

**UNITED STATES DEPARTMENT OF AGRICULTURE  
ANIMAL AND PLANT HEALTH INSPECTION SERVICE  
PLANT PROTECTION AND QUARANTINE**

**CONTAINMENT GUIDELINES  
For Nonindigenous, Phytophagous Arthropods  
and Their Parasitoids  
and Predators**

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# **CONTAINMENT GUIDELINES FOR NONINDIGENOUS, PHYTOPHAGOUS ARTHROPODS AND THEIR PARASITOIDS AND PREDATORS**

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# GUIDELINES FOR CONTAINMENT OF NONINDIGENOUS PHYTOPHAGOUS ARTHROPODS AND THEIR PARASITOIDS AND PREDATORS

## I. PURPOSE OF THIS DOCUMENT:

These guidelines are a reference to help you (a state, federal researcher, or commercial entity) design, build, maintain, and operate a facility for specific types of organisms-- in particular, nonindigenous, phytophagous arthropods and their parasitoids and predators.

Field collections of these organisms may be contaminated with described and undescribed organisms such as plants, hyperparasites, plant pathogens, entopathogens, arthropods, etc.

During inspections or reinspections of your facility, United States Department of Agriculture (USDA), Animal and Plant Health Inspection Service (APHIS), Plant Protection and Quarantine (PPQ) personnel will review these guidelines and any risk mitigation instructions that may accompany your permit. When your facility meets containment standards and risk mitigation instructions, USDA, APHIS, PPQ will issue a letter of eligibility for your facility.

The inspection and permitting procedures of the USDA, APHIS, PPQ are intended to prevent the release of nonindigenous plant pests to the environment of the United States. Accidental or purposeful release of these organisms is a violation of the **PLANT PROTECTION ACT** and is subject to civil and/or criminal penalties and loss of permits.

## Components of this Document:

To facilitate your permit(s), your containment facility must meet the “**Standards**” listed in gray, shaded boxes. To help you meet these standards, ask biotechnology industries, university Biosafety committees, and/or contractors for research hospitals and other research institutions to recommend specialized professional contractors. Professionals know state, local and federal laws that regulate construction, including the installation of emergency doors, incinerators, air intake and exhaust ducts, emergency lighting, plumbing, and many other features. APHIS, PPQ’s Containment Facility Scientists have little or no knowledge of these laws.

The “**Suggestions**” listed under each Standard are methods or equipment that are commonly used at this time to accomplish each containment standard. The design, construction and operation of your containment facility may vary, depending on the organisms you wish to contain, your research objectives, the functionality of your equipment and structural components, and your location. For example, your containment would change if organisms were grown only in winter; if new technology was employed such as a particle gun or Ago-infection to transmit virus; or if under specific conditions, escape of organisms was proven impossible. **Again, we recommend professional advice on all design issues.**

**Safety of facility personnel should not be compromised by containment requirements. Emergency exits should not be blocked by equipment; their operation should not be obstructed by sealing with tape or caulking.**

We encourage Good Laboratory Practices (GLP) in all facilities; however the standards and suggestions listed here **only** cover containment. Cross contamination of cultures within the containment may or may not signify poor containment.

USDA, APHIS, PPQ welcomes alternatives that are proven to meet or exceed the standards. To insure timely permitting, please review this document, and research design alternatives. Once design options are narrowed, call or fax PPQ's Containment Facilities staff at (301) 734-5304, or FX (301) 734-8669 and continue discussions as the facility is planned and built.

## II. CONSTRUCTION STANDARDS FOR THE ENTIRE STRUCTURE

**CONSTRUCTION STANDARD A. Locate the facility** in areas with minimal human, agricultural and environmental risk. **Identify** the facility as dedicated and secure.

### SUGGESTIONS:

1. Locate the facility in areas relatively free of agricultural zones, high-risk microclimates (e.g. known flood zones) or other high-risk areas.
2. Install a 15 foot- wide strip of gravel, mowed lawn, and/or pavement from the foundation and around the containment building(s).
3. If possible, design the containment facility as a separate, dedicated building.
4. Install a fence 6 ft. or higher around the facility at least 15 ft from buildings.
5. At the main entry to containment, post:
  - Containment director/ containment officer name and contact numbers.
  - A sign stating “ACCESS IS BY AUTHORIZED PERSONNEL ONLY”.
  - Emergency telephone numbers.

**CONSTRUCTION STANDARD B. DESIGN THE FLOOR PLAN TO PREVENT ESCAPE OF THE ENCLOSED ORGANISM(S).**

### SUGGESTIONS:

1. Install one primary entry/exit.
2. Build a vestibule at the primary entry.
3. If local building code allows, install a vestibule at each emergency exit.
4. Design the facility with laboratories and rearing rooms connected to a main laboratory.
5. Build restrooms outside of containment rooms. However, if restrooms must be built inside a containment room, use the same construction standards used throughout the facility and place the restroom close to low risk areas.
6. Build offices outside of containment areas.
7. Install a central closet for cleaning supplies.
8. Install windowless doors, or block the windows of the most interior doors with blinds or other covers to prevent organisms from moving toward light, toward the doors and beyond.
9. When exterior doors are opened, air should move toward the inside containment areas.
10. Air should move from the least to most hazardous rooms (i.e. from Laboratory to Rearing Room).
11. See section III. CONSTRUCTION STANDARDS FOR SPECIALIZED ROOMS for recommended features of the glasshouse, vestibules, and showers/restrooms.

**CONSTRUCTION STANDARD C. CONSTRUCT WALLS, CEILINGS AND FLOORS THAT ARE IMPENETRABLE TO THE ENCLOSED ORGANISMS, AND WITHSTAND REPEATED CLEANING AND DECONTAMINATION.**

**SUGGESTIONS:**

1. Construct the walls and ceilings with building materials that resist moisture and withstand repeated decontaminations with bleach or other caustic solutions.
2. Paint the ceilings and walls with a light-colored, washable paint.
3. Install floors that are impenetrable to the organism and withstand repeated cleanings. Monolithic (in one-piece) floors, e.g. poured concrete, asphalt tile, chemically resistant paint etc. are desirable. Wood floors are **not** acceptable.
4. Consider the installation of floor drains to collect liquid wastes for sterilization.
5. Seal junctions, holes or penetrations of walls, ceilings, and floors with plaster, caulk, or equivalent materials.
6. Suspended or dropped ceilings are **not** acceptable.

**CONSTRUCTION STANDARD D. If windows are necessary, install Windows impenetrable to the enclosed organisms.**

**SUGGESTIONS:**

1. Install glazing in windows that resists breakage (double-paned glass, wire-reinforced glass, Plexiglas, etc.). New facilities should install materials comparable to or better than Lexan.
2. Install windows that do not open.
3. Seal joints between the windowsills, frames, etc. and walls with appropriate materials.
4. Store extra window panels nearby for emergency use.

**CONSTRUCTIONS STANDARD E. Install Doors that contain the organism and contribute to the security of the facility.**

**SUGGESTIONS:**

1. Install self-closing, steel doors throughout the containment structure(s).
2. Install thresholds and magnetic door frame gaskets that seal all doors with their frames
3. Install exterior doors that lock.
4. Install windowless doors, or block the windows of the most interior doors with blinds or other covers to prevent organisms from moving toward light, toward the doors and beyond.
5. Emergency doors
  - Post signs on the exterior and interior of emergency exits stating USDA, APHIS, PPQ Containment Facility - Emergency Exit Only.

- Insure emergency doors are not commonly used as an entrance (remove exterior handles, use doors with interior or internal hinges, etc.).
- Install audible alarms that activate when emergency exit doors are opened.

**CONSTRUCTION STANDARD F.** Design and install an **HVAC System** (Heating, Ventilation and Air Conditioning) that prevents escape of the contained organisms.

**SUGGESTIONS:**

1. If possible, install an HVAC system dedicated to the containment areas. If not possible, then install filters to prevent organism escape from containment areas to areas or buildings outside of containment.
2. Install the following screens or filters over these air sources:
  - Internal exhaust vent-- 80 mesh screen. Filters and screen sizes should be appropriate to the organism to be contained. Very small organisms such as mites require finer mesh screening.
  - External exhaust vent-- pore size of screen is determined by size of organism that the researcher must contain. If contained organism is a pathogen, a HEPA filter (99.97% efficient) is necessary (for materials up to 3 microns in size).
  - External air intake – pore size of screen is determined by size of organism the researcher wishes to exclude. If contained organism is a pathogen, a HEPA filter (99.97% efficient) is necessary (for materials up to 3 microns in size).
  - Internal air supply- screen with pore size appropriate to prevent contained organism from escaping into air system if air flows in wrong direction. To slow the clogging of the HEPA filters and the subsequent reduction in HVAC efficiency, ask your design engineer about dust filters placed in front of the HEPA filters.
3. When exterior doors are opened, air should move toward the containment areas.
4. Air movement within the facility must be zero or negative, **not** positive.
5. Seal connections in air ducts, vents, plenums, etc. with caulk or an equivalent material.
6. Install filters and screens in the HVAC system so they are easy to clean, decontaminate and replace.
7. Install tandem filters, parallel filters, or other configurations that allow one filter to be replaced while another supplies air.

**CONSTRUCTION STANDARD G.** Design and install an **Electrical System** that maintains containment features under normal and emergency situations and is impenetrable to the contained organisms.

**SUGGESTIONS:**

1. Install a mechanism to indicate power failure.
2. Install an alternative power source (generator, battery bank, etc.) for use when normal power

is lost or interrupted.

3. Install weatherproof electrical boxes, receptacles, light fixtures, switches, etc.
4. Seal electrical boxes, lighting, switches, wiring, conduit, etc, with appropriate materials (caulk, foam, etc,) that are impenetrable to the contained organisms and withstand repeated decontaminations with bleach or other caustic solutions.

**CONSTRUCTION STANDARD H.** Design and install a **Plumbing System** to contain the organisms and remove liquid wastes.

**SUGGESTIONS:**

1. Install a sink in the containment area for cleaning.
2. Sterilize effluents from sinks, floor drains, toilet, etc with steam or its equivalent before releasing them into the sewer system.

**CONSTRUCTION STANDARD I.** The following system is not a containment requirement, however if installed, insure that **Vacuum Cleaning Systems** prevent the escape of the contained organisms.

**SUGGESTIONS:**

1. Use vacuum appliance only in facility.
2. Autoclave or sterilize vacuum filters and waste before disposal.

**CONSTRUCTION STANDARD J.** The following system is not a containment requirement, however if installed, insure the **Vacuum Aspiration System** prevents the escape of the contained organisms.

**SUGGESTIONS:**

1. Autoclave or sterilize vacuum filters and waste before disposal.

**CONSTRUCTION STANDARD K.** Install a **Communication System** that allows communication between the interior and exterior of the facility and prevents organism escape.

**SUGGESTIONS:**

1. Install a telephone(s) or intercom system.
2. Install a computer (LAN, modem, etc.) or Fax machine to allow for communication and data transfer to and from the containment facility.

### **III. CONSTRUCTION STANDARDS FOR SPECIALIZED ROOMS.**

**CONSTRUCTION STANDARDS FOR SPECIALIZED ROOMS A.** Build **Glasshouses** with security and containment features.

## **SUGGESTIONS:**

1. Construct the foundation of concrete, concrete block, brick, or similar material.
2. Extend the foundation below the soil line to insure a permanent and stable structure. Build the foundation at least 3 ft. above the soil line.
3. Construct glasshouse floors of materials that are impervious to the contained organisms and can withstand repeated disinfecting with caustic liquids.
4. Install a frame strong enough to support the translucent walls and ceilings.
  - Install translucent wall and ceiling materials strong enough to guarantee the security of the facility. Plexiglas, lumite, lexon, safety glass, and wire-reinforced glass are acceptable. Polyethylene, vinyl or plastic sheeting are NOT acceptable.
  - Seal the translucent panels to the frame with caulk or appropriate materials on the inside and outside surfaces.
  - Consider the installation of screens over the roof to protect it from hail.
  - Consider the installation of an alarm system to detect broken glazing panels or other breaches of containment.
5. Seal joints between the glasshouse and other containment rooms with caulk or other suitable material.
6. If containment glasshouse is detached from the primary containment facility, install a vestibule at each door. (See specialized room section on Vestibules.)
7. Install doors between the glasshouse and the rest of the facility that close completely, and seal to their frames. Use doors that are windowless or cover windows with blinds.
8. Insure the HVAC system can be turned off to allow glasshouse fumigation.
9. Cover ventilation ducts with metallic, 80-mesh screen.

## **CONSTRUCTION STANDARDS FOR SPECIALIZED ROOMS B. Vestibules**

## **SUGGESTIONS:**

1. Install a vestibule in front of each entry and/or exit. (Have contractor check local construction codes on vestibules at emergency exits, as they may be prohibited.)
2. If present, shower rooms can count as a vestibule for an entrance (see restroom construction).
3. Build each vestibule at least 6 feet long from door threshold to door threshold.
4. Set up lights in vestibules so they turn off when any door is opened and turn on only when both doors are fully closed.
5. Insure that vestibules are darker than adjacent rooms. Discuss use of insect and/or black light traps in your vestibules with PPQ's Containment Facility (CF) Staff.
6. Insure vestibule doors interlock so that only one door can be opened at a time.
7. Install thresholds and magnetic door frame gaskets to completely seal the doors with their frames and thresholds.
8. Consider installing an air curtain for each vestibule. (Air curtains are fans placed across the top of the interior doors of the vestibule. The fans are set at an angle and blow airborne organisms back into the containment areas when doors are opened.)

**CONSTRUCTION STANDARDS FOR SPECIALIZED ROOMS C.** A shower room is not necessary for containment of these types of organisms. However, if you determine this room is necessary, install **Showers and Restrooms** using the following guidelines to prevent organism escape.

**SUGGESTIONS:**

1. If installed in the containment area, place showers/ restrooms in vestibule.
2. Equip restroom entry doors with all features required for other containment areas.
3. Cover air exhaust vents with screen or filters prescribed for other exhaust vents from the containment area.

**IV. EQUIPMENT STANDARDS**

**EQUIPMENT STANDARD A.** Use Benches, Tables and Other Furniture that are easy to inspect and clean.

**SUGGESTIONS:**

1. Install work surfaces and laboratory furniture (bench tops, cabinets, tables, etc.) that are light gray or white, water resistant, impervious to arthropods, and resistant to caustic chemicals and heat.
2. Insure that spaces between benches, wall cabinets, and equipment are easy to clean and inspect.
3. Dedicate cleaning equipment (mops, brooms, buckets, etc.) for use only in the containment area, and store it in the containment area.

**EQUIPMENT STANDARD B.** Sterilize solid waste or decontaminate infested articles (contained organisms, soil, plant material, solid waste, and contaminated or infested articles) before removing it from the facility.

**SUGGESTIONS:**

1. Install an autoclave in the containment area. A double-door pass-through model is recommended. Conduct tests to evaluate effectiveness of autoclave.
2. Install a gas sterilizer in the containment area for articles that would be damaged by steam. A double-door pass-through model is recommended.
3. If you are considering an incinerator within the facility, consult your contractor about state, local, and federal laws and ordinances.
4. Stock the facility with appropriate sterilizing materials such as insect killing jars, 70% alcohol, and/or bleach.
5. If appropriate, a freezer may be used to kill organisms. However, other methods must be

used to sterilize materials, including dead organisms.

**EQUIPMENT STANDARD C. Use Cages and Containers to confine arthropods.**

**SUGGESTIONS:**

1. Construct cages from glass, Plexiglas, polycarbonate, etc, to contain arthropods within the containment areas.
2. Equip some cages with sleeves to manipulate arthropods inside the cage.
3. Cover cage ventilation areas with screen appropriate to contain organisms. Consider both the pore size of the screen and the material that the screen is made from (metal, polyester, etc.) in your selection. If research arthropods can chew through it, polyester is a poor choice.
4. Insure cages are easy to clean and disinfect.

**EQUIPMENT STANDARD D. A Biosafety Cabinet is not required, however if desired, please discusses with PPQ's CF Staff.**

**V. OPERATIONAL STANDARDS**

**OPERATIONAL STANDARD A. A Containment Director is responsible for the daily operation and physical integrity of the facility.**

**SUGGESTIONS:**

A Containment Director is responsible for containment of the organisms in the facility. He/she also maintains a copy of the Standard Operating Procedures (SOP) Manual for the facility. SOPs contain directions for normal use, maintenance, testing, disinfestation, and disinfection of the facility and it's equipment.

SOPs also describe how to:

- Respond to emergency events (power outage, fire, glass breaks in containment area, flood, etc.).
- Replace translucent panels in glasshouse.
- Monitor visitors.

Make copies of the SOPs available to workers within the containment areas. Date each revision.

The Containment Director;

- Implements the SOPs and conditions listed in permits for organisms held by the facility.
- Trains employees and/or authorized personnel in the SOPs.
- Updates copies of construction records (blueprints) for the facility.
- Maintains daily, weekly and monthly maintenance records of the facility.

The Containment Director updates these lists:

- The names and phone numbers of people to call during emergencies, as changes occur.

- Authorized personnel, as changes occur.
- Incoming and outgoing shipments of permitted organisms, including dead or destroyed incoming organisms, and submits the list to [USDA, APHIS, PPQ](#) by January 31 of each year.

**SOPs also describe procedures related to all operating standards listed below:**

**OPERATIONAL STANDARD B.** Only Authorized Personnel have routine access to the facility.

The behaviors of people who have access to your facility will have far more impact on the containment of the organism than any containment feature. Your selection of individuals to work in this facility is critical to maintenance of plant pest containment. In addition to picking good personnel, please consider the suggestions below.

**SUGGESTIONS:**

1. Lock exterior doors at all times.
2. Train authorized personnel in the SOPs.
3. List the personnel authorized to enter the facility.
4. Require visitors to sign a logbook.
5. Insure emergency exit doors are not used routinely as an entrance (remove exterior handle, etc.).

**OPERATIONAL STANDARD C.** Wear, sterilize, and handle personal Apparel to minimize the risk of organism escape.

**SUGGESTIONS:**

1. Insure visitors and employees wear laboratory coat in the containment area and remove it prior to leaving the containment area.
2. Prohibit entry of overcoats, hats, purses, etc. into the containment areas, as these articles may allow organisms to hide and escape.

**OPERATIONAL STANDARD E.** Clean and Disinfect the interior of the facility and its equipment regularly.

**SUGGESTIONS:**

1. Clean and disinfect the facility, its furniture, and its equipment regularly with bleach or similar disinfectant.
2. Air filters within the containment area should be changed on a regular basis.
3. Autoclave or sterilize solid wastes (air filters, cultures, plant materials, soil, trash, etc.) prior to disposal.

**OPERATIONAL STANDARD F. Open and Handle packages** of permitted organisms to prevent organism release.

**SUGGESTIONS:**

1. Establish one area to open packages received from foreign sources.
2. Place foreign source packages in a sleeve cage or Biosafety cabinet before opening.
3. Autoclave or incinerate packing materials immediately after the removal of specimens and cultures.

**OPERATIONAL STANDARD G. Start, grow, and store cultures** with as few exotic contaminants as possible. Cross contamination indicates poor laboratory practice. However, it may not indicate containment problems.

**SUGGESTIONS:**

1. List all nonindigenous plant materials used to rear herbivores, update as changes occur.
2. Confine all arthropods in cages that prevent escape.
3. Sterilize/destroy all packing materials from shipments and contaminants shortly after receipt.
4. Autoclave, incinerate or decontaminate materials used for rearing permitted organisms (old feeding media, soil, leaf litter, plant twigs, etc.) before removing from the facility.
5. Destroy contaminated organisms as soon as detected. This may mean destroying beneficial cultures, if pathogens are found in the culture.

**OPERATIONAL STANDARD J. Follow all PPQ Regulatory Requirements** for organisms received, reared in, or released from the facility.

**SUGGESTIONS:**

1. Meet all PPQ requirements or conditions as listed in permits for organisms kept in the facility. Permits from other Federal and State Agencies may also be required for certain plant pests. Receipt of a USDA Plant Pest Permit does not relieve applicants from the responsibility of obtaining other permits. USDA Permits may be withheld or revoked if other Federal and State requirement are not satisfied.
2. Send SOP and blueprints to [USDA, APHIS, PPQ \(link to contact information on intro page\)](#)
3. Obtain permission from PPQ prior to shipping regulated organisms outside of the facility.
4. Maintain a list of all organisms described in PPQ permits that enter and leave the facility. Submit the above list to [USDA, APHIS, PPQ \(link to contact information on intro page\)](#) by January 31 of each year.
5. Maintain voucher specimens for each organism shipped from the facility.
  - Use taxonomists recognized by the [Systematics Entomology Laboratory \(SEL\) \(link to](#)

- <http://www.ars.usda.gov/Main/docs.htm?docid=9353>) to identify *voucher* specimens.
- Notify USDA, APHIS, PPQ ([link to contact information on intro page](#)) semi annually of organisms released into the environment —include the organism’s identification, the identifier’s name, the number of organisms shipped, location that received the shipment, organization that received the shipment, and where voucher specimens are housed and maintained.
  - House and maintain voucher specimens on site or select an alternative site.
6. If the facility stops operating as a containment facility, either temporarily or permanently, and if there are any structural or containment changes (prior to implementation) notify [USDA, APHIS, PPQ](#).