground covers in landscaping.

viii. Place spring-loaded rodent traps in likely areas of rodent shelter within 100 feet around buildings, and use continuously.

ix. Eliminate water sources: standing water (barrels, buckets) and/or leaky faucets or pipes.

d. Engineering Controls Utilized at the Job Site

i. The use of tools, such as a dust pan and wet brush, to collect all wet materials and disinfected materials suspected of being contaminated, is suggested. Place these waste materials into a properly doubled waste bag, this will reduce the possibility of infection. A properly functioning HepaVac may be utilized after potentially infected materials have been properly disinfected and removed by properly trained personnel.

ii. Provide an approved disinfectant for the immediate decontamination of suspect materials.

iii. Provide hand washing facilities, with potable water, which should be readily accessible to potentially exposed employees.

iv. Provide soap, antiseptic hand cleanser, and disposable towels or antiseptic towelettes.

v. Require employees to wash their hands immediately after removing contaminated gloves or other personal protective equipment.

vi. Employees should wash hands, face, and any other exposed skin with warm soap and water upon completion of job. Employees should wash any area of the body, and flush mucous membranes with water, as soon as possible after contact with potentially infectious materials.

vii. Utilize procedures listed above involving clean-up of rodent infestations or other potentially infectious materials to ensure that splashing, spraying, splattering, and the generation of dust and droplets are minimized.

viii. All items and equipment found to be contaminated will either be decontaminated or it will be appropriately labeled and disposed of properly.

ix. Mammalogists/wildlife biologists handling wild rodents for research and management must follow NPS Reference, RM 50B: Safe work practices for employees handling wildlife.

e. Training and Education

i. All YOSE employees are authorized to perform hantavirus assessments, light infestation and general housekeeping clean-up of rodent excreta, and nesting material. Employees shall be knowledgeable and trained in the protocols listed in this program and have the ability to take the appropriate precautions against hantavirus. Employees will receive training in the following areas:

a. The epidemiology and symptoms of hantavirus infection and hantavirus pulmonary syndrome.

b. YOSE's hantavirus assessment and clean up protocol and how to recognize tasks that may involve exposure.

c. A review of the engineering controls, work practices, and personal protective equipment required to reduce or eliminate exposure.

ii. Supervisors are responsible for ensuring that employees engaged in exposure assessments, cleanup of unoccupied buildings and cleanup of heavy infestations receive annual training in the following areas:

a. Hantavirus awareness

b. Personal protective equipment

c. Respiratory protection and fit-testing

[i] While the CDC still uses the term HPS, CDPH prefers the term, Hanta Cardio Pulmonary Syndrome (HCPS) because of the cardio aspect of the disease has a significant clinical influence on the outcome of the case and patient.

APPENDIX E

National Park Service Rodent Exclusion Manual

NATIONAL PARK SERVICE
RODENT-EXCLUSION MANUAL

MECHANICAL
RODENT-PROOFING
TECHNIQUES

A Training Guide
For National Park Service Employees

Revision of March 2005

Originally prepared and printed in 1997
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NATIONAL PARK SERVICE

CONTENTS

SUMMARY

Controlling rodents in buildings is very important from the perspectives of both their potential effects on human health and their possible damage to physical structures. Rodent control can be an attainable goal, but it always demands more than randomly setting out a few traps. The most important consideration of all is that *rodents must be prevented from entering the building (or room)*. This demands cooperative efforts among all involved persons—that is, building occupants, pest management professionals, maintenance staff, and site managers—in frequently inspecting buildings and promptly closing small, seemingly unimportant holes. The importance of good sanitation practices and effective trapping and monitoring programs cannot be overstated. These measures are neither complicated nor excessively difficult; however, rodent control is usually unsuccessful when these critical steps are not fully undertaken.

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NATIONAL PARK SERVICE
RODENT-EXCLUSION MANUAL

Mechanical Rodent-proofing Techniques

INTRODUCTION

Rodents have probably been a common problem in human living and working environments since humans began living in permanent dwellings. Even today, many people believe that rodent infestations are "inevitable." However, the recent appearance of hantavirus (also known as sin nombre virus, hantavirus pulmonary syndrome, HPS) in the Western states has re-awakened the public to the serious health consequences posed by rodents, and has prompted new inquiries into more effective ways to manage infestations.

This manual is designed as a training guide to making rodent control in buildings an attainable goal.

MECHANICAL RODENT-CONTROL METHODS

The control of rodents in buildings is not complicated, but it always involves much more than simply setting out a few mousetraps or a package of rat poison. To be effective, rodent control must be done in a professional manner, and should be handled as a cooperative among between site occupants, pest management professionals, and site management and maintenance staff.

At a minimum, the successful control of rodents in structures requires the following (not in priority order):

- ***Basic knowledge of rodent biology.*** A fundamental understanding of the habits and reproductive abilities of different species of rodents is helpful in knowing where to look for signs of animals, and in the selection of the best control measures.

- ***Basic knowledge of National Park Service policy.*** Native rodents are protected under National Park Service policy. This policy promotes the use of rodent exclusion methods—that is, keeping them outside in their natural habitats. (*Note: Management strategies will differ inside and outside, and are prescribed on a case-by-case basis.)*

- ***Thorough inspection of the exterior and interior of a building***. The main purpose of an inspection is to identify structural defects that allow rodents to enter buildings. Inspections also provide information about the species of rodents present, key shelter areas, and locations where animals obtain food and water, and also to identify conditions around buildings that favor infestations. These findings are used to set priorities for repairs needed to keep animals out of buildings, and to make recommendations for changes in conditions that support rodent populations.

- ***Effective exclusion.*** Rodent control in structures is based on one simple rule: *Rodents must be prevented from entering a building (or room).* Excluding rodents by closing all possible holes though which they can enter a structure is always the most important measure against infestation.

- ***Good sanitation practices that eliminate food, water, and shelter for rodents.*** Good sanitation removes water, food, and shelter resources required by rodents, and limits the number of animals that can live in an area. Good sanitation is very important for controlling rodent populations, but even the best of sanitation measures will not prevent infestations where exclusion is inadequate.

- ***Continual removal of 85% to 95% of the rodents capable of reproduction.*** Rodents mature quickly, and produce large numbers of young. Unless most breeding adults are removed, the numbers of animals present may remain constant, or may continually increase.

- ***Regular checking for new rodent activity.*** Regular documented re-inspection (monitoring) of sites is important to determine if previous control efforts are effective; to identify any newly-created entry points; to monitor for changes in sanitation and harborage conditions; and to determine if the number of animals present has changed substantially (e.g., has increased, has decreased, or remains unchanged). The importance of continuing watchfulness is clear when it is known how rapidly rodent populations can increase and how difficult controlling established infestations can be.

- ***Cooperation among people.*** Rodent management must always be a team effort among building occupants (the affected persons), maintenance workers (who make repairs), and area managers (who make decisions). It is important for all involved persons to be totally committed to and have a clear understanding of the program requirements.

- ***Assigning responsibilities.*** Assigning responsibilities to the people involved in a rodent management project is essential to success. To ensure that each team member is aware of rodent-control activities and their own responsibilities, participants should together determine responsibilities, with completion dates, and establish this information in writing.

Common failures in controlling rodent infestations in buildings are usually the result of one or more of the following oversights:

- Underestimating the severity of a rodent infestation—either the number of animals present, or the size of the infested area.

- Failing to locate or satisfactorily eliminate holes used by animals to enter buildings or rooms.

- Using too few traps or trapping stations, or improperly placing traps.

- Failing to have "buy in" or the cooperation of site occupants and site management staff (usually resulting from a failure to assign responsibilities in writing).

- Failing to remove trapped rodents, which become food for surviving animals.

- Failing to secure garbage and other food supplies.

- Placing too much reliance on poison bait as a means of control.

REASONS FOR CONTROLLING RODENTS

There are two very important reasons for controlling rodent populations in and around structures occupied by humans: Rodents can be responsible for spreading disease; and rodents can damage buildings and building contents.

Health Risks

By far the most important reason to control rodents is potential health risks from human contact with rodents or rodent debris. Rodents are known to be capable of carrying over 200 disease organisms, many of which can be transmitted to man. Many of these diseases are spread while rodents wander about in buildings at night searching for food and mates. During those activities, they continually drop feces, urine, and hairs, which can come in contact with human foodstuff, eating utensils, and bedding, or can be responsible in other ways for the spread of diseases.

Old World house mice and rats—i.e., exotic rodents that were accidentally introduced into this country—can spread plague, typhus, rat-bite fever, trichinosis, salmonella food poisoning, and other infectious diseases. Native rats and mice—i.e., rodents naturally occurring in this country—can carry plague, tularemia, leptospirosis (in urine), endemic relapsing fever, Rocky Mountain spotted fever, and Q-fever. Sylvatic (wild animal) plague is endemic in the western United States. In 1992, deer mice were identified as the most important transmitter of sin nombre virus (hantavirus pulmonary syndrome, HPS). Humans can become ill with sin nombre virus after coming in contact with rodents, or rodent feces, urine, or body fluids; or after inhaling dust arising from rodent feces or nesting materials.

Rodent food caches and nests, and dead rodent carcasses (i.e., poisoned animals or animals dying from natural causes) cause secondary health issues when they attract parasites, flies, carpet beetles, and other pests—all of which can cause serious problems in buildings and act as agents of human disease.

The nighttime activities of rodents inside buildings can result in sleep disturbances to human occupants, and, in rare cases, they have been associated with paranoid fears, and even serious accidents.

Damage

Many kinds of physical damage can be expected when rodents infest the interiors of buildings. The animals often build nests and store large amounts of food (e.g., acorns, nuts, seeds, etc.) behind walls or in attics, and such storage can cause structural damage and attract other pests. Rodents often burrow into and re-arrange wall and attic insulation, and, because of their habit of gnawing on objects, they may damage upholstered furniture, museum collections, paper and leather goods, clothing, and electrical lines and equipment (including computers). Each year, many structural fires in this country are thought to result from electrical wiring damaged by rodents.

Outside of buildings, rodent burrows near foundations can increase the rate of structural deterioration by loosening soils, allowing for increased water penetration, and supporting excessive vegetation. The mere presence of rodent burrows attracts large predatory animals that enlarge the burrows, resulting in additional structural damage. Rodent-associated damage to buildings increases the potential for deterioration from weathering, moisture, and other sources. Rodents frequently enter and make nests in parked machinery and vehicles, and damage electrical wiring and hoses. This can be quite serious, if emergency-response vehicles are involved. Rodents often also damage valuable garden and ornamental plants.

RODENT BIOLOGY AND HABITS

Rodents are one of the most numerous, successful, and adaptable of all animal groups. There are over 3,000 different kinds of rodents in the world, ranging in size from small (a fraction of an ounce) to large (more than 100 pounds). Rodents of one kind or another occur in every kind of environment, from desert to tundra.

They differ from other kinds of animals by virtue of their front teeth, which are specialized for gnawing. Rodent teeth grow continuously throughout the animal's life. Because of this, these animals have to gnaw frequently to keep the tips worn down.

Rodents have a keen sense of smell, and the animals produce many natural odors (pheromones). Once rodents enter a hole, room, or building, their odors remain in the area and may attract other rodents. Their scent is often left behind by grease marks made by oils in the skin, and by urine markings.

Rodents present in this country may be either native (New World) or exotic (Old World). It is very important to be able to accurately identify rodents that are causing problems, because, although these animals resemble one another, they have quite different habits and living requirements.

Native (naturally occurring) rodents include: mice (white-footed, pygmy, pocket, grass-hopper, harvest, and jumping mice); rats (wood, cotton, kangaroo, and rice rats); voles; porcupines; pocket gophers; lemmings; nutrias; squirrels (ground, tree, and flying squirrels); chipmunks; marmots; prairie dogs; muskrats; and beavers.

Exotic rodents (animals accidentally introduced into this country from other countries) are house mice and rats (Norway and black rats). Exotic rodents are easily identified by their scaled, nearly hairless tails, giving them the name "naked-tail" rodents.

Mice and rats are the most common structural pests in buildings. A basic description of their biology follows.

MICE

Mice, because of their size and adaptability, are the most common indoor rodent pests in buildings. In the eastern United States, exotic house mice are the animals most often found inside buildings, but native mice (especially white-footed mice) are the most common indoor rodent pests in the West.

In general, rodents produce large numbers of young. This is necessary for the survival of rodent populations due to a high mortality rate. House mice, for example, are capable of reproducing year-round indoors. During one year and under ideal conditions, a single pair of house mice is thought to be capable of producing over 3,000 offspring. This is theoretically possible, because young house mice can produce young when only about 30

days old, and a female can become pregnant with a second litter even while the first litter is still nursing. Native deer mice, better adapted to outdoor life, do not reproduce year-round, and produce fewer young. Yet under ideal conditions, a pair of deer mice is theoretically capable of producing a population of approximately 800 mice during their 4-month-long breeding season. Mice are an important food source for many other animals. Under natural outdoor conditions, however, competition between mice for space and food, as well as natural predation by owls and foxes remove 80% to 90% of all young mice soon after birth. It is not surprising that when ample food, water, and shelter are available, and when predation is absent (e.g., conditions found indoors), mouse populations can explode. Indeed, mice will occupy as many spaces in a building as possible until a limitation in the resources available to them restricts the numbers of animals that can survive.

Mice are exceptionally agile animals and can jump 12 or more inches straight up from one flat surface to another. They can jump to even higher levels against a flat vertical surface such as a wall or springboard. They can jump down to the floor from an elevation of 8 or more feet without being injured. They can climb any slightly rough, vertical surface, such as wood, plaster, brick, metal pipes, wire mesh, and cables. In addition, mice have good balance, and can easily run along horizontal electrical wires, ropes, and cables from one part of a building to another.

Mice are actually somewhat smaller than they appear, and they can squeeze their heads through holes only about ¼ inch in diameter (about the same diameter as a wooden pencil). After getting its head through a hole, a mouse has no trouble getting the rest of its body through.

Although mice tend to prefer cereal grains, they will eat almost any foods consumed by humans and domestic pets. A mouse's daily food requirements are small, only about 1/10 ounce (½ teaspoon) of food and 1/5 ounce of water per day for survival, and much of their water requirements can come from the food they eat. Mice are sometimes difficult to poison, because they will only nibble on small bits of food from many locations, and unless they can be encouraged to heavily feed on poison bait, they may not get a lethal dose. Eating small amounts of poison bait may cause only mild discomfort and make the bait repulsive to them. Some animals have definite food preferences, and will not eat bait at all.

Mice are most active after sunset, but they are sometimes seen during the day, when, in severe infestations, there is extreme competition between mice for space.

Activity habits are different for native and exotic mice. Native white-footed mice occupy a home range area of about 1/3 acre to 4 acres, and they may travel 200 or more feet from the nest to a food source. They do not hibernate, but they are less active during winter. Exotic house mice have much smaller ranges, seldom travel more than 20 feet from their nest site to a food source, and are active throughout the winter months. They are very curious as compared to rats, and will investigate new objects, such as traps.

Mice are strongly attracted to the warmth, shelter, food, and water offered by structures occupied by humans. Outdoors, native mice are most numerous during late summer, and when competition between animals for nest sites becomes strong with the onset of cold weather. This is when animals begin to enter buildings. However, many mice that move into buildings during the fall will continue to feed outside on natural foods until winter. With the return of warmer weather, adult mice begin producing young. Shortly thereafter, when most

animals return to outdoor habitats and remain there during the summer, rodent problems in buildings seem to suddenly come to an end.

RATS

The principal indoor rat-sized pests in the eastern United States are Old World (exotic) rats. The most common rat-sized structural pests in the West are native wood rats, squirrels, and chipmunks. Both native and exotic rats quickly adapt to nearly all living environments provided them by humans (e.g., granaries, fields, sewers, attics, basements). Old World rats, similar to exotic mice, often live most of their lives inside buildings. In the West, especially during winter, chipmunks, wood rats, some ground squirrels, and tree squirrels may nest inside buildings, attics, crawl spaces, and chimneys. However, they usually feed outside and seldom enter occupied portions of a building.

Old World female rats become reproductively mature when about 3 months old, and they can produce an average of 20 surviving young per year. Native rat-size rodents are less productive than mice, but females can usually raise three to four surviving young each year.

Rats generally eat the same foods as mice, but because they are larger animals, they require about 1 ounce (2 tablespoons) of food and 1 to 2 ounces of water per day for survival. As is the case with mice, a water supply is not as critical for rats as food, because most water comes from digested food.

Old World rats are very agile, and can leap 3 feet straight up or 4 feet horizontally. They can also climb the outside of a 3-inch-diameter pipe, walk on wires between buildings, swim ½ mile in open water, tread water for days, swim up currents in sewer lines and through toilet traps, and survive a fall of more than 50 feet. Native rats (e.g., tree squirrels, wood rats, chipmunks, and some ground squirrels) are also very agile.

Rats have powerful teeth, and are able to gnaw holes through concrete block, aluminum siding, adobe brick, wallboard, plaster, wood, and various other durable materials. Usually, there must be an exposed edge to gnaw; smooth surfaces limit their ability to initiate holes.

Although rats are much larger animals than mice, they can squeeze through holes only ½ inch in diameter.

Old World rats usually range within about 100 to 150 feet of their nest. They may sometimes nest indoors and forage outside for food—or nest outside and forage indoors. Native rats have relatively large forage areas and can move long distances from an indoor nest site to a food source.

The underlying causes of most rodent infestations in buildings are structural deficiencies such as holes, cracks, and gaps, which allow animals to enter. These defects can be discovered during routine building inspections. Observations made over long periods of time (monitoring) provide additional information such as

- the relative effectiveness of control efforts;
- changes in the numbers of animals present, or renewed rodent activity;
- locations of greatest rodent activity;
- changes in the amount of food or shelter available for rodents; and
- changes in the rates of structural deterioration.

The terms "inspection" and "monitoring," commonly used by pest control workers, are sometimes confusing, because they describe what seem to be similar activities, but actually have different meanings.

INSPECTION

Inspection is a comprehensive *initial* written evaluation (i.e., a one-time "snapshot" evaluation), in which the "inspector" looks for the presence of rodents and rodent signs, conditions favoring them, and potential sources of rodent access into buildings.

MONITORING

Monitoring is a *continuing* written evaluation that identifies and evaluates changing conditions over time, including re-infestation and new sources of rodent access discovered since the last evaluation. Monitoring will be discussed in the section following the discussion of rodent-control methods.

BACKGROUND FOR RODENT INSPECTIONS

Rodent infestations were studied in 1994 in a number of buildings in three National Park Service areas. The interiors and exteriors of buildings were inspected for rodent activity, conditions favoring rodent activity, and structural defects allowing rodent access. The studies showed that it is common to be able to initially trap animals outside of a building and then later re-capture the same animals inside the building. This study demonstrated the ability of rodents to move between building exteriors and interiors.

After identified sources of rodent access into buildings were repaired, overall rodent infestations decreased by more than 90% when compared to similar structures not repaired. In most repaired structures, no rodent activity was detected. This study clearly demonstrates that the identification of structural defects, followed by relatively simple mechanical repairs, can *significantly reduce, or eliminate*, rodent problems in most buildings.

Adequately rodent-proofing structures requires knowledge of rodent behavior; care in identifying and eliminating sources of rodent access; and periodic follow-up to ensure that *all sources of rodent access are eliminated and no new sources are created* through the repair *or* replacement of utility lines, plumbing fixtures, and so forth.

Information derived from inspections is very useful in follow-up control programs. The Information an inspector should gain and describe in a written inspection report includes

- type, extent, and severity of the rodent infestation;
- locations of rodent entry points;
- possible supporting reasons for the infestation (i.e., available food, shelter, water);
- presence and location of major rodent activity and harborage areas;
- recommendations for the lowest risk and most appropriate rodent control strategies; and
- signs of rodent activity, such as gnawing, rub marks, and piles of cockroach wings (mice will eat cockroaches, leaving wings and legs in a pile).

An example of a written inspection report is provided in Appendix B.

SAFETY NOTE. *Because of the recent recognition of hantavirus (sin nombre virus; HPS), which has been documented nationwide, anyone performing rodent inspections or monitoring duties and who might come in contact with dead or live rodents or rodent debris should follow all of the U.S. Center for Disease Control (CDC) guidelines for personal safety. See Appendix D for a summary of recent CDC recommendations on workers' protection.*

INSPECTION EQUIPMENT

You will need a clipboard, pencil or pen, and inspection forms for recording inspection findings. A bright flashlight should be used during inspections, even during daylight hours. The light helps concentrate focus, and better illuminates rodent signs, structural deficiencies, and likely harborage sites. Other useful equipment may include: hand and extendable inspection mirror; tape measure; Polaroid®, 35 mm, and/or video camera; Phillips and slot screwdrivers; step ladder; compass; colored sticky labels (to mark areas needing repair); and a hard hat and knee pads if sub-floor or attic areas will be entered. Also helpful are electronic moisture meter; stud finder; voltage detector; pocket-size tape recorder; jeweler's eye loop; and long forceps.

BUILDING EXTERIORS

Exterior inspections of buildings should be conducted at least twice a year: Once during spring, to evaluate winter damage, and a second time during fall, before rodents try to move in to buildings. Inspections should document any new structural defects or building repairs/accidents, which may provide new points of entry for rodents. Ideally, the same inspector performs both inspections.

The first step in making an inspection of a building is to prepare a rough drawing of the building exterior. Show all major features where pests might find entry (Figure 1). This may include, but is not limited to, access points for electrical and plumbing service lines, doors and windows, crawl space and basement openings, window wells, porches and decks, dormer corners, and chimneys. Also indicate on the drawing the direction of north with an arrow, the point on the building where you begin the inspection, and a curved arrow to show the direction you moved around the building during the inspection.

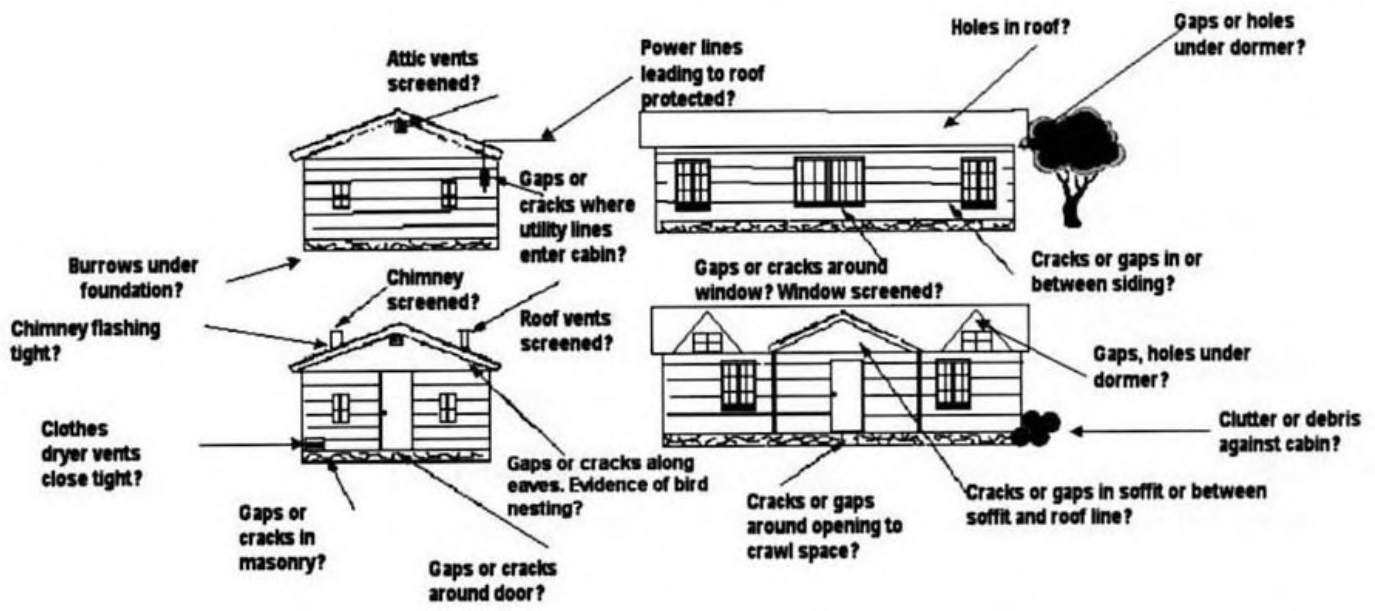


Figure 1

From a point of beginning, slowly and systematically examine the entire building exterior from the ground to the roof while looking for defects that could allow for rodent entry. (You must *think* like a rodent.) When you find defects, note their locations on the drawing, and describe them as possible rodent entry points. The aim of an exterior inspection is to obtain as much information as possible on rodent access points, and on existing conditions in or near the building that might support rodent activity. Normally, deficiencies seen on building exteriors will provide clues as to what will be found inside.

It is not possible to provide an exhaustive list of all the elements that could be found in the wide variety of existing building styles. Model inspection forms (for both interior and exterior inspections), found in Appendix A, will help in developing forms specific to your needs.

The following descriptions offer general guidance as to some of the major deficiencies to look for. Sections of the manual that follow will discuss recommendations for repairs, and specific materials to use for repairs.
Finally, a completed Work Order Form 10-238 for repairs should be provided to site

maintenance staff for inspection.

General Building Exterior

Carefully check the siding, eaves, soffits, cornices, gables, porches, chimney or furnace clean-out ports, loading platforms, and all other external areas for cracks or holes that are ¼ inch or larger in size (Figures 2, 3, 4).

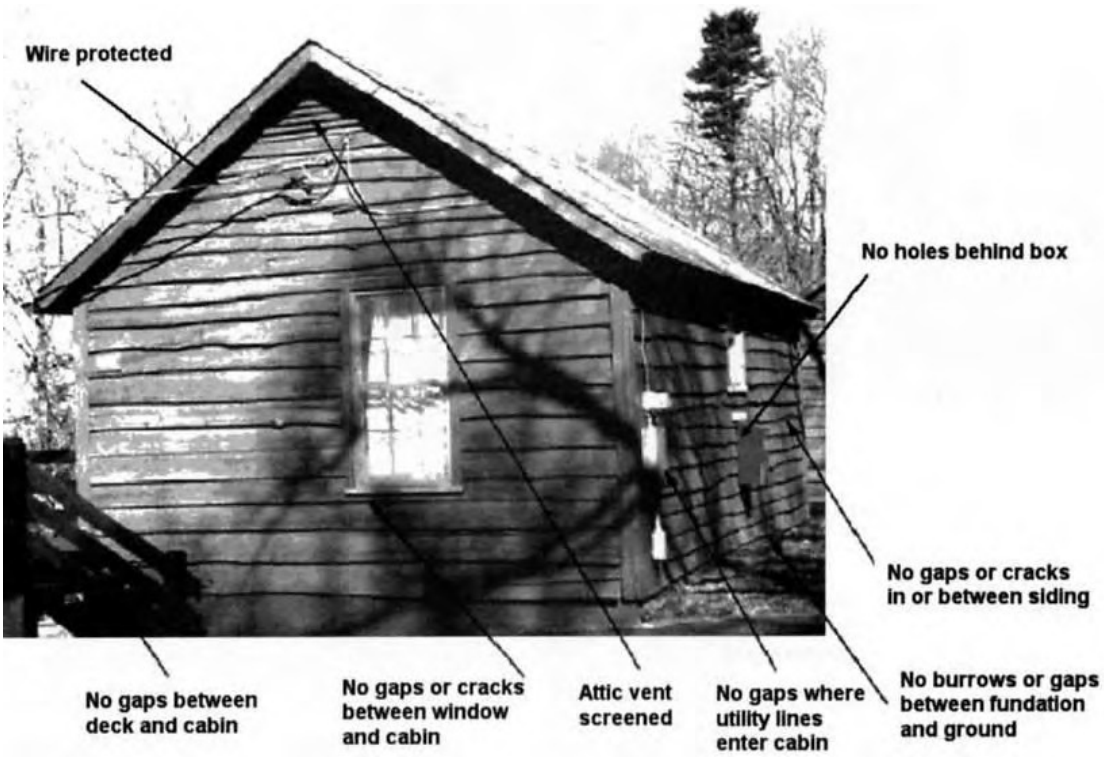


Figure 2

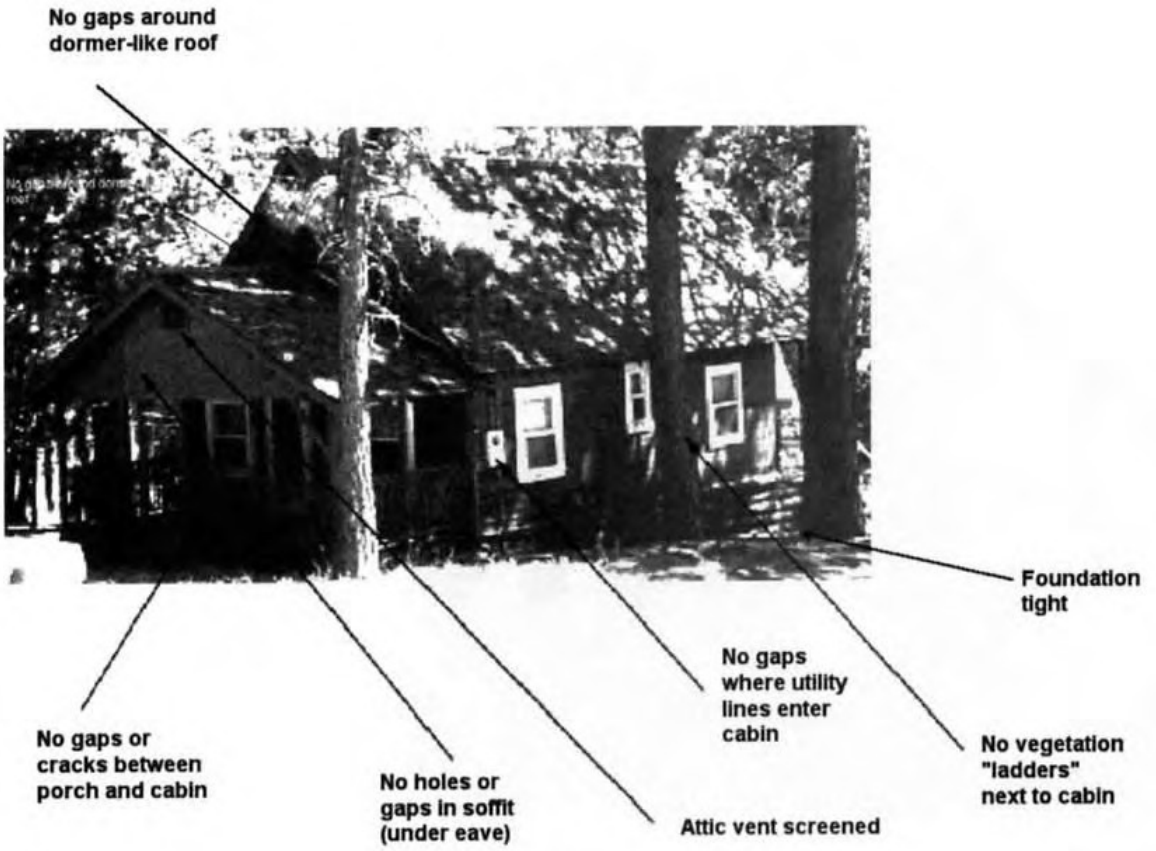


Figure 3

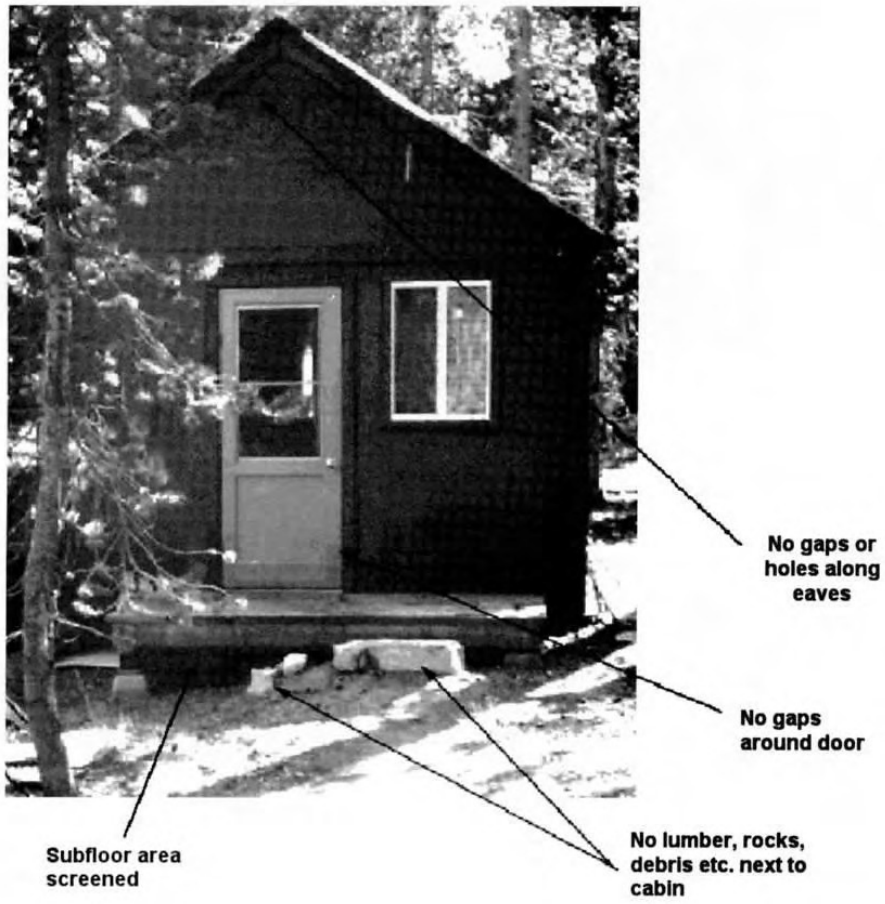
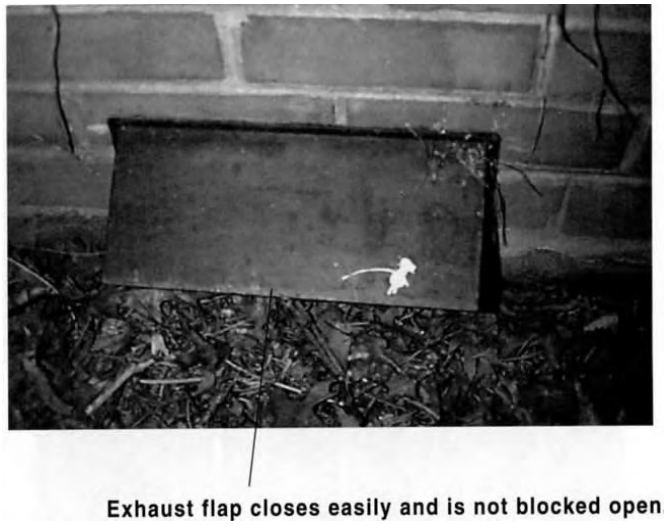


Figure 4

Check around porches and decks adjoining the building, dormer corners, and chimneys, for any holes, cracks, or gaps that could allow rodent entry. Corner joints and cracks in log buildings require detailed inspection. Check to see that exhaust flaps on clothes-dryer vents close easily and are not blocked open by lint (Figure 5).



Exhaust flap closes easily and is not blocked open.

Figure 5

When doubts occur as to whether or not to list borderline-sized holes, mark them anyway. A repair crew will follow most inspections, and it will take them very little time to fill a few extra holes to ensure that the building is adequately sealed. Record the locations and severity of all defects found on the structural drawing.

Report any obvious harborage such as piles or stacks of lumber, firewood, rocks, trash, debris, vegetation, or tree stumps found within 50 feet of the building (Figures 3, 4). Make note of any shrubs with thick bottom leaves and stems that could provide shelter for rodents. Take note of tall vegetation growing next to the building; the wider the vegetation-free area around buildings, the better. Ideally an 18-inch vegetation-free zone should exist around the outside of the building to discourage rodent activity. Watch for "vegetation ladders" (i.e., shrubs or trees touching or overhanging a building) that allow rodents access to the tops of buildings.

Identify standing water near buildings, leaking pipes or hydrants, and inadequate water run-off (grade) from buildings.

Foundations

Foundations are particularly vulnerable to rodent attack (Figures 4, 6, 7).

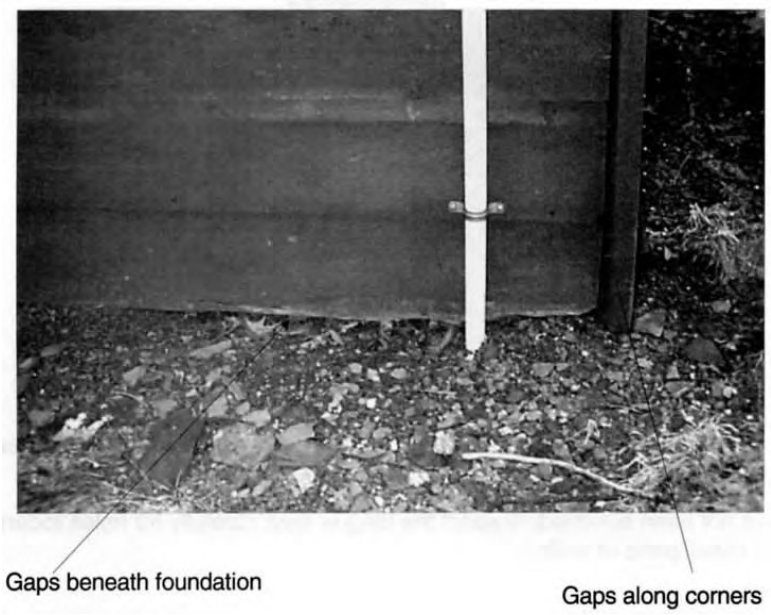


Figure 6

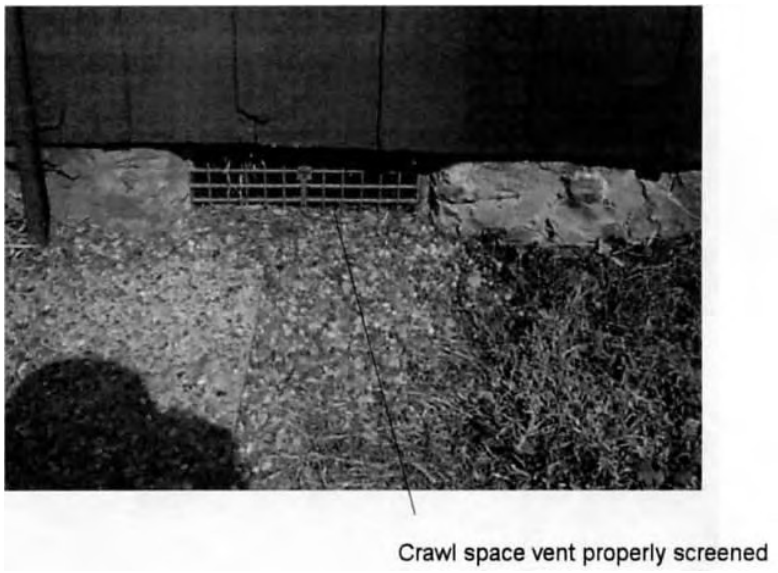


Figure 7

Identify cracks and holes in or under foundations, improperly fitted crawl-space or basement doors, openings around window wells, and so forth. Observe signs of rodent activity next to buildings, as demonstrated by fresh burrowing activity, burrows that lead under foundations, rodent runways along walls, plants damaged by rodents, rodent tracks and droppings, rodent feeding stations, gnawing damage on structures, and rodent harborage (e.g., debris or tall vegetation).

Doors and Windows

Doorways are one of the most common places rodents enter buildings. The animals are drawn to outside doors, especially those with lights that attract night-flying insects and bats. Check doors and screen doors for self-closing springs, door sweeps, and screening made of metal. Carefully examine exterior door frames, thresholds, and windows for cracks and gaps (Figures 8, 9).

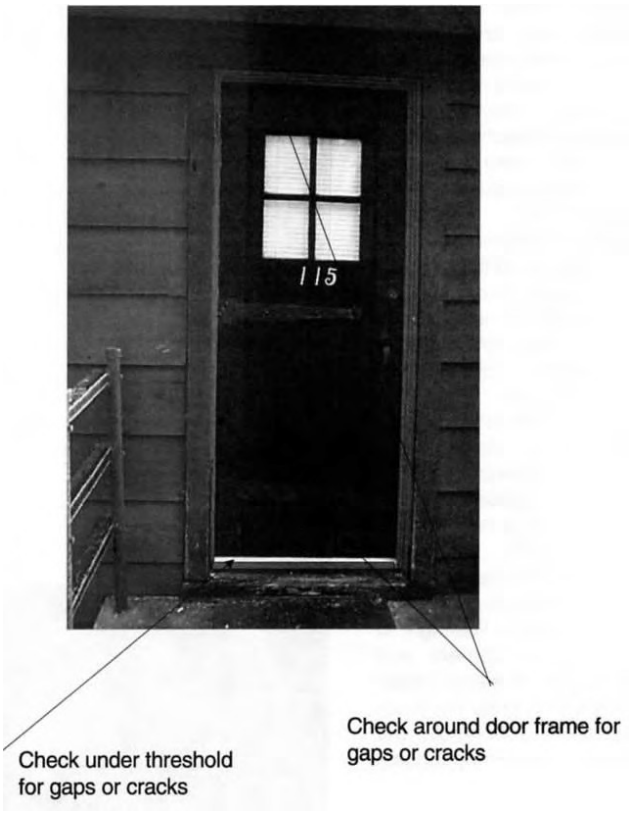


Figure 8

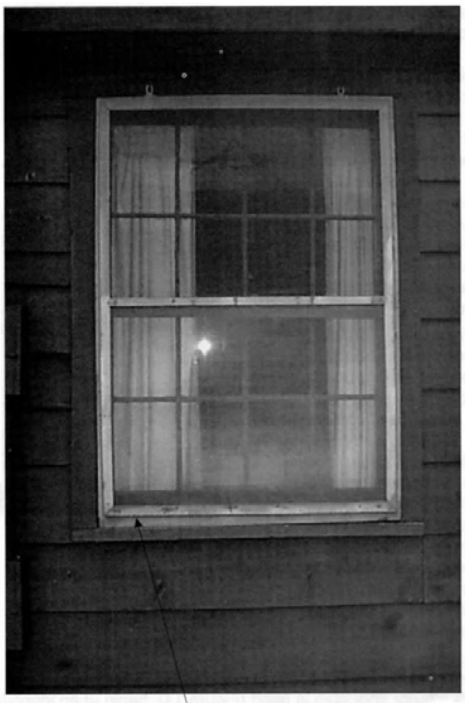
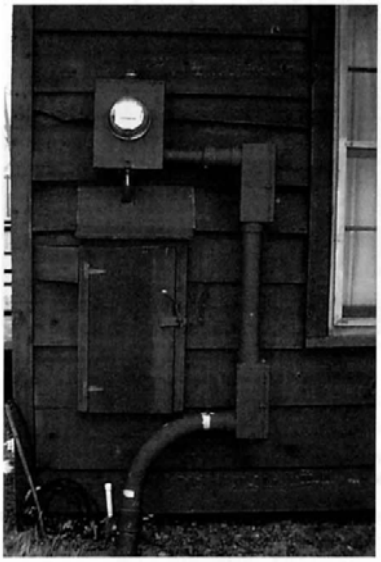


Figure 9

Observe closed doors from the inside of the building during daylight hours to evaluate the size of any holes admitting light.

Service Lines and Breaker Boxes

Gaps and holes around electrical, plumbing, and gas lines entering the building are ideal entry points for rodents (Figure 10).



Check for gaps or holes around electrical, plumbing and gas lines entering the cabin.

Figure 10

Check to see that there are no holes or gaps larger than ¼ inch around electrical lines and pipes that pass through walls. Ensure that electrical breaker box doors fit tightly.

Roofs, Chimneys, and Vents

Use a ladder to examine soffits, gables, and other roof structures (Figure 11).

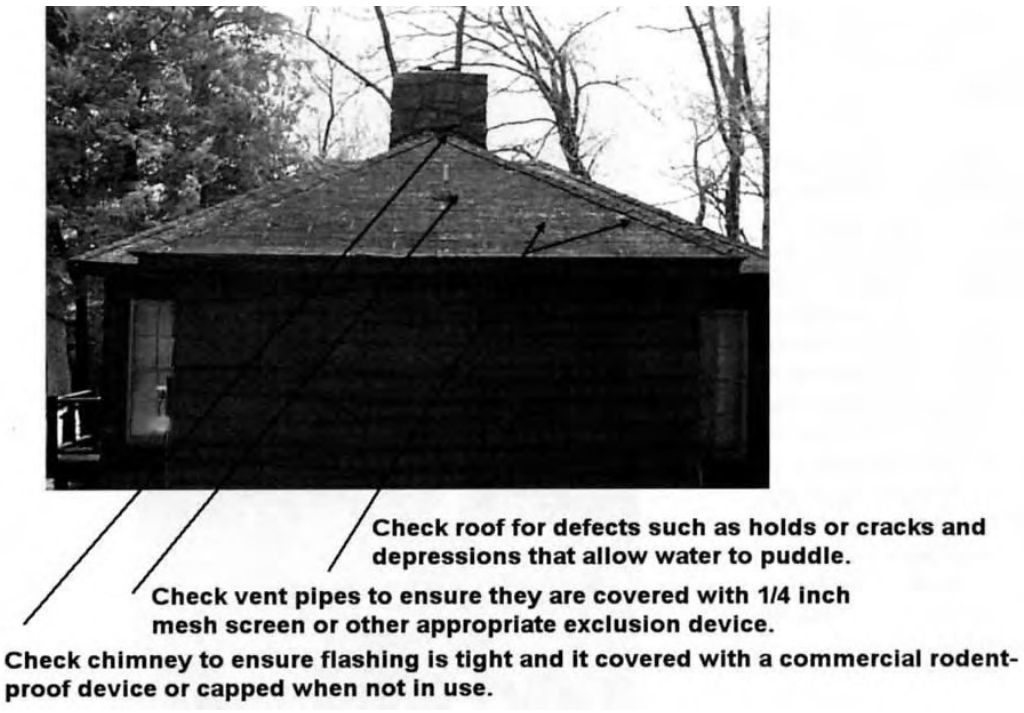


Figure 11

Check to see if chimney and vent flashings are tight, and fireplace chimneys are capped when

not in use or covered with a commercial rodent-proof chimney cover. Verify that all vent pipes are screened with ¼-inch-mesh hardware cloth or appropriate exclusion devices. Look for gaps around heating and air-conditioning units and vents. Be sure the open ends of corrugated metal and Spanish tile roofing are sealed. Check the general condition of the roof for defects and possible water leaks or depressed areas that might hold water. Note any cables or electrical lines leading to the roof and any overhanging vegetation.

Attics and Crawl Spaces

Identifying suspected rodent entry points from the exterior of an attic or crawl space can be difficult (Figures 1, 2). The best method for inspecting these areas is to enter them during daylight hours. Turn off all interior lights, and possible entry points will be visible at locations where light enters from the outside. If holes in the roof are observed, insert a plastic straw or other thin item through the hole and return to the top of the roof to mark the locations.

Garbage

Odors from garbage disposal areas attract rodents to buildings.
Examine garbage containers and surrounding areas for obvious rodent activity and poor sanitation (e.g., garbage on the ground, improperly washed concrete pads), garbage cans located too close to buildings, and loose-fitting garbage-can or dumpster lids. Poor sanitation practices that support rodents should be noted in the inspection report and brought to the attention of building residents or managers.

HOUSE-TRAILER EXTERIORS

The inspection of house trailers (whether used for offices or residences) does not differ greatly from that of other buildings (Figures 12, 13).

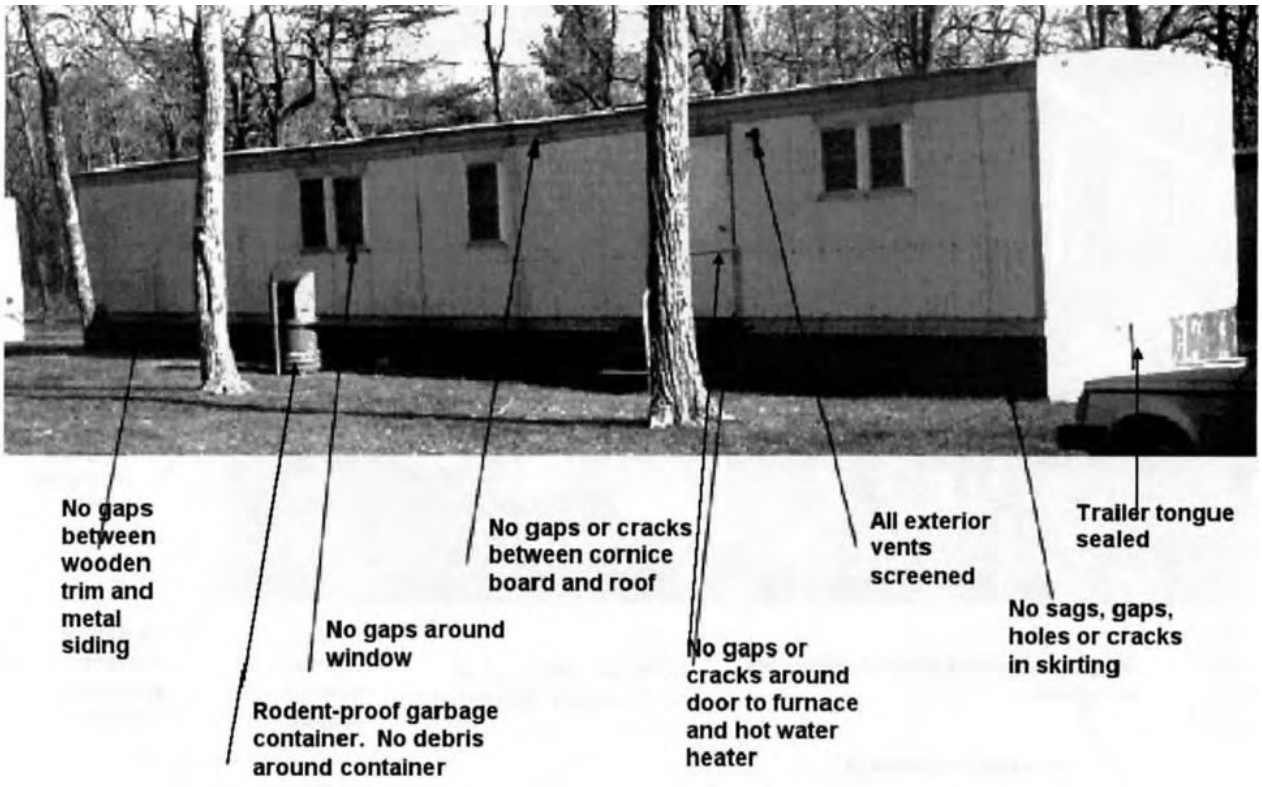


Figure 12

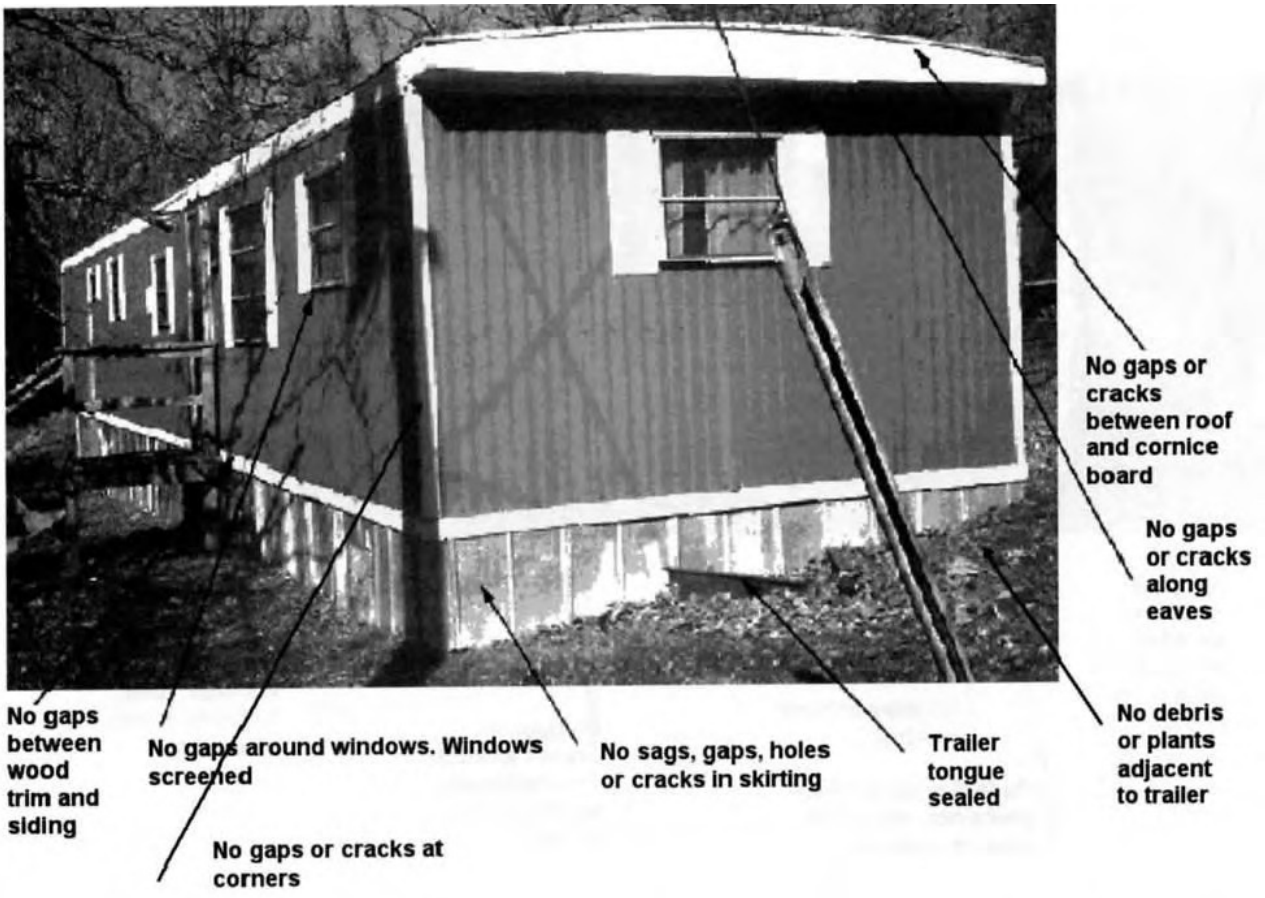


Figure 13

However, trailers are more difficult to rodent-proof because of construction and subsequent repairs (commonly seen in the crawl space) that have damaged the integrity of the floors. Because it can be quite difficult to seal the bottom of a trailer, the exterior inspection must determine ways to keep animals from entering the structure. In addition to the items noted above, be particularly watchful for the following:

- The foundational skirting of the trailer must not have any sags, gaps, holes, or cracks, which could admit rodents into the crawl space beneath the trailer. If the trailer does not have a concrete or similar rodent-proof foundation, the bottom of the skirting around the trailer must be protected with a curtain-wire barrier (see Exclusion section) to prevent the animals from digging beneath it. In certain situations it is better to remove the skirting to prevent a sheltered rodent habitat.

- Holes are commonly found around the trailer tongue when it has not been removed. Inspect the tongue area carefully for holes that rodents could use to access crawl space or walls.

- Electrical, water, gas, and sometimes sewer lines enter a trailer through or under the skirting. Check carefully around all service lines for gaps and holes.

- Hot-water-heater closets on most trailers open to the outside and have pipes and wires that penetrate into the crawl space, and can serve as access points for rodents. Carefully examine hot-water-heater cabinet doors for warping or damage and thoroughly examine cabinet interiors for holes or gaps that could allow animals to enter the trailer. It is not uncommon to find considerable wood rot in hot-water-heater cabinets.

- Check all exterior doors for tight fit, and check all windows for intact glass and screens. Metal exterior doors often become bent during use and do not close properly. Trailer residents sometimes remove window glass or make holes in screens for electrical extensions. Also check for weather-stripping around the edge of doors, and, if present, check its condition.

- Carefully check all roof-mounted air conditioners and other appliances to determine if flashings are tight and units are adequately screened with ¼-inch-mesh hardware cloth. Check to see that roof ventilation vents are screened, and that they close tightly and are not partly open because of an electrical extension line or water line leading to the outside.

BUILDING INTERIORS

Building interiors should also be inspected at least twice a year. In addition, it is desirable to continuously monitor building interiors to detect the presence of rodents or any changed conditions that could attract rodents or allow entry. An interior building inspection is normally performed after inspecting the building exterior. Interior inspections require the same careful, methodical examination to detect rodent access and entry points; food, water,

and harborage conditions; signs of rodent infestation; and sanitation practices (or habits) that might support rodent infestations.

With a rough drawing of the building's interior floor plan in hand (Figure 14), begin at an identifiable point on the inside (usually the front door) and systematically progress along each wall and through *all* rooms, including garage, storage, and utility areas.

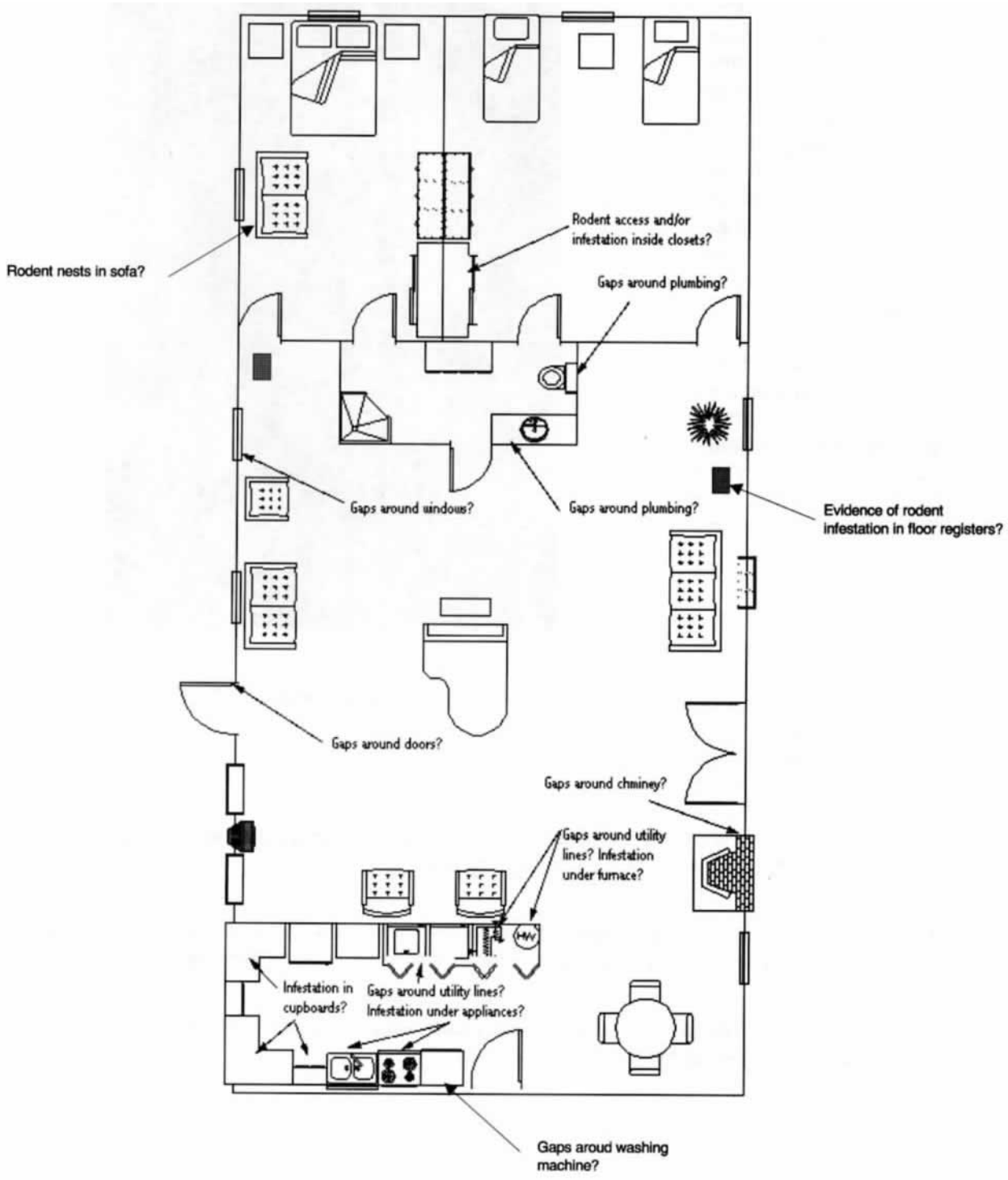


Figure 14

Look for any possible rodent entry points and for conditions that might support their

presence. Record defects found on the inspection report and/or building floor plan.

Finding Rodent Entry Holes

Thorough interior inspections are essential, because rodents can enter rooms through any small hole, crack, or gap—just ¼ inch or slightly larger, which connects room interiors with the outside or with wall, floor, and ceiling voids or crawl space and attic areas. The most common entry places are under doors and through the "larger-than-required" holes in walls and floors (i.e., chases) provided for passage of electrical, water, gas, and sewer lines and vents and conduits (Figure 15).

Figure 15

Carefully check all thresholds and pipe and electrical chases. Holes and gaps around stone or brick fireplaces are also common entry places for rodents. Other entryways that are more difficult to find may be hidden in dark corners of rooms and closets; behind or under built-in cupboards; and around hot-water heaters, furnaces (Figure 16), radiators, dish and clothing washers, and stoves.

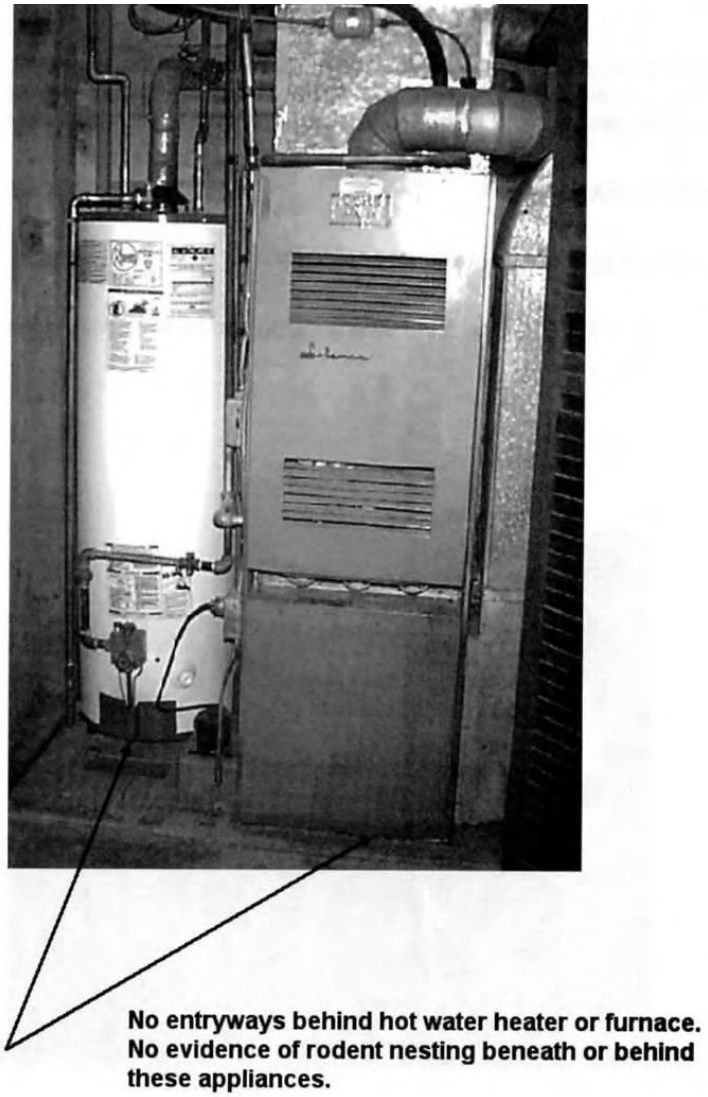


Figure 16

Use a flashlight to examine all corners and closets; remove and inspect behind and under the lower drawers of cupboards; and inspect around appliances.

If evidence of an active rodent infestation is found in a room, it is very important to concentrate efforts on finding the *entry points*. Beyond the initial inspection, this may require follow-up inspections after placing out rodent traps or non-toxic tracking stations (e.g., wheat flour, talc, corn starch sprinkled on the floor or on small boards around the room) to demonstrate areas used by rodents. Closing interior doors between rooms at night will limit rodent activity and allow for the identification of points of entry.

Identifying Rodent Food and Water Sources

Identify any sources of food or water available to rodents. Examples may include, but are not limited to, the following:

- desks
- kitchens
- snack rooms
- pop and candy machines
- coffee stations
- indoor recycling storage areas (e.g., aluminum cans)
- dead insects or rodents on sticky or snap traps
- bars of soap in restrooms
- garbage left overnight in buildings
- broken packages or spilled foods in storage cabinets
- open drains or leaking pipes

Always be on the lookout for feeding stations when conducting rodent inspections. They may be partly visible sites where rodents feel it is safe to eat food they have collected from other locations. Usually, feeding stations are located in protected room corners; under or behind the bottom drawers of kitchen cupboards; under stoves, refrigerators, or sinks; and under or behind furniture. The stations are identified by a greater than normal amount of rodent feces and urine deposits in a certain spot or by the remnants of a variety of foods (e.g., candy wrappers, nut shells) and remnants of cockroach carcasses. The food remnants found in feeding stations can offer helpful clues as to whether or not there is a need to inspect other locations for rodent activity. Determine if there are any sources of moisture available to rodents and other pests. Ask building occupants if they have observed or are aware of water leaks. Be on the lookout for moist areas, swollen wood, and cracked paint. If necessary, use a moisture meter to check walls and floors for suspicious excess moisture coming from leaking plumbing, improper grade or drainage, clogged drain traps, condensation on cold pipes or windows, humidifiers and de-humidifiers, fish tanks, and potted plants. The presence of excess moisture also supports mold, fungus, slime, lint, and insects (e.g., fungus-feeding beetles, flies, mites, and centipedes), as well as spiders and scorpions. All of these can be a source of food and water to rodents. Correcting moisture problems in a building is not only important for pest control but also for the longevity of the building.

Note on the inspection report any poor sanitation practices that promote rodent infestations, and bring these to the attention of building residents or managers.

Indicators of the Presence of Rodents

Such indicators include

- carcasses
- piles of cockroach wings/legs
- seeds, nuts
- rub-marks or grease-marks
- droppings and urine stains
- hair in openings.

One indicator of the presence of mice in closed rooms can be observed by the familiar musky odor they leave behind. Building occupants are usually more than happy to discuss with you where they have seen mice in the building or where mice have gotten into their food items. Be watchful for such signs of rodents as feces, partially eaten nuts, candy wrappers, and/or shredded paper.

Identifying Rodent Harborage

Use a flashlight to look for areas offering shelter to rodents. Such areas will be found inside cabinets; in and among boxes and other items stored on floors; under dressers and chests of drawers; behind and inside machinery (e.g., kitchen appliances, water coolers, etc.); around hot-water heaters and furnaces; and in employee lockers. Sometimes overlooked sources of rodent harborage and activity are found under the lower drawers in kitchen cupboards or stoves; in refrigerator drip pans and coils; inside upholstered furniture or furniture having hollow legs; in attic and storage room clutter; and inside wall voids, electrical motors, and computer cases.

Ensure that boxes and other items stored on floors are placed on shelves or pallets and are elevated 6 or more inches above the floor. Moving items off the floor and away from rodent activity eliminates hiding places, allows floors to be cleaned and inspected, and provides locations for the placement of rodent traps.

HOUSE-TRAILER INTERIORS

Methods used in constructing house trailers may leave many small holes available to rodents that allow access to the maze of inter-connecting open spaces (voids) behind walls, ceilings, and sub-floors. Once inside voids, the animals usually find a way to enter living spaces. An interior inspection of house trailers is very important, and checks must be made of all the items previously noted for other structures (Figure 14). Particular attention should be paid to the following:

- Carefully check all points where gas, water, electrical, and drain lines and vents penetrate floors, ceilings, or walls. Open gaps around pipes are often found under the kitchen sink (Figure 15). Check for loose pipe escutcheons that do not properly seal the chase around incoming water lines. If the hot-water heater is located inside the trailer (Figure 16), carefully check the interior of the cabinet for openings. Look inside the kitchen cupboard above the stove for gaps around the area where the stove vent penetrates the top of the trailer ceiling. If kitchen vents exhaust through the side of the trailer, ensure that either the louvers close properly or that the open end is screened.

- Thoroughly examine the interior of built-in furnace cabinets for gaps or holes (Figure 16). Look for rodent feces, grease marks, or other evidence inside floor-mounted heating registers. Rodents sometimes gnaw through plastic heating ducts in the crawl space and can then move up into rooms through heating registers. Sometimes heating conduits under trailers are open and not even attached to the furnace. Look for openings on ceilings and walls around air-conditioning installations. Look for gaps around the area where the furnace vent penetrates the upper-most portion of the trailer ceiling; this may require the removal of a ceiling and/or wall panel.

- Check for gaps around clothes-washing-machine pipes and bibs. Inspect the exhaust flaps on clothing dryers to ensure that louvers are not restricted by lint build-up. If the clothing dryer is vented to the crawl space, inspect the vent line for possible holes. If a clothing washer and/or clothing dryer are not present, verify that pipes and vents are tightly sealed.

- Many of the main electrical circuit-breaker boxes of trailers are mounted on a wall in a bedroom. Check to ensure that the box is properly installed and does not have open spaces around or inside of it.

- If evidence of rodents is found inside the trailer, carefully inspect the interiors of upholstered furniture for possible nesting sites.

EXCLUDING RODENTS

The need for exclusion in rodent control is evident, and the second step in preventing and controlling rodent infestations is to correct structural defects in the building. Some types of building construction (or instances in which there are mandates to maintain a given historical appearance) may not allow building exteriors to be altered to prevent rodent entry. If so, rodents will enter the inner structure of a building and move around in open spaces (voids) behind walls and floors; however, the animals can usually be kept out of interior living or working spaces by carefully sealing all possible points of entry. The need for exclusion in rodent control is evident. If the building is a historical structure, be sure to contact professional cultural resource management staff to determine if prescribed repairs are acceptable.

The next step after exclusion (rodent-proofing) is to prevent and control rodent infestations. The process is simple: Eliminate (or minimize) all holes, cracks, and gaps of ¼ inch in size or larger through which rodents can enter buildings, rooms, or equipment, or through which animals can reach food, water, or shelter. It is usually easy to find a good number of those entry points in buildings, especially in buildings with active rodent infestations. Common points of entry are those beneath exterior doorways; around water, electrical, gas, vent, and sewer-line chases; through unscreened pipes, exhausts, chimneys, and vents; through broken screens; and through gaps in window and door facings; and under and through building foundations and trailer skirting. The effectiveness of closing such passageways was demonstrated in the 1994 study of rodent infestations in three national park areas. That study reduced rodent infestations in structures by more than 90% through good exclusion methods. The work was performed by maintenance crews with no specialized training in rodent control, and at an average cost of about $600 per structure using standard construction methods and materials. Descriptions of various rodent-proofing materials are noted at the end of this chapter.

Note: It must always be remembered that exclusion is never permanent. Continuing, on-going inspection, exclusion, sanitation, and monitoring are required to keep buildings tight enough to prevent or control re-infestations and to deprive rodents of food and harborage.

Building Exteriors

Most small holes and cracks in building siding can be filled with painter's caulking (Figure 17) of an appropriate color, or be painted after the caulking dries.

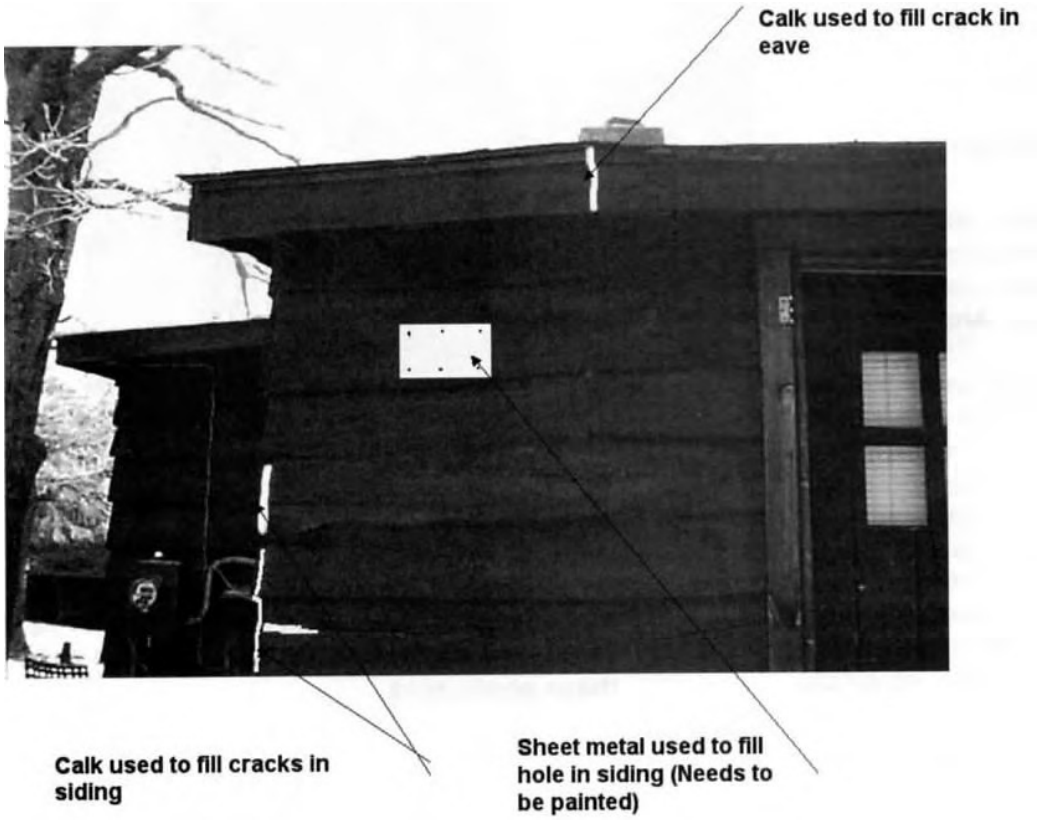


Figure 17

Larger holes may require a filler (e.g., wire mesh or foam) before caulking is applied. Expanding foam (Figure 18), sometimes used for difficult-to-seal cracks, is very messy and expensive and its use requires follow-up after drying is complete.

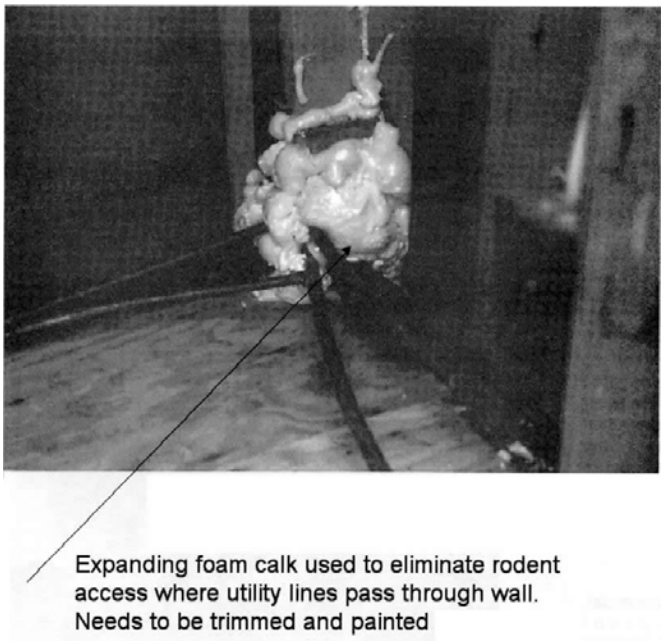
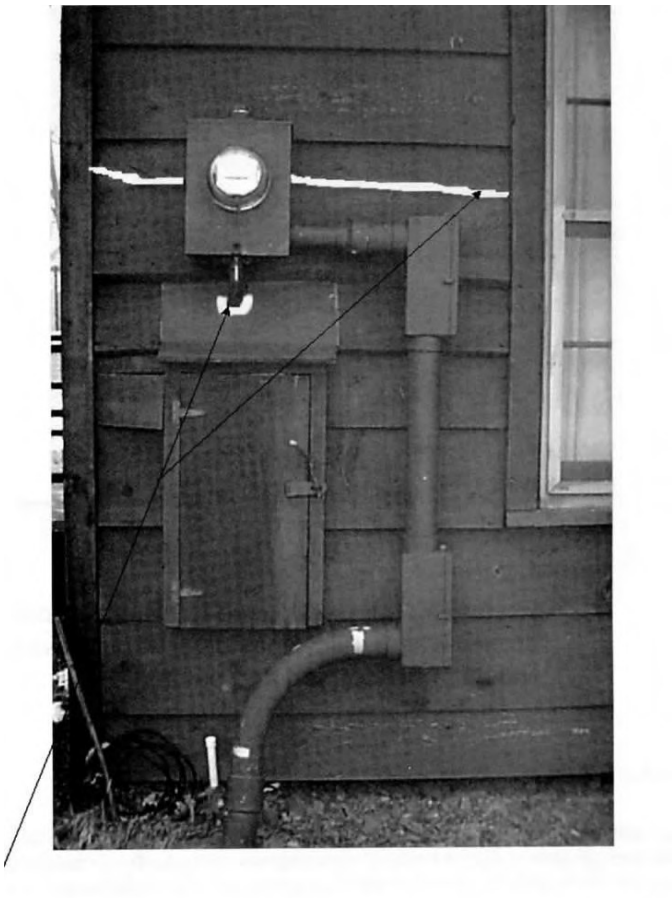


Figure 18

The foam can break in the presence of sunlight, and presents an unfinished appearance unless it is sealed with paint or caulking.

Holes with large open spaces behind them (voids) that prevent the use of fillers (e.g., holes made through sidings by squirrels or woodpeckers) are usually covered with thin, galvanized sheet metal and then painted. When using sheet metal, ensure that all edges are securely attached to the structure.

Utility Lines. Most of the many small gaps and holes around electrical lines, plumbing and drain pipes, conduits, gas lines, air conditioners and ducts, and TV lines that enter the building can be sealed with caulking compounds, hardware cloth, or sheet metal (Figure 19).



Calk used to eliminate hole around utility line and crack in siding

Figure 19

Sheet metal is sometimes used to fabricate conical or flat rodent-proof guards around wires to prevent animals from climbing onto roof structures.

Vents and Chimneys. Where permitted and safe, screen the open ends of plumbing, exhaust, heating, and air conditioning vents, and other pipes, with ¼-inch hardware cloth (Figure 11). Terminal ends for clothing-dryer vents are available that exhaust the air vertically rather than horizontally, and they appear to be more effective in excluding rodents than flapper-type vent ends. Install commercial, rodent-proof chimney guards over fireplace chimneys if hardware cloth could cause a fire hazard (Figure 11).

Doors and Windows. Most small holes around door and window facings can be filled with painter's caulk of an appropriate color, or painted after the caulk dries (Figure 20).

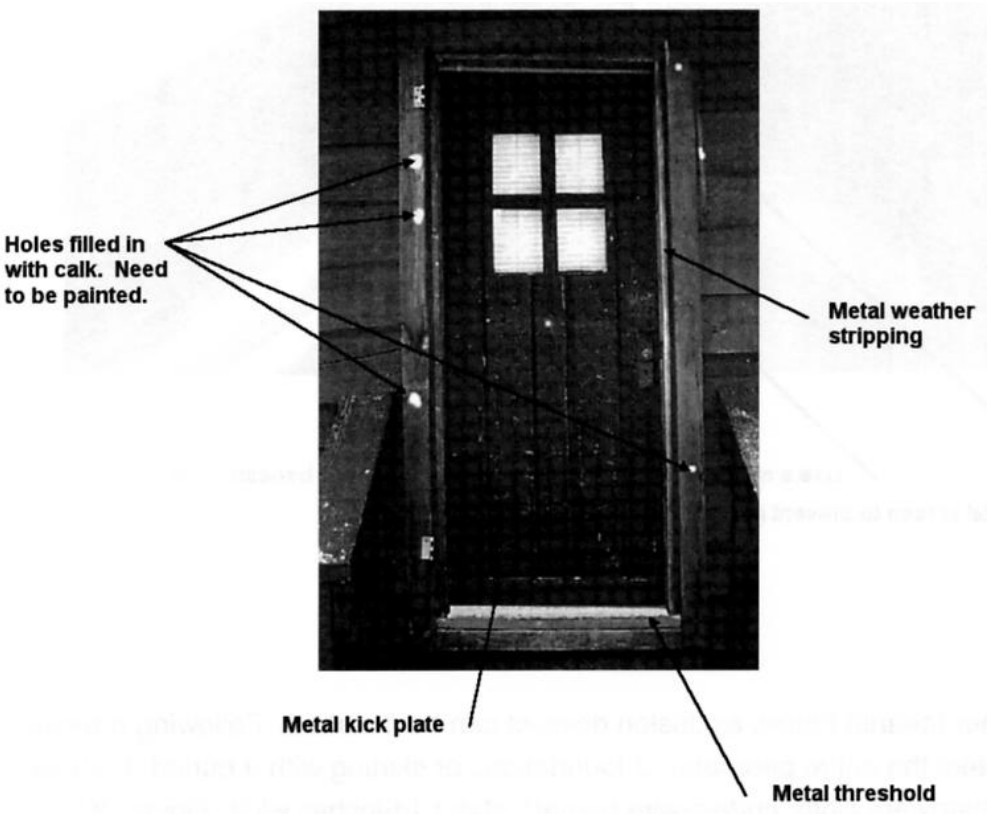


Figure 20

Install metal kick plates (Figure 20), tight-fitting door sweeps, or metal thresholds (Figures 20, 21) on all exterior doors that allow no more than ¼-inch clearance between the door and floor.

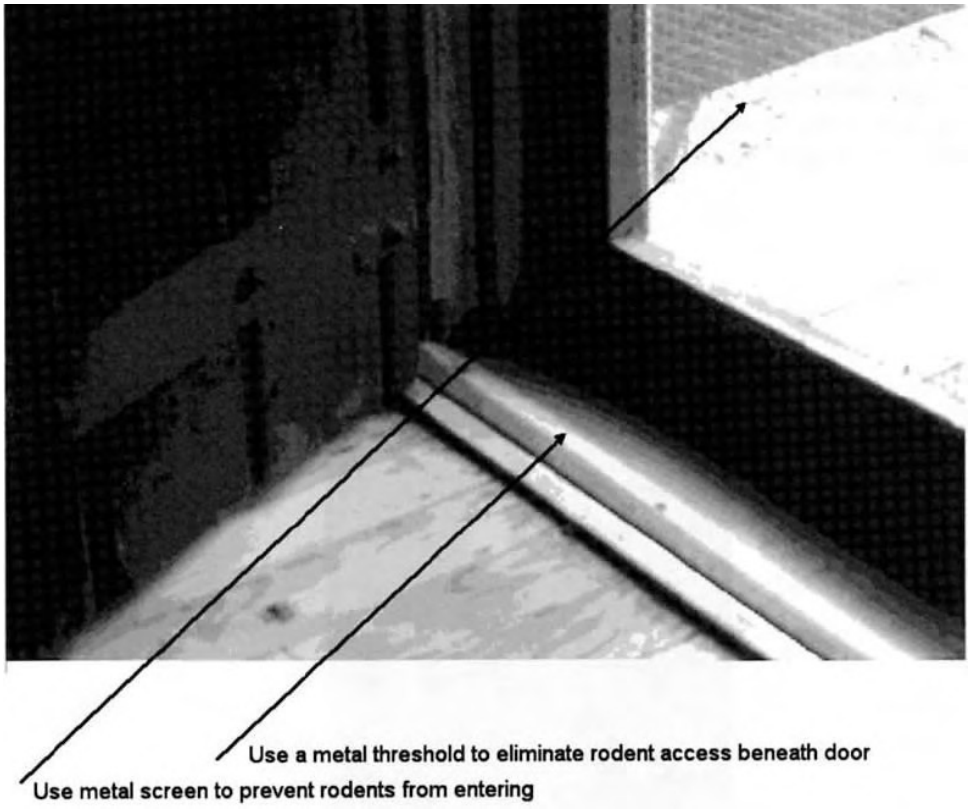


Figure 21

Windows must close properly and have intact screens, preferably constructed of metal (Figure 22). Seal all cracks and gaps around windows and doorframes with caulk, or repair the facings.

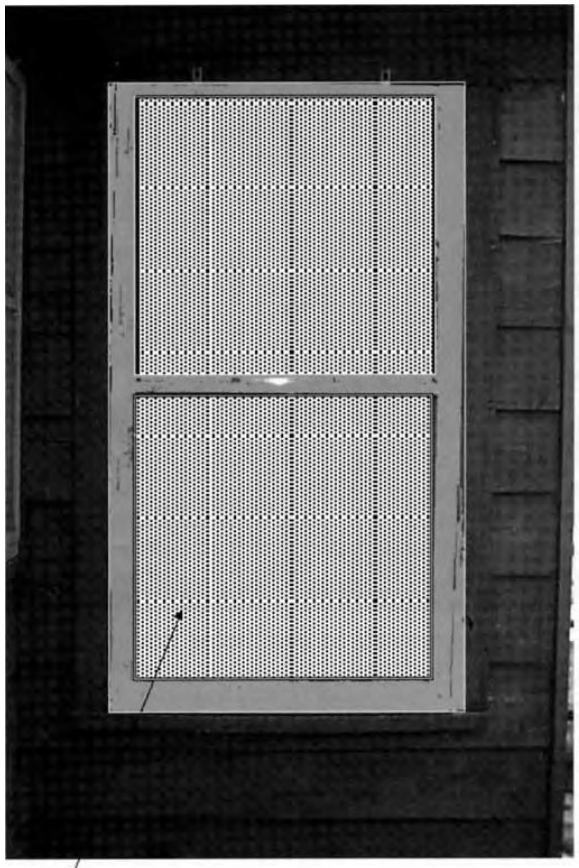


Figure 22

Foundations and Trailer Skirting. Repair cracks in stone and cement foundations with concrete or mortar (Figure 23).

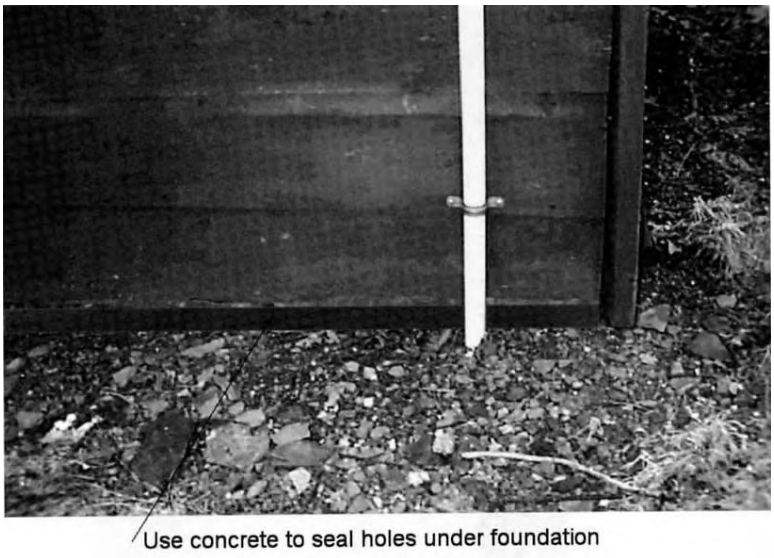


Figure 23

If rodent burrows are found that extend under foundations or trailer skirting, animals must be removed by trapping or other means before exclusion devices can be installed. Following removal of the animals, protect the entire perimeter of foundations or skirting with a buried ¼-inch, L-shaped, 16-gauge to 19-gauge hardware cloth "curtain-wire barrier," about 14 inches wide (Figure 24).

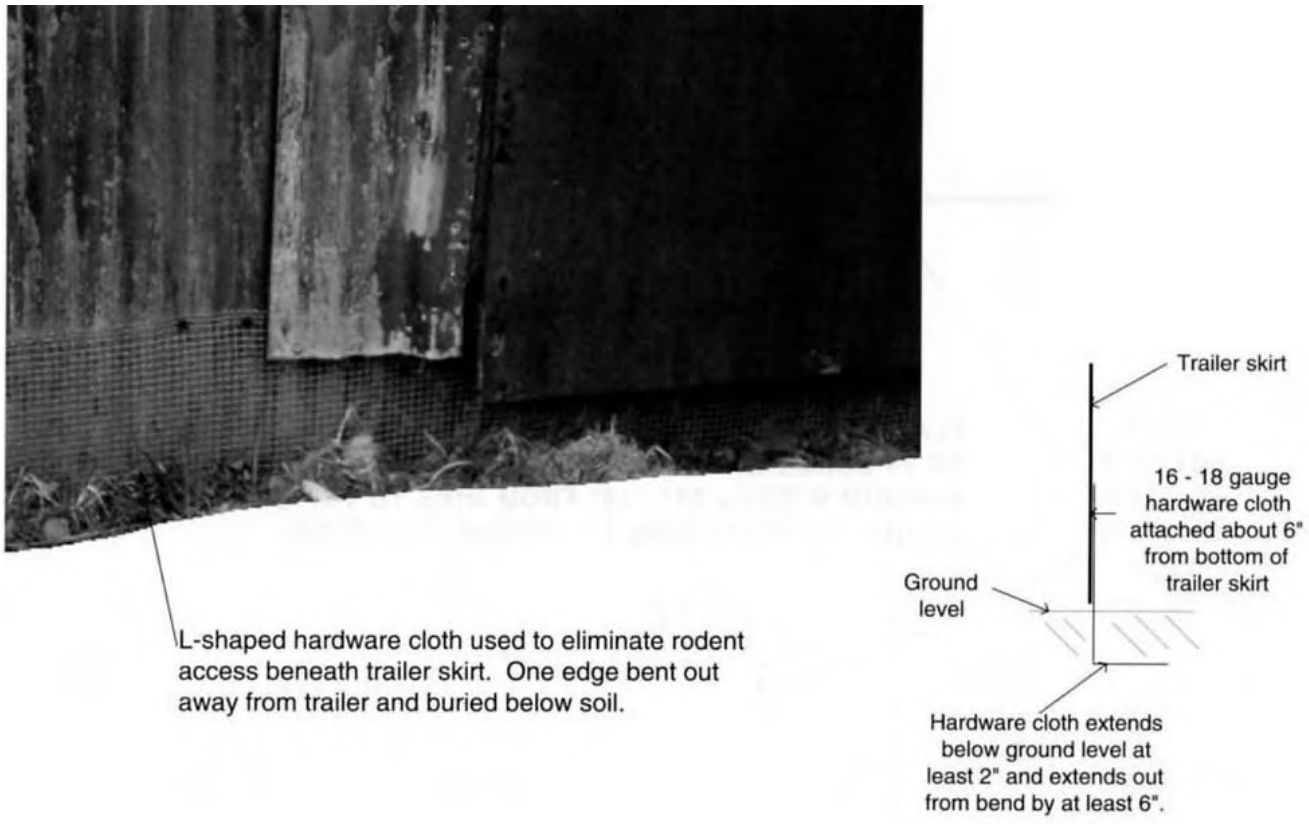


Figure 24

The higher, vertical edge of the wire should be tightly attached to the building siding about 5 to 6 inches above ground level, and the other end of the wire should be buried 2 or more inches below ground. The bottom edge of the wire extending below ground should be curved outward horizontally about 5 to 6 inches from the building. The horizontal edge of the below-ground wire should be made tight by staking it to the ground at approximately every foot of length and then covering it with 2 or more inches of soil and rocks.

Most animals attempting to burrow under a wall begin digging downward where the wall meets the ground. The buried, horizontal portion of the curtain-wire barrier extending out away from the wall makes this impossible.

Old World (exotic) rats are more aggressive in their attempts to burrow under foundations, and may require the construction of a concrete curtain wall. This is a 4-inch-thick, L-shaped wall of concrete that abuts the foundation. It extends above ground 6 to 8 inches, and below ground for a minimum of 2 feet. The lower and horizontal portion of the curtain wall should extend at least 1 foot out from the building. Although this type of construction can be used for nearly any type of foundation, it is expensive to retrofit structures, because a 2-foot-deep ditch has to be dug around the building and concrete forms have to be constructed.

Attics and Crawl Space Vents. Install tight doors or commercially available, screened, self-closing vents over attic and crawl space openings, or screen them with ¼-inch-mesh hardware cloth (Figure 2).

Trailer Tongues. Generally, ¼-inch hardware cloth wire is the best material for closing irregular openings around trailer tongues (Figures 12, 13). However, its use may require considerable ingenuity in finding ways to securely attach the wire to both the tongue and trailer siding. Extreme cases may require the use of quick-setting construction cements or epoxy compounds.

Vegetation. To keep rodents from using vegetation as a way onto roofs, trim all trees and shrubs away from buildings, and remove limbs that overhang or are in close proximity to roof lines. Where possible, an 18-inch-vegetation fire zone should be maintained around all structures. Filling the 18-inch zone with gravel will create a neat, esthetically pleasing appearance. This method requires the approval of cultural resource management prior to implementation.

Garbage and Trash Areas. Repair trash-can and dumpster lids so they fit tightly, and screen any large drain holes in the bottoms of the receptacles with ¼-inch-mesh hardware cloth (Figure 10). Insert a metal disc in the bottom of tulip-style cans to prevent rodent access.

Automobiles and Machinery. It is very difficult to exclude rodents from machinery such as vehicles, construction equipment, and emergency-response equipment when they are parked outside. Machinery can only be kept free from rodent damage by parking it in enclosed, rodent-proof garages. The same general guidelines that were described previously for other buildings apply to the exclusion of rodents from garages and outbuildings. Specially designed door seals and gaskets are commercially available, and effective.

Building Interiors

All holes, gaps, and cracks in walls, floors, ceilings, and cupboard interiors, and around bathtubs or chimneys, must be sealed to keep rodents from entering rooms.

Similarly, all open chases and gaps must be sealed around conduits, electrical wires, circuit-breaker boxes, water pipes, gas lines, drains, exhaust vents and ducts, air conditioners, and other elements that penetrate walls, floors, and ceilings. Unlike use on building exteriors, the use of hardware cloth wire or sheet metal to cover cracks and holes on the building interiors does not produce a desired finished appearance, and caulking, plastering, and/or painting usually accompanies repairs.

Screen floor drains in custodial closets, laundry rooms, and lunchrooms with stainless-steel grates should have openings less than ¼ inch in diameter.

Fit exterior doors with self-closing devices (springs), and reduce the threshold gap to ¼ inch or less. Interior doors may also be fitted with close-fitting door sweeps to make it possible to contain or isolate indoor rodent problems within specific rooms or areas.

Install ¼-inch, 16- to 19-gauge hardware cloth over heating registers and cold-air-return vents if rodents use these pathways.

RODENT-PROOFING MATERIALS

The object of rodent exclusion is to physically prevent or discourage rodent penetration of a physical structure. However, the sharp teeth of rodents are adapted for gnawing, and allow the animals to penetrate many commonly used construction materials. Materials selected for rodent-proofing must be resistant to penetration by rodents, be used in ways that discourage rodents from penetrating them, and be as easy as possible to work with. Regardless of the materials used, no holes should be left open on the inside or outside of buildings that are more than ¼ inch in diameter. (Also see Appendix D, Sources for Pest Control Supplies and Equipment, for the addresses of manufacturers.)

Solid-metal Materials

Sheet Metal. Galvanized sheet metal, 24-gauge or heavier, is recommended for most general rodent-exclusion uses.

"Tyrne" Sheet Metal. Some pest control technicians prefer to use a 40-pound-weight, tin-coated steel, known as "Tyrne" sheet metal. It is a soft, bendable (annealed) metal, which is sometimes resin-coated to facilitate ease of painting. "Tyrne" is extremely animal resistant, and comes on a 14-inch-wide by 50-foot-long roll (Follansbee Steel).

Kick Plate. Door bottoms can be protected from gnawing rodents by the installation of a 12-inch-wide kick plate made from 24- or 26-gauge metal (galvanized steel or brass) at the bottom of the door.

Rodent Guards. Flat or tunnel-shaped rodent guards for single vertical utility lines leading into buildings can be made from sheet metal (Figure 25).

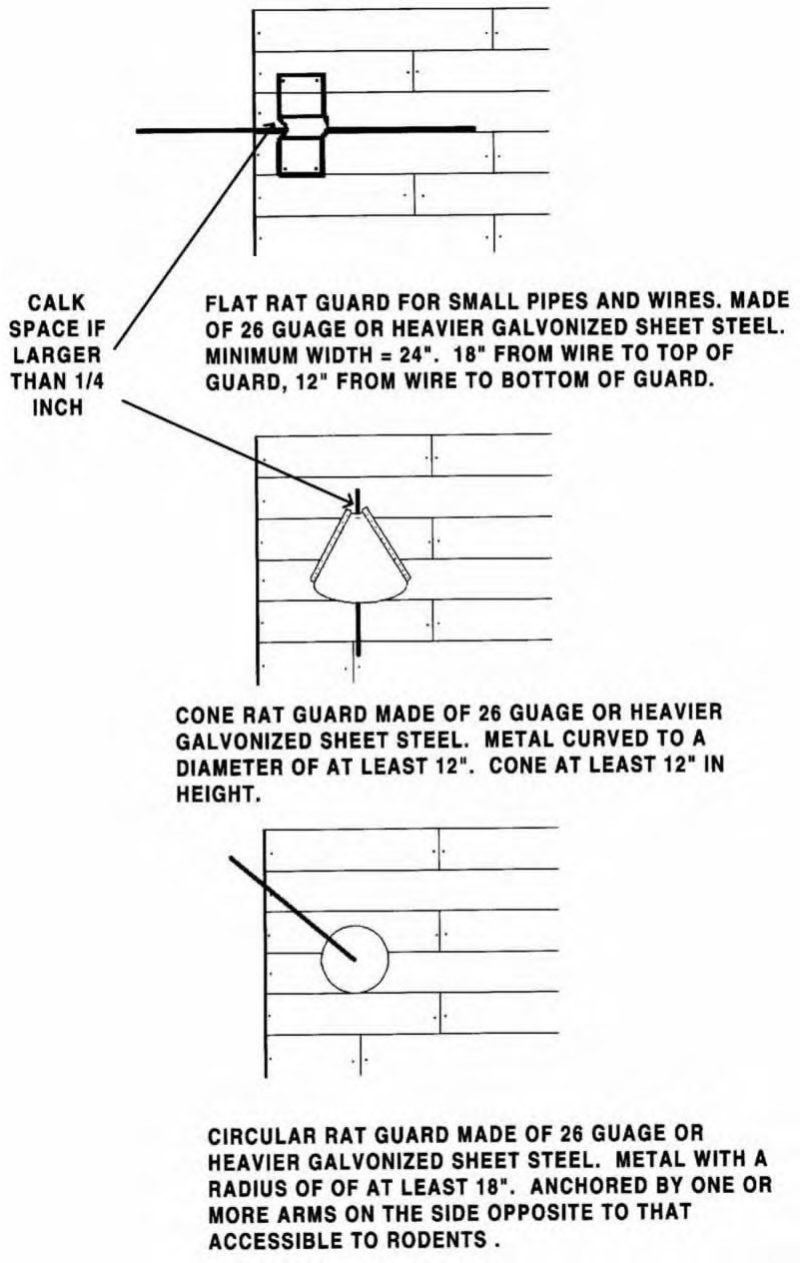


Figure 25

Multiple vertical utility lines require more elaborate guards. Protect horizontal lines leading into buildings with 18-inch-radius metal disk-guards set far enough away from buildings to keep animals from jumping from the line to the roof.

Aluminum-coil Stock. This is soft and easily shaped, and excludes birds (except woodpeckers) and bats, but mice, rats, and squirrels can easily gnaw through aluminum. If at all possible, use galvanized sheet metal rather than aluminum.

Screening Materials

Expanded Metal. Galvanized (non-rusting) expanded metal, 28-gauge or heavier, resembles heavy-duty hardware cloth, and, although it is bulky and somewhat difficult to work with, it is highly resistant to most animals.

Perforated Metal. Galvanized (non-rusting) perforated metal, 24-gauge or heavier, is also highly resistant to most animals, but it is also somewhat difficult to work with.

Hardware Cloth. Hardware cloth is the best, and one of the easiest, materials to use for screening foundation vents, open pipes, and other holes. It effectively excludes mice and most native rats. However, light-gauge hardware cloth is not entirely resistant to more aggressive animals, such as Old World rats.

Use 16- to 19-gauge, welded-at-each-joint, ½-inch by ½-inch-mesh, galvanized-after-welding wire screen to exclude larger animals or aggressive rats. This is extremely strong material, and will last 10 to 20 years due to its heavy zinc coating.

Use 19- or heavier gauge, galvanized, ¼-inch or smaller mesh hardware cloth to keep smaller animals (e.g., mice) out. Covering hardware cloth with metal window screening also keeps insects out.

Stainless-steel Hardware Cloth. Cover floor drains with ¼-inch-mesh, heavy 16- to 19-gauge stainless-steel hardware cloth, and be careful to not leave any openings around the sides any larger than ¼ inch. Covering drains will increase clogging, so be sure to inform building maintenance staff when you install these screens.

Metal Window Screening. Metal window screening is not an adequate protective material for rodent-proofing, and it should only be used on windows to keep insects out. Plastic window screening does not provide any rodent-proofing qualities at all.

Weather Stripping

Many different types of weather stripping are commercially available for sealing small spaces between movable parts like doors and windows. However, special types of weather-stripping can be obtained for unusual applications. Refer to manufacturer catalogs for specific designs.

Compression Seals. Compression seals are commonly made from felt, foam, or sponge materials, and are not highly resistant to gnawing rodents. Compression seals are best used for non-uniform gaps, are inexpensive, and are easy to install; however, they are less durable than other kinds of weather stripping.

"Bump"-type Seals. Include vinyl tubular gaskets (with or without reinforcing molding). They may be backed with vinyl, felt, wool pile, or foam strips. These are unobtrusive and also suitable for non-uniform gaps. Heavy-duty types of seals function better, but even these are not resistant to gnawing rodents.

Metal Tension Strips. These strips are available in a variety of designs in brass, bronze, and aluminum wafer-like strips. These are not difficult to install, but they are not suitable for non-uniform gaps. They are permanent, tight, and unobtrusive, but they only offer moderate resistance against rodents.

Interlocking Seals. Interlocking seals are made in two pieces, and form a double seal on door jambs, door bottoms, and windows. They are relatively expensive, and they may require installation by a carpenter. They are not suitable for non-uniform gaps, but they are permanent, highly effective and unobtrusive, and they offer moderate resistance against rodents.

Door Sweeps. Although they require frequent repair, good door sweeps are one of the most important means for keeping rodents out of structures. To keep rodents from gnawing on door sweeps, install metal kick plates on the outside of doors, allowing less than ¼-inch clearance to the floor. Gustatory repellents (bad-tasting substances) are sometimes applied to rubber and vinyl door sweeps and seals to keep rodents from gnawing on them.

Door-bottom or Threshold Seals. These compressible rubber or vinyl seals fit on door bottoms or thresholds, and are suitable for uneven gaps. They are relatively expensive, and are somewhat difficult to properly install.

Common Door Sweeps. These include felt, vinyl, and stiff-bristle sweeps that are inserted in a metal holder and used to weather-seal door bottoms. They are suitable for slightly uneven gaps, are moderately priced, and are easy to install, but they are highly visible. Sweeps with elongated mounting holes for screws allow readjustments as the sweep wears. Automatic door sweeps are also available; these drop to seal against the floor when the door closes, but they may require professional installation.

Garage-door Strips. Weather stripping used on overhead garage doors is usually either flap-type door sweeps or round rubber gaskets that compress under the weight of the door. Garage-door sweeps are suitable for somewhat uneven gaps, are durable, are moderately priced, and are easy to install—unless they somehow interfere with the door-locking mechanism. Damage to garage-door sweeps and compression gaskets from rodents trying to gain entrance is usually confined to gasket corners, which can sometimes be protected with metal flashings.

Filler Materials

Lath Screen or Lath Metal. This is a galvanized, light-gauge metal mesh that is installed over wooden walls before the plaster finish is applied. This material is extremely malleable, and can be wadded up and pushed into holes. It is highly rodent-proof. Lath screen is galvanized and does not rust or bleed through caulk. This is an excellent filler material, and it can be easily compressed to completely fill odd-shaped openings. After forcing lath screen into holes, slightly expand its sharp edges with a screwdriver to better fill the cracks and then force the metal into the edges of the hole. Be careful of sharp edges when handling this material.

Steel Wool. If steel wool must be used, only use 00-sized material. Steel wool is an effective and easy-to-use filler for small holes, but it rusts and cannot be used where moisture is present. Rodents often work their way between the steel wool and edges of the opening. Always caulk over steel wool to seal it and to make it easier to determine if rodents have penetrated the seal.

Copper Screen. Copper is a soft metal, and can be penetrated by rodents. (Aluminum and plastic screening do not exclude rodents at all.)

Aluminum Screen and Plastic Screen. These materials do not exclude rodents at all.

Copper Mesh. "Stuff-It" is a compressible copper mesh that is commercially available and is reported by the manufacturer to be rodent-proof. However, it is still best to caulk over openings filled with copper mesh.

Caulking Compounds

Use the best available caulking, and use colors that match the structure.

Oil and Oil-resin Caulking Compounds. Some prefer this caulking compound because it is long-lasting (from 1 to 4 years) and has superior smoothing qualities, even in cold weather. Although inexpensive and easy to apply, oil-resin caulking compounds may discolor, shrink, or adhere poorly to porous surfaces, such as brick. It cures slowly, and requires paint thinner for cleanup. Oil-based caulking compound is adequate for filling small holes and cracks that are not subject to stress (e.g., between wooden frames and siding).

Latex Caulking Compounds. This caulking can be either acrylic or vinyl. Acrylic latexes are good for non-moving joints, last longer, and have better weathering characteristics, but they are more expensive than vinyl latexes. Both of these products are easy to apply, cure quickly, do not stain or bleed, clean up with water, are durable (3 to 10 years), have good adhesion, and do not shrink greatly. However, latex caulking compounds may freeze before hardening when used during cold weather.

Butyl Caulking Compounds. Although this material is slow-curing, it is very good for sealing gaps between metal and masonry and for joints up to ¾ inch wide and 3/8 inch deep. Butyl caulking compounds are slightly more durable than latex-based caulking compounds,

but are more difficult to apply. However, butyl-based caulking compounds are resistant to shrinking, possess excellent adhesion properties, and are good for use below ground level. This material is flammable when wet, and requires paint thinner for clean up.

Elastomeric Sealants. This group of materials includes silicones, polyurethanes, polysulfides, and so forth. They are best used for joints subject to movement (e.g., between masonry and wood, metal, or fiberglass siding). Silicones can be used in cracks larger than 1 inch wide and ½ inch deep, and are quite durable (for up to 20 years). Elastomeric sealants cure rapidly, are waterproof, remain flexible in a wide range of temperatures, show excellent resistance to shrinking, and adhere well to most materials. However, only certain formulations can be painted, and these sealants are more expensive than other caulking, and they require solvents for clean up.

Asphalt Sealants. Asphalt sealants are tough, outdoor caulking materials that mice have been observed gnawing but not penetrating. This material requires mineral spirits for clean up and thinning. It remains flexible between expanding and contracting surfaces; resists oil, grease, salt, and heavy traffic; and sets up tack-free in about 30 minutes. Color selection is limited.

Roof Cement (in caulking tubes). This material is softer and thinner than canned roofing cement and is easier to apply. The best products contain fiber material.

Roof Cement (in cans). This material is waterproof and pasty. It sticks to nearly everything it touches, as long as the items are dry and not dusty. It is available in 1-gallon and 5-gallon cans. This is a good material for cementing around chimney flashings and caps, because it expands and contracts with changing temperatures. Roof cement lasts twice as long as mortar when applied to clean and dry surfaces, and it is relatively inexpensive when compared to other types of adhesives.

Epoxy and Fiberglass Resins. These materials can be used as caulking and hole-filling material. They are available from auto- and boat-repair supply sources. Many formulations harden quickly, and are highly durable, weather-resistant, and rodent-proof.

Mortar and Cement Products

Although these materials are both excellent barriers to wildlife, they are not practical in most situations, because they harden so slowly and require so much time to mix and clean up.

Cement and Concrete. These materials are good for large jobs (e.g., steps, sidewalks, tuck-pointed foundations, chimneys, barriers around slabs and sidewalks). The best mixes for cement are one part cement to three parts sand or richer. For concrete, use one part cement to two to four parts sand, or richer.

Cement Mortar. This is a mixture of several materials, and is designed to be an elastic spacer for ceramics (e.g., brick). Cement mortar it is not as hard as cement, and it weathers faster, is not a substitute for cement, and is not generally recommended for rodent exclusion. If mortar must be used, use a 1:3 mixture or richer.

Cement Patching Powder. This material has similar physical characteristics to cement. Is available in small-sized containers and is easy to mix. Most brands harden in less than 4 hours and provide good to moderate rodent exclusion.

Wood

Wooden patches on holes can effectively repel smaller rodents if there are no gnawing edges (e.g., butts, joints, holes, other surface breaks). Use the smoothest and best grades of wood available.

Although it is clear that excluding rodents is the most important key to preventing rodent infestations, good interior sanitation is always important in controlling rodents. Good sanitation practices have tremendous impact in limiting the sizes of or increases in rodent populations. Guidelines to good sanitation practices include the following:

INSIDE

Food and Water

- Reduce and eliminate *all* possible food and water available to rodents.
- Store all foodstuffs (e.g., dry pet food, grass seed, groceries) in glass, metal, or durable plastic rodent-proof containers.
- Keep all garbage cans tightly covered, remove garbage from buildings every night, and empty outdoor garbage containers at least twice a week.
- Promptly remove leftover food not eaten by pets.
- Check for and remove foods stored in desks, cupboards, or filing-case drawers.
- Continuously clean up all crumbs in kitchens and snack rooms, and never leave leftover food or dirty dishes out.
- Do not take food into rooms other than the kitchen or snack room.
- Do not store empty aluminum cans for recycling inside buildings.
- Keep stove tops clean, and clean frequently around stoves and lower stove drawers.
- Clean frequently under bottom drawers in built-in kitchen cabinets.
- Clean lint from refrigerator cooling coils and drip pans, and from under refrigerators.
- Promptly repair all water leaks.
- Ensure that all occupants understand that their cooperation is essential.

Harborage

Mice will nest in anything that doesn't move. Continually rearrange furniture, boxes, and clothing to discourage nest development. Store items a minimum of 6 inches above the floor. Elevate hollow-base furniture above the floor by placing on legs or blocks. Remove all stacks of paper, plastic sacks, cardboard boxes, and other items rodents could use for shelter. All forms of clutter should be eliminated.

Importation of Rodents

Be sure that rodents are not imported into buildings from the outside. Animals are sometimes brought in with grocery sacks, boxes, patio furniture, firewood, and other items. Do not bring any more firewood inside than is necessary.

Preventing Rodent Damage in Unoccupied Buildings

Rodent damage to furniture and household contents in unoccupied cabins and houses can be reduced by removing or limiting food and available harborage and nesting sites. Remove bed linens, and hang mattresses on taut lines between ceiling beams. Remove padded cushions from furniture, and store cushions on edge, separated from one another and off the floor. Store all boxes and other materials on raised pallets or shelves. Remove drawers from cupboards or chests, empty them, and re-insert them upside down. Place all stored food in rodent-proof containers or cabinets.

OUTSIDE

Remove as much grass, weeds, and debris as possible from around buildings. These materials provide food sources and harborage sites for rodents. If possible, maintain an 18-inch-wide, vegetation-free zone around buildings. Continuously clean up all outside and inside clutter and litter. Trim the bottoms of hedges and other ground-hugging plants up from the ground to eliminate rodent harborage. Trim plants that touch or overhang buildings back 3 to 4 feet. Promptly repair all water leaks.

Store firewood, lumber, rubbish, equipment, construction materials, and other items on pallets raised at least 18 inches off the ground and located at least 30 feet from buildings, walls, and fences.

It is better to place exterior lighting on poles out and away from structures and to direct the light back on to buildings from a distance. This prevents the attraction of night-flying insects, which can serve as a food source for rodents.

POST-TREATMENT MONITORING AND EVALUATION

The documented monitoring of rodents is the last important step in managing rodent infestations. Before beginning a monitoring program, use diagrams of exterior and interior floor plans to identify locations where traps or non-toxic tracking stations have been placed. Assign specific persons to do monitoring, and establish a fixed schedule for those activities. Maintain written records on a monitoring form, showing rodent signs around the outside of structures and any developing structural deficiencies that could allow access. Signs clearly indicating the potential for rodents to move into structures are increases in numbers of rodents around a building (resulting from changes in weather, or from seasonal changes in the amount of food or shelter available to rodents) and newly developed structural deterioration

To monitor for possible rodent activity inside buildings, place traps and non-toxic tracking stations in all areas of likely rodent harborage. It was recently demonstrated that tracking patches might be a more effective tool than traps for monitoring for the presence of mice in structures. Regularly check traps and tracking stations, and individually record them on a floor-plan drawing, along with the numbers and types of rodents captured (or tracking stations showing rodent activity). Maintain records of any snapped traps that failed to catch rodents and of traps not snapped that had the bait removed.

Observe and record the presence and locations of any rodent sign (e.g., feces, food damage, feeding stations, gnawing damage, rodent holes), and question occupants about their observations of rodent activity.

Over time, the written monitoring record will provide very helpful information on the actual presence of rodents and on relative increases and decreases in the number of animals present, and will also clearly point out those areas in the building where rodent activity is heaviest.

Monitoring records will also demonstrate the effectiveness of treatments. This information can be used to show the needs for developing more effective management strategies or control methods. This information should also be presented at regularly scheduled meetings with site occupants and the site manager to ensure their cooperation.

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Grand Teton National Park (Division of Maintenance, Grand Teton National Park, WY).

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Inspection and Monitoring Form

Date:		Inspected by:			
Park:		Region:		Building:	

Grounds and Building Exterior

Observation Guides	Defects Noted
1. **TRASH CANS:** Location(s)? Plastic can liners? Regularly emptied? Cans regularly washed/cleaned? Can bottoms under plastic liners clean? Can bottoms with holes? General can condition? Lid conditions? General sanitation around cans? Food-waste only in special cans? Schedule for emptying?	
2. **TRASH DUMPSTERS:** Dumpsters located at a distance from building? Clean? Regularly emptied? Regularly steam-cleaned? Lid conditions? Secure against rodent entry?	
3. **FOOD:** Evidence of animals being fed by people? Other potential sources of food for rodents seen?	
4. **EXCLUSION:** Buildings tightly sealed? Vehicles parked in rodent-proof garages? Fences/walls tight? Wires into building pests could travel on? Attics/crawlspaces screened? Foundations protected by curtain wire or concrete curtain wall? Chimneys/vents screened? Door sweeps tight? Window/door frames good condition?	
5. **WATER:** All pipes/downspouts/gutters in good condition, not leaking? Standing water near/around facilities? Evidence of animals using water sources? Erosion problems? Grade against buildings? Peeling paint? Roof edges in good condition?	
6. **HARBORAGE:** Cracks and crevices in walls? Rodent harborage under nearby rocks/storage? Debris on ground supporting/attracting animals? Weed-free area around buildings?	
7. **LIGHTS:** Type and location? Evidence of live/dead insects around lights? Rodent evidence?	
8. **VEGETATION:** Plants that attract rodents? Foundations and wall bases with weed-free zone? Vegetation touching/overhanging building? Wall bases clear and trimmed close to ground? Tap-rooted plants present to attract gophers? Hazard trees?	
9. **SANITATION:** General cleanliness? Rubble or stored items near or adjacent to buildings? " Bone yard" neatly arranged, storage up off ground? Presence of pests?	
10. **ANIMALS:** Open burrows and locations? Gopher burrows in visitor use areas? Active animals seen? Young animals? Dead animals? Raptors? Predators? Ant nests? Evidences of pest infestations? Factors contributing to continued pest presence? History of animals present and types?	
11. **GENERAL BUILDING CONDITION:** Type of construction material? Shade available for rodents?	
12. **PHOTO RECORDS:** Pictures made?	

APPENDIX A (continued)

Inspection and Monitoring Form

Date:		Inspected by:			
Park:		Region:		Building:	

Building Interiors

Observation Guides	Defects Noted
1. **WINDOWS:** Tightly sealed, glass complete, screens in good repair? Opened regularly? Frames intact?	
2. **DOORS:** In good repair, effectively seal off rooms/areas? Seals and sweeps tight (no light showing through)? Close properly?	
3. **FACILITY AREAS:** **PIPES:** Routinely inspected? In good repair? Leaks? Pipe traces open or sealed? **MECHANICAL ROOM:** Free from debris or water? Cracks or crevices in walls? Openings directly to outside? Vent and exhaust chases sealed? Suspended ceilings? Pests in dust collectors or central vacuum systems? Door sweeps too high? **ELECTRICAL ROOMS:** Conduits and lines open or sealed? Holes, cracks, or crevices in walls? Openings directly to outside? Suspended ceilings? Pests inside seldom-used equipment? Door sweeps too high? **CUSTODIAL CLOSETS:** Cleanliness? Personal item storage? Food stored/eaten here? Walls, floors, sink areas with cracks, crevices, holes? Excessive or long term storage of paper or supplies? Suspended ceilings? Mops off floor? **BOILER/STEAM ROOMS:** Standing water? Holes in walls, floors, or ceilings? Pest evidence? What? Suspended ceilings? Door sweeps too high? Grates on drain?	
4. **WATER SOURCES:** Standing water? All cracks, crevices, holes sealed? Pipe traces sealed?	
5. **MUSEUM COLLECTION STORAGE:** How often inspected? Cracks, crevices, holes in walls, floors, ceiling? Temperature and humidity monitored/controlled? Control on materials moving into and out of storage? Inspect seldom-used storage areas, outbuildings, and old books. Is there continual pest monitoring? How? Who? Doors/windows seal tightly? Storage on floor? Air conditioner sealed? Procedures for pest identification, isolation, preservation, record keeping? Suspended ceilings?	
6. **GIFT AND ACQUISITION AREA:** Procedures for de-infesting new acquisitions/gifts? Regular inspection for pest infested materials? Isolation from primary collections storage? Route that materials take in entering area? Specific unpacking area away from primary collections area? Suspended ceilings? Storage conditions?	
7. **INTER-LIBRARY LOANS:** Procedures for examining incoming materials? Are pests or damage identified? Isolation of suspected books? Food, beverage, etc. present? Suspended ceilings?	
8. **CONSERVATION LABORATORIES AND PRESERVATION OFFICES:** Separated from collection storage and other areas? Treatment area present? Insect identification collection? Is collection kept pest free and in pest-free drawers/containers? Suspended ceilings?	

APPENDIX A (continued)

Inspection and Monitoring Form

Date:		Inspected by:			
Park:		Region:		Building:	

Building Interiors (cont.)

Observation Guides	Defects Noted
9. **GALLERIES/EXHIBITS/VISITOR CENTER:** Vacuumed regularly? Custodian reports pest signs? To whom? Materials moving into/out of galleries checked for pests? Food/drink allowed in galleries? Exhibit preparation/manufacturing areas clean? Holes in walls, ceilings, floor; cracks, or crevices? Pest presence? Continually monitored for pests? By whom? Monitoring documented? Doors and windows in/adjacent to galleries seal tightly? Suspended ceilings? Air/heating vents filtered? Door sweeps too high?	
10. **GIFT AND SALES AREAS:** Ongoing monitoring for pests? Display cases with pest harborage under/around them? Infested materials immediately removed, isolated for identification and treatment? Food, drinks eaten here, properly stored, disposed of? Proximity of area to museum galleries? Administrative offices? Pipe, electrical line traces sealed? Suspended ceilings?	
11. **STAFF LOUNGE AREA:** In same building as museum and museum storage? Refrigerator (including defrost drain pan and coils) clean? Is only central area where food allowed? Sink/counters in good repair, clean? Pest presence? Microwave/stove/oven clean? Coffee pot/other appliances clean? Trash can has liner, lid? Emptied every night? Regularly washed? Empty pop cans stored in building? Floors regularly mopped/ dusted/vacuumed? Personal lockers present? All pipe, electrical line traces sealed? Suspended ceilings? Door sweeps too high?	
12. **WATER SOURCES:** In good repair? Floor drains screened? Water fountains with pipe traces sealed, pipes insulated to prevent condensation? Leaks? Sinks, lavatories in good repair, without leaks, clean? Bottled water dispensers leak? Aquaria? Plants?	
13. **STAFF AREAS, WORK STATIONS, AND OFFICES:** Food, water present; coffee/cold drinks allowed? Candy/snacks/foods in desks? Trashcans with liners, lids? Only food/paper or mixes of trash put into cans? Dried/live flowers/plants present? Pest evidence? Pipe, electrical line traces sealed? Proper storage of supplies, equipment, other materials? How long paper/envelopes stored? Doors, windows close tightly? Suspended ceilings? Pests behind/under desk drawers, cabinets, etc. Air and heating vents covered with filters? Door sweeps too high? Monitored for pests?	
14. **ATTIC AND BASEMENTS:** Holes to outside? Pest evidence? Inspect under attic insulation. All pipe, wire traces sealed? Ducts, vents screened and sealed? Water leaks? Damaged wood? Moisture present? Doors, windows tightly seal? Proper storage? Suspended ceilings? Grates on drains?	
15. **WALL VOIDS:** Inspect for insects, dead animals, or odors.	
16. **CRACKS AND CREVICES:** Present? Inspected for accumulated hair or lint and pest harborage.	
17. **OTHER:**	

APPENDIX B
Example of a Written Inspection Report
Evaluation of Trailers

Trailer # 1

I was finally able to inspect the interior of this trailer and speak with the resident before I left the park. The resident and his roommate have only been in the trailer since early October and said they have had considerable problem with mice and have lost food items to rodents. Mouse feces were common in the trailer and larger, rat-size fecal pellets were found near the kitchen corner next to the furnace cabinet. Although sanitation in this trailer left a lot to be desired, there is resident can do to lessen rodent problems inside the trailer until major repairs are completed.

DEFICIENCIES

EXTERIOR

- A large portion of the trailer skirt is missing from this trailer. 'The bottom covering of this trailer is relatively intact and seems to only broken on the south east corner and where pipes penetrate the floor. It may be possible to repair the bottom covering and screen pipe penetrations rather than installing a completely new skirt. If the decision is to install a new skirt, install 'L' wires, hardware cloth at the base of the skirt all around the trailer.

- Repair windows that do not close and which have openings filled with wadded up plastic bags.

- Remove all vegetation at the rear of the trailer out 3 to feet from the trailer.

- Install supporting wooden framework for the hot water heater cabinet and a cabinet door. Carefully inspect the existing cabinet and replace rotten floor and open pipe and electrical line chases and wall separating the cabinet from the kitchen sink.

INTERIOR

- Remove copper mesh pushed into crack (West side) of the living room floor and repair and reseal the floor.

- Close the opening around the clothing washer bib and caulk pipe chases at floor level.

- Re-caulk/seal the bathtub; various cracks are nearly large enough to allow mice to enter.

- Caulk the pipe chases under the bathroom sink at the toilet.

- o No rodent activity was seen inside the furnace inspection door but seal the bottom and upper louvers with hardware cloth.

- o Caulk the pipe chase for the copper water inlet line located in the cupboard to the right of the kitchen stove.

- o Replace the wall under the kitchen sink which separates the kitchen from the hot water heater cabinet; seal all pipe and chases.

TRAILER # 2

I was not able to speak with the resident of this trailer but a male resident from nearby Trailer # 3 told me that the woman living in # 2 has had considerable rodent problems she has not been able to control and, lately, found large, 'rat-like' animal feces in the kitchen. I thought I would try to speak with the resident of # 2 to provide a few pointers on both sanitation and rodent control or at least leave a note; however, our inspection of the trailer showed there is nothing the resident can do to control rodents until major repairs are completed on the trailer.

DEFICIENCIES

EXTERIOR

- o Install a furring strip under the drip flashing.

- o Install an 'L' wire, hardware cloth barrier at base of skirting.

- o Caulk up the small holes around the trailer tongue.

- o Caulk the gas line inlet chase.

- o Repair loose trailer skirting panel on west side.

- o Install new floor in hot water heater cabinet and seal all holes and pipe/electrical chases in interior walls and ceiling.

INTERIOR

- o Insert compressed metal wire (lathe metal or copper mesh) in and then caulk over the open rodent hole in the bottom of the door facing.

- o The kitchen stove contains rodent nests; remove and clean stove. We found rat-sized feces under the top and around the base of the kitchen stove; a medium-sized onion

- Caulk the kitchen pipe chases under the sink.

- There are abundant rodent feces in the floor heater vent. This allows rodent-contaminated dusts to be blown out with warm air. Clean the vents and check the heater ducts and bottom of the furnace under trailer for possible rodent entry.

- Seal up the large holes around the circuit breaker box and caulk electrical line chases at the floor level.

- Remove rusted steel wool and re-caulk bathroom pipe chases under sink and at toilet.

- Seal up the large hole around the clothing washer bibs and caulk pipe chases at floor level.

- Caulk the floor level holes in the east corner of the middle bedroom. Screen around the furnace, the base of the furnace, interior louvers, and around the furnace chimney pipe chase with 3 inch hardware cloth.

APPENDIX C
Hantavirus Worker Protection

This document summarizes the updated recommendations from the Centers for Disease Control and Prevention (CDC) for hantavirus risk reduction for workers. The information is adapted from the Morbidity and Mortality Weekly Report, July 26, 2002; Vol. 51; No. RR09.

Precautions for Workers Frequently Exposed to Rodents

Persons who frequently handle or are exposed to wild rodents are probably at higher risk for hantavirus infection than the general public because of the frequency of their exposures. Such persons include, but are not limited to, wildlife specialists, maintenance workers, pest-control workers, some custodial staff, and building and fire inspectors. Therefore, enhanced precautions are warranted to protect them against hantavirus infection, as described below.

- Workers in potentially high-risk settings should be informed by their employers about hantavirus transmission and symptoms of infection, and be given detailed guidance on prevention measures. Determining the level of risk for HPS in each work setting is the responsibility of the park. The Regional Public Health Consultant and Safety Officer may be contacted for assistance, if necessary.
- Workers who develop a febrile or respiratory illness within 45 days of the last potential exposure should immediately seek medical attention and inform the attending physician of the potential occupational risk of hantavirus infection.
- When removing rodents from traps or handling rodents, workers should wear either a half-face, tight-seal, negative-pressure respirator or a positive pressure PAPR (powered air-purifying respirator), equipped with N-100 filters. Employees must be in compliance with NPS Director's Order #50B and Reference Manual #50B for respiratory protection. Requirements include medical clearance, and annual training and fit testing for each approved respirator type.
- Workers should wear rubber, latex, vinyl, or nitrile gloves when handling rodents or handling traps containing rodents. Before removing the gloves, wash gloved hands in a disinfectant or chlorine solution and then wash bare hands in soap and water.
- Mammalogists or wildlife biologists who handle wild rodents for research or management purposes should refer to the published safety guidelines available on CDC's website, All About Hantavirus (http://www.cdc.gov/ncidod/dvrd/spb/mnpages/rodentmanual.htm).

Precautions for Workers Having Potential Contact with Rodents

Insufficient information is available to provide general recommendations regarding risks and precautions for persons who work in occupations with unpredictable or incidental contact with rodents or their nesting sites. Examples of such occupations include archaeologists, natural resource specialists, utility operators, curators, and certain construction workers. Workers in these jobs may have to enter buildings and crawl spaces, or might otherwise be exposed to sites or material that are potentially rodent-infested. Recommendations for such circumstances must be made on a case-by-case basis after the specific working environment has been assessed. The Regional Public Health Consultant or the Safety Officer may be consulted as needed to assist in the assessment. Determining the level of risk present and implementing appropriate protective measures is the responsibility of the park.

Areas with evidence of rodent activity (e.g., dead rodents, nests, and excreta) should be thoroughly cleaned to reduce the likelihood of exposure to hantavirus-infected materials. Cleanup procedures must be performed in a manner that limits the potential for dirt or dust

Cleanup of Rodent Urine, Droppings, and Contaminated Surfaces

- During cleaning, wear rubber, latex, vinyl, or nitrile gloves.
- Spray rodent urine and droppings with a disinfectant or chlorine solution until thoroughly soaked. (See Cleanup of Dead Rodents and Rodent Nests.)
- To avoid generating potentially infectious aerosols, do not vacuum or sweep rodent urine, droppings, or contaminated surfaces until they have been disinfected.
- Use a paper towel to absorb the urine and pick up the droppings. Place the paper towel in the garbage.
- After the rodent droppings and urine have been removed, disinfect items that might have been contaminated by rodents or their urine and droppings.
    - Mop floors with a disinfectant or chlorine solution.
    - Disinfect countertops, cabinets, drawers, and other durable surfaces with a disinfectant or chlorine solution.
    - Spray dirt floors with a disinfectant or chlorine solution.
    - Disinfect carpets with a disinfectant or with a commercial-grade steam cleaner or shampoo.
    - Steam-clean or shampoo rugs and upholstered furniture.
    - Launder potentially contaminated bedding and clothing with hot water and detergent. Use rubber, latex, vinyl, or nitrile gloves when handling contaminated laundry. Machine-dry laundry on a high setting or hang it to air dry in the sun.
    - Leave books, papers, and other items that cannot be cleaned with a liquid disinfectant or thrown away, outdoors in the sunlight for several hours, or in an indoor area free of rodents for approximately 1 week before cleanup. After that time, the virus should no longer be infectious. However, to further reduce risk, wear rubber, latex, vinyl, or nitrile gloves and wipe the items with a cloth moistened with disinfectant.
    - Before removing the gloves, wash gloved hands in a disinfectant or chlorine solution and then wash bare hands in soap and water.

Cleanup of Dead Rodents and Rodent Nests

- Wear rubber, latex, vinyl, or nitrile gloves.
- In the western United States, use insect repellent (containing DEET) on clothing, socks, and arms to reduce the risk of fleabites that might transmit plague.
- Spray dead rodents and rodent nests with a disinfectant or a chlorine solution, soaking them thoroughly. Wait 10 minutes before disturbing to ensure inactivation of the virus.
- Place the dead rodent or nest in a plastic bag, or remove the dead rodent from the trap and place it in a plastic bag. When cleanup is complete (or when the bag is full), seal the bag, place it into a second plastic bag, and seal the second bag. Dispose of the material in the double bag by burning it or discarding it in a covered trash can that is regularly emptied. Contact the local or state health department concerning other appropriate disposal methods.
- Clean up the surrounding area as described in "Cleanup of Rodent Urine and Droppings and Contaminated Surfaces."

1. General-Purpose Household Disinfectant: Prepare according to the label, if not prediluted. Almost any agent commercially available in the United States is sufficient as long as the label states that it is a disinfectant. Effective agents include those based on phenols, quaternary ammonium compounds, and hypochlorite.
2. Hypochlorite Solution: A chlorine solution, freshly prepared by mixing 1½ cups of household bleach in 1 gallon of water (or a 1:10 solution) can be used in place of a commercial disinfectant. When using chlorine solution, avoid spilling the mixture on clothing or other items that might be damaged by bleach. Wear rubber, latex, vinyl, or nitrile gloves when preparing and using chlorine solutions. Chlorine solutions should be prepared fresh daily.

Cleaning Sheds and Other Outbuildings

Before cleaning closed sheds and other outbuildings, ventilate the building by opening doors and windows for at least 30 minutes. Use cross ventilation if possible. Leave the area during the airing-out period. This airing helps to remove infectious primary aerosols that might be created by hantavirus-infected rodents. In substantially dirty or dusty environments, additional protective clothing or equipment may be worn. Such equipment includes coveralls (disposable when possible) and safety glasses or goggles, in addition to rubber, latex, vinyl, or nitrile gloves. For recommendations regarding precautions for cleanup of outbuildings with heavy rodent infestations, see below.

Recommendations for Cleaning Homes or Buildings with Heavy Rodent Infestations

- Special precautions are indicated for cleaning homes or buildings with heavy rodent infestations. A rodent infestation is considered heavy if piles of feces or numerous nests or dead rodents are observed. Persons cleaning these homes or buildings should contact their Safety Officer or Public Health Consultant. These precautions also can apply to vacant dwellings that have attracted rodents while unoccupied and to dwellings and other structures that have been occupied by persons with confirmed hantavirus infection. Workers who are either hired specifically to perform the cleanup or asked to do so as part of their work activities should receive a thorough orientation about hantavirus transmission and disease symptoms and should be trained to perform the required activities safely.
- If the building has been closed and unoccupied for a long period (weeks or months), ventilate the building by opening doors and windows for at least 30 minutes before beginning any work. The ventilation helps to remove aerosolized virus inside the structure. Use cross ventilation if possible. Leave the area during the airing-out period.
- Persons involved in the cleanup should wear coveralls (disposable, if possible); rubber boots or disposable shoe covers; rubber, latex, vinyl, or nitrile gloves; protective goggles; and an appropriate respiratory protection device as detailed in "Precautions for Workers Frequently Exposed to Rodents."
- Personal protective gear should be decontaminated or safely disposed of upon removal at the end of the day. If the coveralls are not disposable, they should be laundered on site. If no laundry facilities are available, the coveralls should be immersed in liquid disinfectant until they can be washed.
- Unless burned on site, all potentially infectious waste material from cleanup operations should be double-bagged in durable plastic bags and then discarded in a covered trash

- Persons involved in the cleanup who develop a febrile or respiratory illness within 45 days of the last potential exposure should immediately seek medical attention and inform the attending physician of the potential occupational risk of hantavirus infection.

APPENDIX D

SOURCES OF RODENT CONTROL SUPPLIES AND EQUIPMENT

The following list of rodent control equipment and chemical suppliers is not meant to completely cover the entire field and is offered as an assistance in finding specific products. Space limitations do not permit including every possible vendor. Undoubtedly, the list omits those products or companies not coming to our attention. Products or companies listed here are not endorsed or recommended by the United States Government or G&L Consultants. No discrimination is intended against products or companies not listed. Additional listings classified by subject can be found at http://wildlifedamage.unl.edu/handbook/handbook/supplies/sup_mat.pdf. The list, compiled by Scott E. Hygnstrom and Dale J. Hafer, is provided by the Prevention and Control of Wildlife Damage, Coop. Extension. Div., Inst. Agric. and Nat. Res., University of Nebraska, Lincoln NE.

ALPHABETIZED LISTING

Advantage Products
P.O. Box 307
2343 Commerce Blvd.
Mound, MN 55364
800-257-3464
Rodent bait stations

Allen Special Products
Box 605
Montgomeryville, PA 18936
800-848-6805
Manufacturer of "Stuff-It", a copper, non-rusting, material to exclude pests.

Aearo Safety
8001 Woodland Drive
Indianapolis, IN 46278
800-327-3431
Respirators, personal protective safety equipment. www.aearo.com

Atlantic Paste and Glue Co.
4-53rd St.
Brooklyn, NY 11232
718-492-3648
Catchmaster rodent sticky traps.
www.catchmaster.com

Ben Meadows Co.
PO Box 80549
Atlanta, GA 30366
800-241-6401
Weed flamers. www.benmeadows.com

Bramton Co.
Dallas, TX
800-272-6336
Simple Solution (odor eliminator, enzyme from Bacillus subtilis that breaks down sulfide bonds in skunk scent). www.bramton.com

Burlington Scientific Corp.
222 Sherwood Ave.
Farmingdale, NY 11735
Ro-Pel (benzyldiethyl methyl ammonium saccharide) general gustatory repellent to prevent gnawing by rodents.

Chim-a-lator
8824 Wentworth Ave. S.
Minneapolis, MN 55420
800-729-9505
Chimney covers. www.dalsinmfg.com

Clean & Fresh
6619 13th Ave
Brooklyn, NY 11219
800-373-7487
Odor neutralizers, degreasers, and cleaning supplies.

Critter Control Inc.
9435 E. Cherry Bend Rd.
Traverse City, MI 49684 800-
451-6544
Rodent and animal traps and control supplies.
www.crittercontrol.com

DAP Inc.

2400 Boston St.
Suite 200
Baltimore, MD 21224
800-543-3840
Asphalt caulking. www.dap.com

Direct Safety Co.
P.O. Box 50050
Phoenix, AZ 85076-0050
800-528-7405
Respirators (UVEX), other safety equipment.
www.directsafety.com

Epoleon Corp.
18414 Doty Avenue
Torrance, CA 90504
310-327-5801
Deodorizers. www.epoleon.com

Follansbee Steel
PO Box 610
Follansbee, WV 26037
304-527-1260
Tyrne metal.

Forestry Suppliers, Inc.
205 West Rankin Street
PO Box 8397
Jackson, MS 39204-0397
800-647-5368
Weed flamers; live/multiple capture/snap traps; monitoring equipment, other products.
www.forestry-suppliers.com

Fox Valley Marking Systems, Inc.
172 S. Northwest Hwy
Cary, IL 60013
800-323-4770
Metal traps.

Fumigation Service and Supply
16950 Westfield Park Road
Westfield, IN 46074
317-896-9300
www.fumigationzone.com

G.G. Bean
Brunswick, ME
207-729-3708
Skunk Kleen, water based deodorizer.
www.ggbean.com

Havahart Traps

Woodstream Corp.
Front and Locust Streets
Lititz, PA 17543
717-626-2125
Live traps. www.havahart.com

HY-C Co.
2107 North 14th St.
St. Louis, MO 63106
314-241-1214
Chimney covers. www.hyccompany.com

Improvements
4944 Commerce Parkway
Cleveland, OH 44128
800-642-2112
HEPA vacuum bags, door sweeps, weather stripping, caulking tips, epoxy kits, vertical-rising dryer vent cover, under appliance vacuum tip and brush. www.improvementscatalog.com

Industrial Safety Co.
1390 Neubrecht Rd.
Lima, OH 45801
800-537-9721
Respirators and replacement cartridges, safety supplies. www.indlsafety.com

J.T. Eaton and Company
1393 East Highland Rd.
Twinsburg, OH 44087
800-321-3421
Traps, rodenticides, bait boxes.
www.jteaton.com

K Fence Systems
Rt. 1 Box 195
Zumbro Falls, MN 55991
507-753-2943
www.kfence.com

Kness Manufacturing
2053 Hwy. 5 South
P.O. Box 70
Albia, IO 52531
800-247-5062
Snap/multiple-capture rodent traps; supplies.
www.kness.com

Lab Safety Supply

P.O. Box 1368
Janesville, WI 54547-1368
800-356-0783
HEPA filters, respirators, vacuum cleaners, disposable coveralls. www.labsafety.com

M & M Fur Co.
Box 15
Bridgewater, SD 57319-0015
605-729-2535
Animal lures and urine, traps, trapping supplies.
www.mandmfurs.com

Macklanburg-Duncan Co. 800-654-8454
Major manufacturer of weather stripping devices with designs shown in their catalog.
www.mdteam.com

McClintock Metal Fabricators
Haul-All Equipment Systems
Woodland, CA 95695
800-350-3588
Hid-A-Bag, a tightly closing garbage can for vertebrate pests. www.mcclintockmetal.com

Moldex-Metric Inc.
Safety Products Div.
4671 Leahy St.
Culver City, CA 90232
800/421-0668
Disposable fume, dust, mist HEPA respirators, fit testing kits.
www.moldex.com

Morrison Manufacturing Co.
PO Box 52
Highway #175
Morrison, IA 50657
800-648-CAGE, 319-345-6406
Safe-N-Sound Live Traps live traps.

Myro, Inc.
Magic American Products
23700 Beachwood, OH 44122
800-321-6330
Milwaukee, WI 53233
Caulk finishing tool and plastic caulking tube tips; available in hardware departments of stores like K-Mart. www.magicamerican.com

Neutron Industries

Formula NI-712 Super Concentrated Organic Odor Eliminator
800-421-8481
www.neutronindustries.com

Nilfisk of America
300 Technology Drive
Malvern, PA 19355
610-647-6420
HEPA filter vacuum cleaners.
www.pa.nilfisk-advance.com

Precision Environmental
180 Canada Larga Road
Ventura, CA 93001
800-375-7786
Heat treatment for pest infestation
www.precisionenv.com

Professional Equipment
130 Dale St.
West Babylon, NY 11704 800-334-9291
Full line of test equipment, moisture meters.
www.professionalequipment.com

Pocatello Supply Depot
USDA-APHIS Animal Damage Control
U.S. Fish and Wildlife Service
238 E. Dillon St.
Pocatello, ID 83201
208-236-6920
Gopher control supplies, deodorants and netroleum alpha.

P-W Manufacturing
610 High Street
Henryetta OK 74437
918-652-4981
Death-Klutch DK-1 and DK-2 Gopher Getter gopher traps.

Sealeze Corp.
8000 White Pine Rd.
Richmond, VA 23237
800-446-7325
Pest Stop, brush-type weatherseals for commercial and residential doors and windows.
www.sealeze.com

Sherman, H.B.

3731 Peddie Drive
Tallahassee, FL 32303
850-575-8727
Standard Sherman folding live traps.
www.shermantraps.com

Survival Air Systems (SAS) Co.
3401 69th St.
Long Beach, CA 90805
800-262-0200
Respirators, personal protective equipment.
www.sassafety.com

Sudbury Laboratory Inc.
572 Dutton Rd.
Sudbury, MA 01776
Chaperone Deer and Rabbit Repellent (thiram)
rabbit, deer, meadow mice repellent.

Target Specialty Products
1155 Mabury Road
San Jose, CA 95133-1029
408-293-6032, 800-352-3870
Deodorants. www.target-specialty.com

Tomahawk Live Trap Co.
PO Box 323
Tomahawk, WI 54487
715-453-3550
Live traps.

Tramex
c/o Black Hawk Sales Inc.
28 in Oak Drive
Littleton, CO 80127
303-972-7926
Non-destructive moisture meter.
www.tramexltd.com

Univar USA
6100 Carillon Point
Kirkland, WA 98033
425-889-3400
Chemicals, pest control equipment.
www.univarusa.com

USDA Animal Damage Control
P.O. Box 81886
Lincoln, NE 68501
402-434-2340
Neutroleum alpha, odor eliminator

UVEX Safety, LLC
910 Douglas Pike
Smithfield, RI 02917
800-343-3411
Safety equipment, face protection.
www.uvex.com

Wildlife Control Technology Inc.
2501 N. Sunnyside Ave.
Fresno, CA 93727
559-490-2262, 800-235-0262
Fencing materials, "Bat Kit" and instructions.
www.wildlife-control.com

ZA Macabee Gopher Trap Co.
110 Loma Alta Ave.
Los Gatos, CA 95030
408-354-4158
Gopher traps

IDENTIFICATION SOURCES: call/write to inquire about services or other sources of identification.

Arizona Dept of Health Services, Disease Control
3008 N. 3rd Ave., Room 201
Phoenix, AZ 85012
Pests of public health concern.

Duke University Medical Center
Micology Center
Div. Infectious Diseases and International Health
Durham, NC 27710
919-684-3717
Histoplalsmosis in guano/feces.

Mid West Laboratories, Inc.
13611 B Street
Omaha, NE 68144
402-334-7770
Complete chemical/analytical lab services.
www.midwestlabs.com

New Mexico State University
Las Cruces, New Mexico
Department Entomology
Cooperative Extension Service
New Mexico Pest Survey and Detection Program.

University of Arizona
Cooperative Extension
2400 S. Milton
Flagstaff AZ 860001
602-774-1868

APPENDIX F

Rodent Monitoring and Management Plan

Appendix F - Rodent Monitoring and Management Plan

Introduction

Preventive management, such as rodent-proofing of buildings, proper food storage, and enforcement of regulations against feeding animals, is the preferred method for minimizing contact between the animals and humans that could result in transmission of disease. In some cases, such as when access to human food is not eliminated, the abundance of rodents can overwhelm preventive management, and local reduction of rodents may be needed. The two species of most concern are the deer mouse (*Peromyscus maniculatus*), and the California ground squirrel (*Spermophilus beecheyi*), as the most abundant carriers of hantavirus and plague, respectively (MacNeil et al., 2011; Mills et al., 2002; California Department of Public Health, 2011). Other potential carriers of plague, and sources of undesirable interactions with people include yellow-bellied marmot (*Marmota flaveventris*), golden-mantled ground squirrel (*Spermophilus lateralis*), and Belding's ground squirrel (*Spermophilis beldingi*).

Population reduction of these species can take two forms: trapping/relocation and lethal trapping, depending on the species involved and the severity of the problem created by their abundance. Deer mice, for example are known carriers of hantavirus, and with its recent outbreak in Yosemite, tolerance for contact between mice and humans is very low, requiring increased preventive management in sanitation, mouse-proofing of buildings and indoor trapping, as well as responsive management in attempting to reduce the mouse population through outdoor trapping. The marmot and squirrel species, on the other hand, are less abundant and widespread than the mice, resulting in localized human-contact problems that have, so far, not resulted in the need for responsive management.

Although there are no definitive thresholds of population levels of these species at which increased preventive and/or responsive management would begin, it is important to monitor the rodent populations in developed areas to be able to potentially understand when abundance may lead to unacceptable interactions and contact. Below is provided a proposed deer mouse monitoring program, and the sampling protocol on which it would be based. Also below are standards and precautions for capture and handling of wildlife.

Objectives

The first objective for monitoring deer mice would be to gain an understanding of overall population fluctuations of mice in selected developed areas among years. Monitoring rodent populations involves mark-and-recapture which could discern increased population numbers and subsequent potential increased risk of mice transmitting hantavirus to humans.

Mark- and-recapture monitoring would also be used to inform the frequency and density of lethal trapping efforts. Trapping levels would be adjusted accordingly to population numbers found. Areas of current focus for lethal trapping include Curry Village. Daily trapping of deer mice is occurring at Curry Village as recommended by both the California Department of Public Health and the Center for Disease

Control. Other possible areas of concern, such as Tuolumne Meadows lodging or housing may also require lethal trapping if determined through population monitoring.

A second objective for monitoring would be to determine if a relationship exists between deer mice population size and acorn abundance. Abundance of acorn production from oak trees has been documented annually for 16 years (Koenig et al., 1994). Given that deer mouse populations have been known to fluctuate based on food availability (e.g., Wolff 1996), understanding whether a positive relationship between acorn production in the fall and population size the following spring may provide potential for predicting if human habitations in the subsequent summer are more likely to have mice issues. Understanding the probability in advance would assist in preparing for or increasing the level of standard preventive measures in developed well in advance.

A third objective of monitoring would be to assess if capture rates from current trapping levels are having an influence on population size within the home range of developed areas where trapping is occurring. This would involve analyzing trap capture data and ensuring the mark-recapture study area is large enough to include both dispersal populations and populations within the home range of developed areas.

Methodology – Population Monitoring

Population monitoring would follow protocol set forth in the USFS Multiple Species Inventory and Monitoring Protocol: Chapter 5: Small Mammal Monitoring (USDA 2006), below. Traps would be baited with oats and bird seed. Trapping would occur on three consecutive nights, with traps checked for captures the following morning. On the first morning, all captured mice would be sexed, aged (adult vs juvenile), and reproductive status determined, if possible from lactation (females) or enlarged testes (males). Before release, each captured mouse would be marked with a colored, permanent marker on its ventral surface, to enable future identification of previously-trapped mice. In the subsequent two nights, the grids of traps would be set, and, the following mornings, checked for captured mice. Resulting data would be analyzed through mark-and-recapture statistical equations to estimate the local mouse population size. Comparison of data among years would allow park biologists and safety personnel to detect years of high mouse abundance, and take management and visitor-information actions to minimize the risk of human Hantavirus infections.

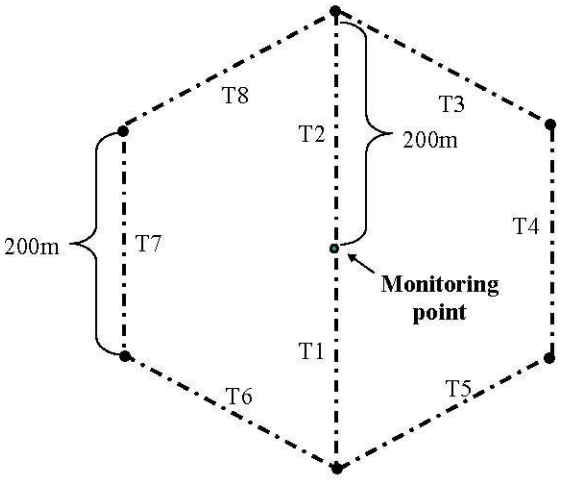
Protocol Details

The following detailed monitoring protocol follows the United States Forest Service Multiple Species Inventory and Monitoring Protocol for Small Mammal Monitoring (2006).

Most small mammals are primary consumers and represent the primary prey items of many carnivores, including many raptors and medium-sized mammals. They are abundant in many ecosystems and serve many important ecological roles in terms of influencing their prey and their predators. One core survey method is identified, Sherman live trapping. Supplemental survey methods, such as Tomahawk trapping and pitfall trapping are offered as methods to expand the breadth of species detected.

Sherman traps would be deployed along 8 transects, each 200 m in length, arrayed in a hexagonal pattern and centered on the monitoring point. Transects connect point count stations around the

monitoring point, with two additional transects passing through the center of the hexagon (400 m north to south). Traps are placed 20 m apart on a transect, starting at each point station and ending 20 m before the next point count station, for a total of 10 traps along each transect and 80 traps overall. Traps are placed within 2 m of the intended location at habitat features such as logs, burrows, the base of trees, runways and, always, in areas that provide cover from weather (e.g., under shrubs, in tall grass). Transects and trap locations can be established and flagged as the traps are being set. However, efficiency can be gained when the hex is first flagged for point count sampling by hanging flags every 20 m along the flag line between point count stations. These flags then mark where small mammal traps are to be placed.



Twenty meter spacing between traps is within the range generally recommended for rodent community inventory, and approximates the radius of a circle representing the smallest home range size of species expected to be detected (Jones et al. 1996). Thus, at least one trap would fall within each home range intersected by each transect.

Capture rates of small mammal species vary with trap size, type and locality (Quast and Howard 1953, Williams and Braun 1983, Lawrence 1992, Slade et al. 1993, Whittaker et al. 1998, Whittaker and Feldhamer 2000), and a combination of trap types and sizes is thought to be most effective at determining small mammal community composition. Thus, two different sizes of Sherman live traps are prescribed for sampling small mammals. Transects are used rather than a grid because they appear to be more effective and efficient at detecting the composition of small mammals at a site, given similar trap effort (Petticrew and Sadleir 1970, Steele et al. 1984, Read et al. 1988, Pearson and Ruggiero 2003). Further, transects have a greater effective sampling area, and the large hexagonal array has a greater probability of intersecting a variety of habitats/microhabitats containing different species compared to a grid (Pearson and Ruggiero 2003). The hexagonal transect configuration corresponds with the spatial array of most of the primary survey methods (e.g., point count stations, visual encounter surveys).

Live trapping is conducted primarily during the summer breeding season in temperate zones, but it could be informative to conduct multiple times per year in warmer climates; specific timing depends on latitude and local climatic conditions. In locations with year round mild weather (e.g., southern U.S.) special considerations, such as timing of activity cycles, may preclude summer sampling. In areas with over 1000 m of topographic relief, visits at lower elevations are conducted first in order to control for the delayed activity cycles at higher elevations. Locations within the survey area (National Forest) that are likely to have early breeding (e.g., east or south side of mountain ranges) should be surveyed earliest in the season relative to other locations. Trapping should be avoided during periods of unseasonably cold, hot or wet conditions to avoid unnecessary mortalities. Surveys conducted at the same locations in different years should maintain similar survey conditions and timing across years (e.g., same survey months).

Traps are covered with 'coroplast'(corrugated plastic, http://www.coroplast.com/product.htm) covers (not black) to regulate temperatures within traps, and particularly to reduce maximum temperatures. Polyester batting (e.g., Dacron™) is placed in traps (~2 in diameter ball at back of trap) to provide warmth in locations where temperatures are likely to drop near or below freezing. Trapping during weather extremes increases metabolic stress on animals, increasing their risk of mortality, hence precautions to reduce stress and mortality are critical (Animal Care and Use Committee 1998).

Sherman traps are baited with a mixture of rolled oats and mixed bird seed (containing sunflower seeds and millet); a good rule of thumb to follow in proportions is one gallon rolled oats to one gallon mixed bird seed. Oats provide carbohydrates, and sunflower seeds are a high protein and fat food. Other items may be added, but bait should be consistent throughout the Region. Bait type can influence capture rates of small mammals (Jones et al. 1996, Weihong et al. 1999), so whatever mixture is used for monitoring should be used consistently throughout the season and over time. Mealworms are a recommended addition, as they provide a high protein food source for shrews, and are freezer killed prior to use in order to keep them from leaving traps after baiting. Likewise, the addition of peanut butter is recommended primarily to aromatize the bait, although in some areas this can be problematic (e.g., attracts fire ants in southeastern U.S.). Bait for each trap may be placed in a small piece of folded plain paper to improve efficiency of baiting and avoid fouling the trap mechanism.

Trap locations along transects are uniquely numbered in groups of 100 corresponding to each of the eight transects (transect 1 = 101-110, transect 2 = 201-210, etc.). Trap locations may be marked in any number of ways. In pilot testing (Manley et al. 2002, Roth et al. 2004), the transect lines were flagged every 20m where traps were to be placed, and wooden clothes pins were then used to indicate the exact location (within 2 m of flag) and number of each trap. Clothes pins were spray painted bright pink and numbered with permanent black ink. This technique proved to be simple and efficient.

All traps are set, opened and baited in the late afternoon of the first day, and checked a minimum of twice daily starting on the morning of the second day, for a minimum of three consecutive 24-hour days. Length of the trapping session (i.e., number of days) can influence the number of species detected (Olsen 1975, Steele et al. 1984). Three consecutive days is the minimum trapping period required for sampling small mammal communities to determine species richness. This trapping period was chosen

based on data analysis from pilot testing in the Sierra Nevada, which suggested that the largest gains in the detections of small mammal species occurred over the first three days, when an average of 84% of the small mammal assemblage likely to occur at each site was detected (Manley et al. 2002). A 3-day trapping period equates to a 40-hour work week for field crews. The fourth night of trapping only increased the estimated proportion of the assemblage detected by 2%, and required at least 5 hours of overtime per person each week to accomplish. The addition of a fourth night of trapping is recommended for abundance estimates, where traps would be collected Friday morning as opposed to Thursday afternoon (see section 5.2.1, Sherman Trap Array Augmentation).

Morning trap checks are completed before temperatures rise, potentially stressing the trapped animal (by 10 a.m. is recommended), and afternoon checks are completed before dark. Traps are re-baited as necessary. All non-functional traps (e.g., trap door closed but no animal captured, bait gone from trap without an animal being captured, or trap missing) are noted on data sheet, reset and re-baited, or replaced, so they become functional (Nelson and Clark 1973).

Releasing trapped animals into a plastic (shrews and mice) or cloth (squirrels) bag then working them into a corner makes grasping the nape area easier. Holding small mammals in this manner is the most efficient method for examination. Capture cones, hand-crafted mesh cones with a cloth entryway, are also an option, particularly for larger species (see Chapter 6, section 6.2.2). Each observer should carry a thick leather glove in the event a mustelid (e.g., weasel) is captured.

Captured animals are identified to species, sexed, aged (as juveniles, sub-adults or adults), examined for breeding status (e.g., pregnant, lactating, enlarged testes or non-breeding), marked by cutting a patch of hair near the base of the tail, weighed and released. Additional information is recorded in order to discern similar species within genera (e.g., Tamias, Peromyscus, Microtus, and Sorex), including relevant body measurements such as the lengths of the hind foot, ear, tail, and head/body. Marking animals enables the calculation of relative abundance estimates for capture data. If at all possible, any trap capturing a mustelid should be replaced and then cleaned before reuse because the strong smell can negatively affect subsequent rodent captures. Trap mortalities are collected and frozen as soon as possible, labeled with date of collection, county and state of capture, collector's name, project name, agency office of contact, description of habitat type at the trap location and a description of the specific locality where the animal was collected (e.g., edge of dry creek bed at north end of meadow). Species identification is confirmed and animals are donated to a local museum collection. Deer mouse (Peromyscus maniculatus) and other known vectors of Hantavirus (e.g., P. leucopus, P. gossypinus, Sigmodon hispidus) should not be routinely collected due to the associated risk.

All traps are cleaned and disinfected after sampling is completed at each location. Traps are emptied of all loose bait, organic material and polyester batting before being placed into a mild bleach/water (CDC recommends 3 T/1 gal) solution or 5% Lysol solution where they remain for approximately 10 minutes. Heavily soiled traps are scrubbed with brushes while submerged in the mild bleach or Lysol solution until clean. Traps are then rinsed with water and allowed to dry fully before being used for the next survey. Polyester batting is also soaked in mild bleach or Lysol solution for 10 minutes and placed in plastic bags before disposal. Cleaning traps with mild bleach or Lysol solution is recommended after each site survey

is conducted where species that are hosts for Hantavirus are captured (Mills et al. 1995). A mild bleach solution does not appear to affect subsequent captures of small mammals (Yunger and Randa 1999).

Equipment Needed

Per site: 84 Sherman traps (80, plus replacements), trap bait, polyester batting, 1 gallon plastic bags for bait (Ziploc bags preferred), scales (30, 50, 100, and 300 grams), field rulers, small scissors, clipboard, mammal field guides or keys, rubber gloves, leather gloves (for weasels and larger squirrels), backpacks for carrying traps (one per transect), hand lens (shrew identification), cloth face masks or respirators (as needed) and hand sanitizer (the latter two for protection from Hantavirus). Equipment clean-up: two 30¬gallon garbage cans, water supply, bleach, hose with nozzle, scrub brush, protective eyewear, large flat area to spread out traps while drying, gloves.

Staffing, Training and Safety

Field crews are comprised of a minimum of four people, with one designated as field crew leader (GS-7/9). A crew of four individuals can be expected to sample four points per week (each crew of two can sample two sites per week). Four people are a minimum crew size because many sites require more than two people to transport traps in and out. Trappers will often need at least one additional person on the days that traps are set and pulled at sites. The crew leader should have at least two years of experience capturing and handling small mammals and the ability to effectively train and supervise field crews. Crew members can be GS-3/4/5 biological technicians, preferably with academic training in mammalogy and some experience handling animals. Inexperienced individuals can perform well, but potential problems include lack of attention to detail in implementing the protocol, and difficulty coping with stress imposed on some individual animals.

Prior to any data collection, an expected species list is generated based on range maps, guides to local fauna, and local occurrence records. When in doubt, consider the species as potentially occurring in the area and include it in the species list. The distinguishing features of each species should be noted (e.g., strongly bi-colored tail, hind foot length), with particular attention called to species that could be easily confused in the field.

Two weeks of training are recommended and should include the following as a minimum: (1) work with study guides that identify and discuss the defining features of each species, (2) visit University museums to observe and study the variability of defining characteristics that could be encountered in the field, and (3) practice trap setting and animal handling in a variety of environmental conditions. Oversight of surveys at the Forest or multiple-Forest level should be conducted by a journey-level GS-11 or higher grade employee with at minimum two years of relevant field and supervisory experience.

Crews should work in teams of two whenever possible because of the dangers of hiking cross-country with heavy backpacks and the potential for injury from handling animals. Each crew should have at least one radio, and it is recommended that each crew also have a cell phone. Cell phones facilitate rapid and efficient communication with supervisors and co-workers. Safety precautions recommended for handling possible vectors of hantavirus followed that of Mills et al. (1995), however, crew leaders should

check specific Regional recommendations for handling small mammals. Animal handling follows guidelines defined by the American Society of Mammalogists (Animal Care and Use Committee 1998).

Quality Control and Assurance

Protocols for the use of baited live traps for small mammal surveys are well established, with recognized sources of bias that can affect data quality. Factors affecting data quality that should be discussed in detail with crew members include: (1) setting traps so they are effective at capturing animals and animals have a high probability of survival once captured, (2) observer care in handling animals to minimize escape prior to marking or mortality of stressed animals, and (3) observer error in species identification and the identification of marked animals. Ideally, all traps are fully functional and set properly to capture animals; it is reasonable to expect < 1% of all traps to be improperly placed and set. Proper trap placement and function can be determined subjectively through field reviews by supervisors. Mortalities should be < 1%, and reported to the field supervisor at the end of each day and recorded and tracked throughout the project. Mortality rates can be determined by examining field data. Escapes rates can be reasonably expected to be < 1% of all animals captured. It may be difficult to meet this objective for individual species, specifically for larger and more difficult to handle animals (e.g., weasels). However, escapes rates can be kept at < 5% even for these animals with the proper gear and training. Escape rates per species and across all animals can also be determined by examining field data. Species identification and correct classification of marked animals is difficult to quantify. Swapping observers among sites and transects in the course of a trapping period can help reveal and reconcile differences in species identification among observers.

Lethal Trapping to Reduce Mouse Populations

Indoor trapping of mice should remain at a consistently high level to prevent contact between mice and people. If, however, outdoor monitoring of mice indicates a rise in population, outdoor lethal trapping effort should be in proportion to the abundance of mice. It will take at least several years of monitoring to determine the magnitude of fluctuations in mouse populations, and establish appropriate responses to adequately reduce mouse populations. An index of the effectiveness of trapping to reduce mouse populations could be determined in a monitoring area by recording the proportion of the mice trapped that were marked during the monitoring phase. Changes in the number of mice that must be trapped and removed indoors should also be considered a possible reflection of variation in outdoor mouse populations. Monitoring and lethal trapping priority should be given to areas of most dense human use. Lethal trapping success both indoors and outdoors can be used as an index of overall population levels, especially when compared with mouse monitoring program data. Tracking of visitor complaints would also be used to gauge efficacy of trapping.

Lethal trapping of mice found to be in excessive abundance will be done through the use of snap traps baited with peanut butter. A total of six snap traps each will be contained in bear-resistant metal boxes, with a series of holes cut in it to allow mice to enter. Boxes will be distributed in a grid format as evenly as possible across the landscape. Traps will be set in the evening, and checked in the morning. Data will

be collected including date, location, times of evening set, and morning check, number of mice caught, and number of traps tripped per box. Personnel checking boxes and handling mice will wear appropriate PPE, including appropriate respirator, rubber or Nitril gloves, and eye protection.

Literature Cited

California Compendium of Plague Control, 2011,California Department of Public Health, Division of Communicable Disease Control, Vector-Borne Disease Section. http://www.cdph.ca.gov/HealthInfo/discond/Documents/2011CAPlagueCompendium.pdf

Koenig, J.M., H. Knops, W.J. Carmen, M.T. Stanback, and R. L Mumme. 1994. Estimating acorn crops using visual surveys. *Canadian Journal of Forest Research* 24: 2105-2112.

MacNeil, A,, T.G. Ksiazek, and P. E. Rollin. 2011. Hantavirus Pulmonary Sytndrome, United States, 1993-2009. Emerging Infectious Diseases. Vol. 17, No. 7.

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Bibliography

National Park Service Director's Order. RM 50B 4.15 Safe Work Practices for Employees Handling Wildlife. Occupational Safety and Health Program.

National Park Service Director's Order, 83E Public Health Program – Illness Surveillance and Initial Response.

USFS Multiple Species Inventory and Monitoring Protocol: Chapter 5: Small Mammal Monitoring (USDA 2006)

APPENDIX G
Safe Work Practices for Employees Handling Wildlife 4.15

Appendix G - Safe Work Practices for Employees Handling Wildlife

4.15 SAFE WORK PRACTICES FOR EMPLOYEES HANDLING WILDLIFE

Purpose

The purpose of this document is to provide guidance that will assist National Park Service (NPS) staff in identifying and mitigating risks associated with handling wildlife so that important natural resource management and visitor protection activities can be performed in a safe manner.

Even if only brief and incidental to primary duties, any park unit employee may come into contact with live or dead animals. All employees are encouraged to review this document and consider when and how to protect themselves from the potential hazards of handling wildlife.

Background

NPS staff handle a wide range of wildlife species under a variety of circumstances in efforts to manage park resources, maintain park facilities, provide for visitor experiences, and protect human health and safety. Wildlife biologists may be the most recognized animal-handlers due to their work in wildlife capture, tagging, sampling, monitoring, translocation, and research. In addition to handling live animals, biologists also may handle dead animals for diagnostic submission, necropsy, or disposal. These investigations on both live and dead wildlife are critical because they contribute to a better understanding of park resources and help managers make informed decisions.

While biologists may handle wildlife most frequently, they are not the only employees who come into contact with wildlife. Maintenance workers and others deal with wildlife as well, often for removal from structures or for disposal. In fact, the mission of the NPS to conserve natural resources while providing for their enjoyment inherently brings wildlife and people, both staff and visitors, into closer proximity in parks than most other areas. These management activities and human-wildlife interactions often are vital to meeting park objectives and fulfilling NPS mandates; however, they are not without some risk.

Although an inherent risk to human health and safety exists with each wildlife encounter, this risk should be viewed in perspective with other hazards and a comprehensive approach to occupational safety used to reduce a variety of risks. This prudent approach to minimizing risks of injury or illness includes an understanding of basic safety measures and disease transmission, common sense, and awareness of surroundings. Basic safety measures may mean implementing the use of proper protective equipment for a particular job, or traveling in pairs and informing a supervisor of activities, especially if traveling alone. An understanding of potential zoonotic diseases – those diseases that can be transferred between humans and animals – not only can help prevent illness, but also aid in the identification of symptoms that can lead to timely medical attention.

Equally important to implementing basic safety measures and becoming informed on potential zoonotic disease risks, is having an awareness of the general environment. Planning for expected terrain, weather, or wildlife interactions, informs decisions on what personal protective equipment (PPE) to bring to the field. Although it is unreasonable to contain all risks or control the natural environment, deliberate **P**lanning, **P**reparation, and **E**xecution of safety measures, as appropriate for the situation, can reduce the chances of illness or injury.

Objectives

To assist NPS staff in preparing Job Hazard Analyses (JHA) for handling wildlife by:

- Identifying types of risks that may be encountered when handling wildlife, *and*
- Introducing appropriate levels of precautions based on specific activities.

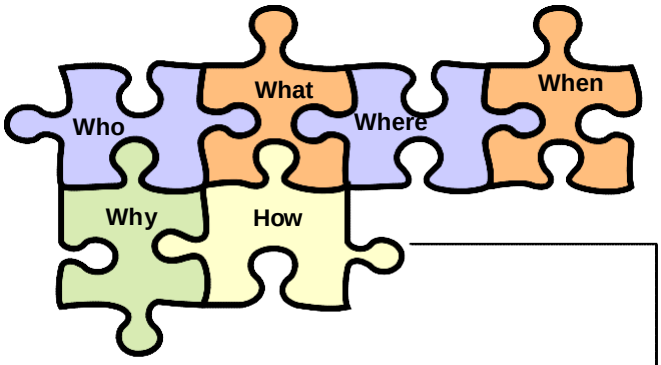
A thorough understanding of potential hazards associated with different activities performed by employees working with wildlife is essential in providing a safe work environment. When conducting wildlife studies, analyzing and mitigating risks are integral parts of every job.

A JHA is a multi-step process designed to study and analyze a job in a particular working environment. It breaks a task down into steps, identifies potential risks associated with each component, and may reveal ways of reducing or eliminating these hazards. JHAs result in a detailed written procedure for safely completing a particular job. (See Reference Manual 50B Section 3.1 Job Hazard Analysis)

The key to a successful Job Hazard Analysis is avoiding a "one size fits all" approach. The process is meant to stimulate constructive conversation between supervisors, employees, and others involved in the task. The outcome is a written document outlining the steps of the job, the potential hazards, and proposed actions to avoid or mitigate these hazards.

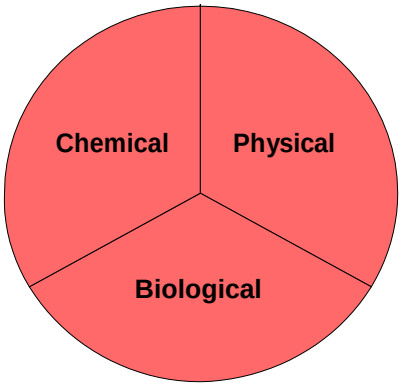
Plan

(Define the task and the context in which it will occur)



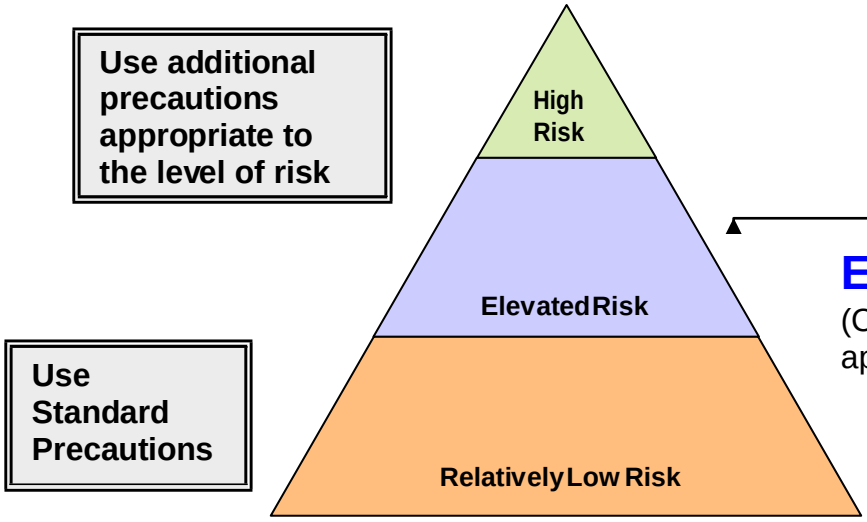
Prepare

(Understand the hazards; this may require outside assistance)



Execute

(Carry out the protective actions appropriate to the level of risk)



Plan

A number of physical, chemical, and biological risks are present in everyday field work, but these threats can be increased when focus is being placed on handling wildlife. Handling wildlife is inherently risky to human health and safety in part due to the level of uncertainty and unpredictability associated with the activity. To better understand, prepare for, and moderate these risks, the tasks must be well defined and each component carefully considered. This may be accomplished by describing who, what, where, when, why, and how each part of the job will be completed (see Table 1). By clearly explaining each of these components, as well as identifying the equipment and personnel needed to complete them, the analysis can uncover potentially hazardous situations and allow for appropriate mitigation.

Table 1. Defining the task

Who	• who assumes responsibility for supervision of the overall project • who completes the collection, transport, or shipping of an animal, or of wildlife samples
What	• what parts of animal collection, sampling, or transport present a hazard • what training is necessary • what recourses are available for additional information
When	• when are these actions appropriate (does the benefit outweigh the potential risks) • when should specific actions be performed
Where	• where should these tasks be completed • where should animals/samples be transported to
Why	• why is the task necessary • why is the task potentially hazardous
How	• how should the task be completed (a detailed explanation) • how breaches in safe work practices will be handled

Prepare

Perhaps the most critical element of the JHA is having an appreciation of potential hazards of working with wildlife. Hazards may be grouped into three general categories: physical, chemical, and biological. Examples of each hazard type may be found in Table 2. While chemical and physical hazards may be relatively easily identified, biological hazards are more likely to be unrecognized or misunderstood. Therefore, this document provides proportionately more information and resources to assist managers in identifying biological hazards, primarily sources of infectious zoonotic disease.

Table 2. Potential Risks

Category	Specific Risk
Physical	• Environmental o Uneven or Extreme Terrain (e.g., slips, trips, falls, avalanche, wind) o Elevation (e.g., altitude sickness) o Climate (e.g., dehydration, drowning) o Weather (e.g., lightning, exposure to heat, cold, UV radiation) • Animals o Predators o Handled animal (e.g., kicks, bites, crushing, strains) o Associated animal (e.g., attack from another member of the group) • Equipment o Firearms o Helicopters o Biomedical sharps (e.g., needles, scalpels, necropsy knives) o Vehicles, live-capture traps, transport cages • Man-Made o Traffic o Noise o Electrical
Chemical	• Task Specific o Pharmaceuticals (e.g., anesthetics, antibiotics) o Chemicals used for specimen preservation (e.g., formalin) o Disinfectants (e.g., bactericides, viricides) • Environmental o Toxins (e.g., pesticides, herbicides) o Gases (e.g., hydrogen sulfide, sulfur dioxide) o Chemical spills (e.g., gasoline, oil)
Biological	• Infectious zoonotic disease • Exposure to venomous animals or allergic reaction to any animal • Poisonous plants

A. *Physical*

Employees working outdoors are exposed to many types of physical hazards depending on the type of work, geographic region, season, and duration of time spent outside. In addition, man-made hazards such as electrical overhangs, utilities, canals, and various types of infrastructure, should be identified and assessed prior to work.

1. *Injury (due to animals or equipment)*

Wild animals can inflict injury on humans unintentionally or as an act of aggression or defense. While mammalian predators and venomous reptiles often are thought of as dangerous, most wildlife can injure humans through biting, kicking, scratching, stomping, or crushing. An understanding of animal behavior is essential for safely handling wildlife.

In addition to hazards associated with direct animal handling, much of the equipment, if improperly used, can be dangerous to humans. Traditional firearms, remote delivery systems (i.e., dart guns), traps, and snares can cause trauma to humans. Knives, needles, and other sharps can also cause injury. Use of aircraft for animal capture and monitoring poses an additional risk. Department of the Interior policies on use of firearms by non-law enforcement personnel and ACETA (Aerial Capture, Eradication, and Tagging of Animals) are under development.

2. *Injury (due to environment)*

Although the allure of working outdoors attracts many people to the NPS, there are unique hazards employees encounter when working outdoors. The basic hazards that need consideration when working outside are:

- Exposure to:
  - Heat Stress
  - Cold Stress
  - Dehydration
  - UV Radiation (Sun)
  - Lightning
  - Wind (falling trees/limbs)
- Topography
  - Elevation
  - Water hazards

B. *Chemical*

Chemical hazards can be divided into those associated directly with wildlife capture or handling, and those already part of the environment. Chemicals related to handling wildlife include pharmaceuticals (e.g., anesthetics), reagents used to preserve biological samples (e.g., formalin), and disinfectants (e.g., bleach). Pharmaceuticals used to immobilize wildlife can be dangerous and potentially life-threatening. Exposure to drugs may occur through accidental injection, ingestion, or absorption through mucous membranes or breaks in the skin. See Kreeger et al., 2002, for an overview of human safety associated with chemical immobilization; see Draft Director's Order #77-4, Use of Pharmaceuticals for Wildlife, for NPS requirements on use of wildlife pharmaceuticals. Material safety data sheets (MSDS) for many chemicals used in laboratory analysis of samples can be found at MSDS Search (www.msdssearch.com).

Environmental chemical hazards may be either naturally occurring (e.g., sulfur dioxide), may be intentionally applied (e.g., pesticides, herbicides), or could be accidentally spilled (e.g., gasoline, oil). Exposure to these substances from dermal contact (either direct or indirect) or inhalation may result when working in contaminated environments. If the substance is known, obtain an MSDS and evaluate the activity to be conducted and determine the likely risk exposure.

C. *Biological*

There are a variety of biological hazards associated with handling wildlife. Some of the most common are exposure to venomous animals (e.g., snakes) and hypersensitivity type allergic reactions due to contact with any plant or animal a person is responsive to (e.g., bee stings, pollen, poison ivy). While less common and potentially less well understood, transmission of infectious diseases between wildlife and humans also poses an important biological hazard. Diseases that are shared between animals and humans are termed zoonotic diseases. Zoonotic diseases are generally uncommon; however, the consequences of disease may be high. This can lead to an increase in concern and dread about infection. There are a number of established zoonotic diseases of importance (see the ZED website at http://inside.nps.gov/publichealth/zed/zed.htm) and new zoonotic diseases continue to emerge (e.g., highly pathogenic avian influenza Asian strain H5N1). Concern at some level is prudent. Further, many zoonotic diseases (e.g., plague, West Nile virus, brucellosis, bovine tuberculosis, and in most areas, rabies) are exotic to park systems and impart negative impacts not just on human health, but also on the health of native wildlife species. Therefore, management of these diseases may be warranted.

Transmission of zoonotic diseases requires three elements: an infection source, a susceptible host, and a route of transmission for the pathogen (Siegel et al., 2007). Potential zoonotic infection sources include animals, carcasses, body fluids (e.g., blood, urine, and saliva), feces, aborted fetuses, and environments (e.g., water, soil, burrows) contaminated by infected animals. Besides humans, susceptible hosts can include other species or animals of the same species. Transmission routes for zoonotic diseases are varied and depend on many factors, including the biological properties of the pathogen and the way in which the pathogen leaves the infected host.

There are three main routes of transmission for zoonotic pathogens: contact, through the air, and via vectors (see Table 3). It is possible for the same pathogen to be transmitted by multiple routes. Contact transmission occurs when pathogens enter the human host by ingestion, mucous membrane contamination, or through breaks in the skin. Direct contact transmission occurs when the pathogen is transferred after handling infected animal or biological samples from an infected animal. Indirect contact transmission may occur by handling contaminated objects, touching contaminated surfaces, or from the environment. Transmission via air occurs when pathogens from animals or their environments travel through the air and are inhaled or deposited on mucous membranes. Pathogens may become aerosolized when an infected animal coughs or sneezes, when contaminated dust particles are disturbed, or through aggressive handling of infected animal tissues. Some pathogens (e.g., plague) may be transmitted by respiratory droplets or splashing of contaminated fluids. These pathogens travel only short distances through the air in droplet form and require close proximity (<2 meters) to the infected animal or environment. Other pathogens (e.g., hantaviruses) may be transmitted as ultra-small particles and can travel longer distances by air currents. Vector-borne transmission occurs when a biting arthropod (e.g., mosquitoes, ticks, fleas) transfers the pathogen from an infected animal to a human host. Vectors may be encountered when handling wild animals and when working in field settings.

Table 3. Disease Transmission Routes

Transmission Route	Entry Into Body	Risk Activity Examples	Disease Examples
Contact-Direct	Ingestion, mucous membrane contamination, breaks in the skin	Trapping, handling, sampling live or dead animals; handling animal samples (e.g., blood)	Rabies, *Salmonella*, plague, tularemia, brucellosis, anthrax, scabies
Contact-Indirect	Ingestion, mucous membrane contamination, breaks in the skin	Handling contaminated equipment such as traps, lab or field equipment, needles, pencils, soiled laundry, vehicle interiors, countertops	Same as above
Aerosol	Inhaled small particles or droplets deposited on mucous membranes	Disturbing contaminated dust particles (e.g., cleaning buildings), close contact with animals	Small particulate: hantaviruses, highly pathogenic avian influenza Droplet: Plague
Vector-borne	Bite of infected invertebrate animal (e.g., tick, flea, mosquito)	Working in environment with vectors; handling carcasses infested with vectors	Lyme disease, plague, tularemia, Rocky Mountain spotted fever, relapsing fever, West Nile virus

Execute (applying strategies for mitigation)

Once potential chemical, physical, and biological hazards are identified, mitigation strategies may be implemented. Excellent communication between supervisors, employees, and others participating in the task, is the first step in mitigating a hazard. Each party plays a role in taking responsibility for creating and maintaining a safe working environment. Part of this communication requires a working knowledge of potential hazards, familiarity with appropriate working conditions, and recognition of the need for additional training. Management support for training, clear description of the scope of work, development of standard operating procedures (SOPs), and on-the-job monitoring are necessary to reap the benefits of JHAs. It is important to remember that familiarity with an activity or expertise in a subject area can lead to complacency by employees and supervisors. The key is to always think through the task, identify the potential hazards, and provide for reasonable safety precautions, no matter how often a job has been performed. For resources related to mitigating general hazards, see Table 4.

The types of approaches used to prevent human injury or illness during wildlife capture and/or handling vary with factors such as the species, sex, age of the animal, behavior of animal (wild, habituated, food-conditioned), reason for animal handling, level of employee experience, and presence of enzootic zoonotic disease(s). In general, handling devices (e.g., squeeze chambers in traps and other restraint mechanisms) and/or animal anesthesia can decrease the risk of physical injury from animals that are not easily restrained; however, training and familiarity are required for the safe use of these tools. These techniques may not be appropriate under all conditions or may not be sufficient for hazard reduction if used alone. Reducing biological risks generally requires an

appropriate barrier between the animal, or animal samples, and the handler (e.g., gloves, coveralls, or eye/respiratory protection). Additional methods for hazard reduction may include the following:

- Development and review of protocols or SOPs on animal handling
- Daily or periodic project safety briefings and post-handling debriefing
- Training on appropriate techniques for chemical or physical restraint
- Awareness of intentional or accidental trauma from animals
- Awareness of potential zoonotic diseases in the area or handled species
- Vaccination against potential pathogens as appropriate to the level of risk (e.g., rabies, tetanus)
- Training on when and how to use PPE
- Contingency plans (e.g., escape route, contact information for medical advice)

While human safety is the primary goal, these techniques should not be used in a manner that puts animals at undue risk of injury, excessive stress, or capture-related death.

Training employees in the essential components outlined in this document is critical to protecting workers from injuries and illnesses when conducting wildlife management or research, nuisance animal removal, and pest control. Training is an important part of the NPS safety and health program. If employees are unfamiliar with specific job hazards and proper work practices, this may be a cause for higher injury rate, and training may provide a solution. The NPS regularly produces a variety of training courses that can be useful in providing information for working safely. Information may be found on the DOI Learn website at https://doilearn.doi.gov, and the ZED website.

SOPs are appropriate for jobs where the same basic actions will be repeated regularly, and are particularly helpful when consistency is needed to ensure suitable outcomes. They need not be onerously detailed or prohibit deviations for unique circumstances in the field. SOPs are often indirectly incorporated into wildlife capture or management plans. For example, an SOP for necropsy procedures may be particularly helpful to direct use of PPE, ensure consistent sampling, explain correct shipping, provide for adequate sanitation, and describe situations that may indicate high risk wildlife mortality events. For sample submission instructions, see the NPS Wildlife Health website.

A. *Mitigating General Hazards*

There are general safe work practices that provide protection against a variety of the most common hazards (see Table 4).

Table 4. General Hazard Mitigation

Hazard	Exposure	PPE and Safe Work Practices
Physical	Contact	• NOAA's National Weather Service Heat Index • Heat Stress Facts • Protect Yourself from the Sun • Cold Stress Facts • Cold Card • Hazard from Mudslides • Landslides • Flashflood Warning System • NIOSH Slips, Trips, Falls • Work Zone Traffic Safety • RM 50 B Section 4.2 • Hearing Loss Prevention • Lightning • Proper Biomedical Sharps Disposal
Chemical	• Inhalation • Ingestion • Dermal absorption • Injection	• RM 50 B Section 4.4 Hazard Communications • OSHA Hazardous Communication Standard • MSDS Search • NIOSH Pocket Guide to Chemicals • NIOSH Respirator Topic Page • Formalin MSDS
Biological	No high risk exposure anticipated	Standard Precautions: • Hand Hygiene – **Hand washing with soap and water is the single most important measure for reducing the risk of disease transmission.** Alcohol-based sanitizers can be used as an adjuvant to hand washing (particularly when running water is not available), but is not a substitute for hand washing. • Promptly disinfect soiled equipment, environmental surfaces, and other contaminated items using an appropriate disinfection agent; dispose of biological waste properly. • Do not eat, drink, or smoke when handling animals. • When working with wildlife indoors, be sure to work in a well-ventilated area. • Avoid needle sticks or cuts during handling; report injuries. • Take care to avoid and/or use physical barriers for protection from wildlife defense mechanisms (e.g., bites, scratches, stings). • Transport, ship, and store samples according to applicable regulations (do not store samples with food). • Discuss need for prophylactic vaccination (e.g., rabies, tetanus) with physician. • Carry appropriate medications/tools to treat allergic hypersensitivities and mitigate venomous bites (e.g., epinephrine auto-injector, snake bite kit). • Seek medical attention if concerned about an exposure to a zoonotic disease or if ill, inform physician of potential exposures.
	Contact	Add to Standard Precautions: • Disposable gloves should be readily available and worn when touching blood, body fluids, secretions, excretions, mucous membranes, and non-intact or diseased skin. • Coveralls, lab coat, or dedicated clothing. • Goggles if splash risk exists. • Impermeable gloves (e.g., leather) if handling animals that may bite or scratch.

Table 4. General Hazard Mitigation

Hazard	Exposure	PPE and Safe Work Practices
	Aerosol	Add to Standard and Contact Precautions: • Mask (droplet hazards) or respirator (inhaled particulate hazards). Use of respirator requires specific program elements (See Reference Manual 50 B Section 4.3 Respiratory Protection) • Eye protection: Goggles appropriate to the disease risk.
	Vector	Add to Standard Precautions: • Insect repellents on body and clothing. • Wear light colored long-sleeved clothing and long pants. • Wear coveralls or dedicated clothing if ticks or fleas are a concern. • Minimize activities at dawn and dusk if mosquitoes are a concern. • Tick checks. • Bag animal carcass with insecticide if arthropods observed.

B. Mitigating Specific Zoonotic Disease Risks

Standard Precautions (see Table 4) are infection control measures that should be applied at all times by all persons when working with or exposed to wildlife. Standard precautions alone are likely adequate protective measures for low-risk situations, such as working with apparently healthy animals in areas without enzootic disease.

Beyond these Standard Precautions, certain situations may present additional risks for zoonotic disease transmission that require other protective work measures and practices. The first step in mitigating disease hazards is to identify if a zoonotic pathogen may exist in the species of wildlife being handled and in the region of the country where the work is being done. Additionally, it is important to assess the relative likelihood of pathogen presence. An abbreviated list of zoonotic disease pathogens is available on the ZED website. This website also contains links and reprints of publications on specific safe work practices for some of the most serious zoonotic diseases. Several zoonotic disease handbooks also are available (e.g., Heymann 2004). Additionally, consultation with a wildlife disease professional is warranted and encouraged if there are questions or uncertainty about zoonotic disease risk in a given area or species. Once a disease risk has been recognized, a transmission route(s) can be determined and appropriate safe work practices and PPE selected for the job. See Table 5 for recommendations on appropriate PPE for specific tasks and conditions.

The keys to preventing exposure to zoonotic diseases are:

1. ***Use available resources to identify potential zoonotic pathogens.***
2. ***Determine potential route(s) of transmission (contact, aerosol, vector-borne).***
3. ***Determine appropriate safe work practices and PPE to prevent exposure.***
4. ***Implement these measures when working in potential exposure situations.***

Table 5. Specific Activities with Exposure to Zoonotic Disease Pathogens and Protective Practices

Activity	Conditions	ActivityRisk	PPE	WorkPractice
1. Handling apparently healthy live animals.	No substantial local zoonotic disease concerns or vectors.	Zoonotic disease risk from casual contact is minimal.	• Clothing appropriate to the nature of the operation *Except:* • Disposable gloves and eye protection when handling healthy birds[1]	1. Use Standard Precautions.
2. Handling biological samples from apparently healthy live animals.	No substantial local zoonotic disease concerns or vectors.	Zoonotic disease risk may increase with contact of body fluids or biological samples from animals.	• Disposable gloves • Coveralls, lab coat, or dedicated clothing	1. Use Standard and Contact Precautions.
3. Handling apparently healthy live animals (or samples) from areas with known zoonotic disease risks.	Disease exists (or spills into) handled species or vectors associated with handled species.	Risk increases if a zoonotic disease is known to be present in the area, a species, or vector (e.g., plague, rabies, brucellosis).	• Disposable gloves • Coveralls, lab coat, or dedicated clothing • Eye and respiratory protection as appropriate to the level of disease risk	1. Use Standard and Contact Precautions plus appropriate precautions for transmission routes of diseases of concern. 2. Become familiar with symptoms of the disease in humans and seek medical attention if symptoms occur (inform health care provider of occupation and potential exposure).
4. Handling sick or injured live animals.	For euthanasia, sampling, or transportation.	Risk increases because cause of illness may be zoonotic and sources of contaminations may increase (e.g., diarrhea)	• Disposable gloves • Coveralls, lab coat, or dedicated clothing • Eye and respiratory protection as appropriate to the level of disease risk	1. Use Standard and Contact Precautions plus appropriate precautions for transmission routes of diseases of concern. 2. Submit diagnostic samples (if ill). 3. Prevent visitors or others from contacting a sick or injured animal.
5. Handling for disposal or submission of animal found dead.	Single dead animal in area with no substantial local zoonotic disease or vectors.	Small animal: Risk is minimal if barrier is used. Large animal: Risk is limited but may increase with size of animal being handled due to potential for contamination	Small animal: • Disposable gloves or inverted bag for collection Large animal: • Disposable gloves • Coveralls, lab coat, or dedicated clothing • Eye and respiratory protection as appropriate to the level of disease risk	1. Use Standard and Contact Precautions plus appropriate precautions for transmission routes of diseases of concern. 2. Transport outside passenger area of vehicle (i.e., bed of truck or trunk). 3. Bag carcass tightly if it must be placed in passenger compartment or to avoid leakage of blood or other body fluids into the environment. 4. Cover all carcasses.
6. Handling for disposal or submission of	Multiple dead animals in any event or single	Risk may differ if the mortality event is	Small animal: • Disposable gloves or inverted bag for	Follow work practices described in #5 above. *In addition:*

[1] DOI memorandum on: Employee Health and Safety Guidance for Avian Influenza Surveillance And Control Activities in Wild Bird Populations

Table 5. Specific Activities with Exposure to Zoonotic Disease Pathogens and Protective Practices

Activity	Conditions	ActivityRisk	PPE	WorkPractice
multiple animals found dead.	dead animal in an area of substantial zoonotic disease or vector risk.	recurring (e.g., juvenile birds washed ashore) vs. unexpected.	collection Large animal: • Disposable gloves • Coveralls, lab coat, or dedicated clothing • Eye and respiratory protection as appropriate to the level of disease risk	1. Inform wildlife biologist of finding and consult with wildlife disease professional for potential causes of illness. 2. In an unexpected mortality event: Submit 1-5 animals for diagnostic evaluation and dispose of remaining carcasses in landfill or other approved means. 3. Store samples in approved locations according to protocols. 4. Become familiar with symptoms of diseases of concern in humans and seek medical attention if symptoms occur (inform health care provider of occupation and potential exposure).
7. Handling dead animal for necropsy, dissection, or food processing.	Healthy appearing animal that is collected for management or research or animal found dead with no known zoonotic disease risk.	Risk is increased due to closer contact with a variety of body fluids and tissues, but no reason to suspect presence of pathogens or vectors.	• Disposable gloves • Coveralls, lab coat, or dedicated clothing	1. Use Standard and Contact Precautions. 2. If an animal has received any drugs (anesthetics, euthanasia agent), it is unfit for human consumption and must be removed from the human food chain.
8. Handling dead animal for necropsy or dissection.	Animal found dead, animal that has been observed ill, or species with known zoonotic risk (e.g., bat, ground squirrel).	Risk is increased due to closer contact with a variety of body fluids and tissues and unknown cause of death.	• Disposable gloves • Coveralls, lab coat, or dedicated clothing • Eye and respiratory protection as appropriate to the level of disease risk • Shoe covers or boots which can be disinfected	1. Consult with public health prior to use of carcass or carcass parts for display or educational purposes. 2. Become familiar with symptoms of the disease in humans and seek medical attention if symptoms occur (inform health care provider of occupation and potential exposure). 3. Become familiar with warning signs for unusual mortality events: - Multiple dead animals - Blood coming from body orifices (nose, rectum) without obvious signs of trauma - Animals displaying neurologic signs prior to death.
9. Collection of biological samples from the environ-ment for management or research.	Collection of samples (feces, urine, fetuses) from the environment where no known zoonotic enzootic disease occurs.	Risk from contact with body fluids and tissues, but no known disease is present.	• Disposable gloves • Coveralls, lab coat, or dedicated clothing	1. Use Standard and Contact Precautions. *In addition:* 2. Store samples in approved and dedicated specimen storage location according to protocols.

Table 5. Specific Activities with Exposure to Zoonotic Disease Pathogens and Protective Practices

Activity	Conditions	ActivityRisk	PPE	WorkPractice
10. Collection of biological samples from the environment for management or research.	Collection of samples (feces, urine, fetuses) from the environment where zoonotic disease or vectors occur.	Risk from contact with body fluids and tissues from potentially infected animals or their parasites.	• Disposable gloves • Coveralls, lab coat, or dedicated clothing • Eye and respiratory protection as appropriate to the level of disease risk • Shoe covers or boots which can be disinfected	1. Use Standard and Contact Precautions plus appropriate precautions for transmission routes of diseases of concern. *In addition:* 2. Consult a wildlife health professional for potential causes of illness. 3. Become familiar with symptoms of the disease in humans and seek medical attention if symptoms occur (inform health care provider of occupation and potential exposure). 4. Consult with public health prior to use of samples for display or educational purposes.
11. Cleaning areas of animal excreta and handling rodents in traps.	Indoor or field locations with significant accumulation of organic matter.	Mouse excreta or large quantities of bird or bat guano are of considerable concern, particularly in indoor facilities.	• Disposable gloves • Disposable coveralls • Eye and respiratory protection as appropriate to the level of disease risk • Shoe covers or boots which can be disinfected	*See:* NPS worker protection recommendations for hantaviruses.
12. Incidental exposure as a result of other duties.	Indoor or outdoor.	Briefly handling or contact with live or dead animals incidental to any work assignments.	Small animal: • Disposable gloves or inverted bag for collection Large animal: • Disposable gloves • Coveralls, lab coat, or dedicated clothing	1. Communicate with Natural Resources, Risk Management, or Public Health staff as appropriate. 2. Transport outside passenger area of vehicle (i.e., bed of truck or trunk). 3. Bag carcass tightly if it must be placed in passenger compartment or to avoid leakage of blood or other body fluids into the environment. 4. Cover all carcasses.

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Definitions

Aerosol – Solid particles or liquid droplets suspended in a gas (generally air).

Aerosolized – When liquid droplets or solid particles become suspended in air.

Arthropod – Animals belonging to the phylum Arthropoda which includes insects (e.g., mosquitoes, fleas, gnats) and arachnids (e.g., ticks, mites).

CDC – Centers for Disease Control and Prevention, a part of the U.S. Department of Health and Human Services, is the primary Federal agency responsible for conducting and supporting public health activities in the United States.

Dedicated clothing – Garments worn only during specific work activities which are not to be worn for office/personal activities (e.g., in offices, at home, in public venues).

Dermal – Referring to the skin. For example, dermal absorption means passing through the skin.

Enzootic – A disease that occurs at a regular, predictable, or expected rate in an animal population or area.

Job Hazard Analysis (JHA) – A JHA is a multi-step process designed to study and analyze a job.

Mask – A barrier worn over the nose and mouth to prevent droplet contamination of mucous membranes.

Respirator – A barrier worn over the nose and mouth that filters particulates of certain sizes from inhaled air. Particulate respirators are also known as "air-purifying respirators."

Necropsy – An examination and dissection of a dead animal to determine cause of death or the changes produced by disease.

Pathogen – A biological agent that causes disease or illness to its host (e.g., bacteria, viruses, or fungi).

PPE – Personal protective equipment.

Vector – For the purpose of this document: An arthropod capable of transmitting an infectious agent to other host species.

Zoonoses – Infectious diseases that can be transferred between domestic or wild animals and humans.

Consultation

Consultation/Contacts
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APPENDIX H

Guidelines for Local Plaque Surveillance and Control Programs in California

Guidelines for Local Plague Surveillance and Control Programs in California
June 2011

The primary goal of a public health plague surveillance program is the early detection of plague activity and conditions that may present increased risk for disease transmission to humans. The California Department of Public Health, Vector-Borne Disease Section (CDPH/VBDS) recommends that local agencies conducting plague surveillance and/or control operations consult with and work collaboratively with VBDS. The following recommendations are provided to help ensure appropriate evaluations and risk reduction measures are implemented.

Routine surveillance

- Surveillance activities should focus on plague endemic areas—see the California Compendium of Plague Control[1] and consult with VBDS staff for specific regional information.
- Testing should be limited to species typically involved with plague transmission in California—see Submission Criteria for Rodents and Wild Carnivores[2].
- To properly evaluate the presence or level of plague activity in an area, attempts should be made to sample all rodent species involved with local plague ecology. This typically requires overnight trapping and use of various sizes and types of live traps to successfully sample relevant rodent species (e.g. ground squirrels, chipmunks, woodrats, deermice).
- Serological titers (particularly < 1:256, from a single or few animals) are not necessarily indicative of current plague activity or risk. Serological evidence must be assessed within the context of a comprehensive evaluation of the level of plague activity and current risk—see Epizootic Investigation below and the California Compendium of Plague Control [1].
- Fleas taken from rodents or collected from burrows should be identified to species to assess abundance of known or suspected vectors.
- Fleas submitted for testing should be pooled by host and species. Consult with VBDS for assistance in flea identification prior to submission.
- Detection of plague bacteria in rodents or their fleas confirms current plague activity and should prompt an immediate follow-up investigation and risk evaluation.

Evaluating Plague Activity: Epizootic Investigation and Risk Evaluation

When direct or indirect surveillance detects plague or suggests increased plague activity, additional surveillance and a risk evaluation should be completed to help guide an appropriate public health response.

- An evaluation of current plague activity involves direct surveillance of rodent and flea populations to acquire additional evidence of increased activity or epizootic

plague. In addition to the detection of plague bacteria in rodents or vector fleas, multiple high titers from rodent blood samples suggest recent plague exposure and increased local transmission. Surveillance efforts also provide an opportunity to evaluate densities of plague reservoirs, susceptible (amplifying) rodent species, and vector flea loads.

- Direct surveillance can be augmented by other (indirect) indicators of plague activity such as documentation of rapid decreases in rodent populations (requires prior knowledge of local "baseline" populations), evidence of burrow abandonment, fleas on the ground or in burrow entrances, or carrion flies emerging from or near burrows.
- Direct and indirect surveillance results should be integrated into a comprehensive risk evaluation which also considers: 1) plague history and current ecological conditions of the area, and 2) potential human exposure to infected animals and their fleas (type and degree of human activities and their proximity to plague activity or other identified risk factors)—see CDPH/VBDS plague surveillance evaluation form[3] for a template.

Plague Control Activities

Plague control should be a collaborative effort between state and local public health authorities, county agricultural officials, and the appropriate land-use jurisdictional authority (e.g., USFS, state parks, BLM, DOD, other public agencies).

- The presence of active plague transmission closely associated with human activities may necessitate the suppression of potentially infective vector flea populations to rapidly lower the current disease risk. In these instances, temporary closure of recreational or other public-use areas prior to and during insecticide applications (or in lieu of applications) may be warranted.
- Limit flea suppression to areas of actual or potential human exposure. Routine and/or repetitive insecticide treatments can lead to the development of resistance and should be avoided.
- Exposure of the public to insecticides should be minimized during flea control operations. Insecticides used for burrow treatments or in bait stations must follow product label instructions and all other applicable laws and regulations. Insecticide treatments should continue a minimum of 7 days before assessing control efficacy.
- Post-treatment flea counts are necessary to determine the efficacy of the pesticide application. Reduction of flea density to less than one flea per rodent host is considered sufficient to interrupt transmission to humans. Public use areas closed due to plague activity should remain closed until surveillance and control activities suggest the potential for human disease has been sufficiently mitigated.

- Managers of public use areas with potential for plague should be strongly advised to adopt an on-going integrated disease management program that includes habitat manipulation and sanitation methods to reduce rodent abundance. In some cases, additional rodent control measures (e.g., trapping, poisoning) may be warranted as long-term control measures, but these activities should be directed by qualified and experienced professionals and should not precede flea control. Rodent control using toxic baits or fumigants is not a viable option to rapidly reduce plague risk—see California Compendium of Plague Control [1].

Supporting documentation and recommended reading

[1] California Compendium of Plague Control:
http://www.cdph.ca.gov/HealthInfo/discond/Documents/2011CAPlagueCompendium.pdf
[2] Submission Criteria for Rodents and Wild Carnivores: Contact VBDS staff
[3] CDPH/VBDS plague surveillance evaluation form: Contact VBDS staff

Contact information

Vector-Borne Disease Section
(916) 552-9730
http://www.cdph.ca.gov/programs/vbds/Pages/default.aspx.