# Standard Operating Procedures Contained Research Facility

**Revised 9/26/2022**

# Introduction

## Background Information

The arrival of new pests in California is a common occurrence. California's location on the Pacific Rim, border with Mexico, unique climate, and wide variety of crops makes the state particularly vulnerable to these pest invasions. Non-indigenous (not native) pests, including arthropods, plant pathogens, nematodes, or weeds, pose huge potential losses on California agriculture and the statewide economy, and threaten natural ecosystems. Additionally, the risk of economic damage from these organisms is intensified by growing genetic resistance of pests (indigenous and non-indigenous) to pesticides, and the lack of effective controls for many pests.

Under the direction of the House and Senate Agricultural Appropriations Subcommittees in 1991 and the California Legislature in 1990, the University of California, in collaboration with the California Department of Food and Agriculture (CDFA) and the United States Department of Agriculture (USDA), developed a facilities proposal called The Pest Control Quarantine & Containment Facilities Project. The Center for Exotic Pest Research at UC Riverside and Contained Research Facility (CRF), at UC Davis, resulted from that proposal and were built using federal and matching state funds. These facilities function as a single program to solve the urgent demand for strengthened pest exclusion, early detection, and alternative strategies for managing plant

pest and disease problems. This program focuses on research that deals with preventative action rather than crisis management to pest invasion.

The state-of-the-art CRF at UC Davis was designed primarily to support research efforts of faculty addressing a wide array of projects. The CRF expands the ability of UC Davis faculty to work in the areas of invasive species, and biological control by providing research conditions in a highly secure, biologically contained environment.

The CRF consists of a 22,541 ft2, two story, stand-alone building supporting approximately 8,542 square feet of assignable laboratory and greenhouse space on the first floor. An additional 3,000 ft2 of the first floor is dedicated to waste sterilization, mechanical and electrical spaces, and administrative areas. The entire second floor, including a mezzanine, is dedicated to air handling and filtration. Construction of the CRF began in May 2001 and was completed by September 2006 at an estimated cost of

$20,000,000. The facility is constructed in a way that will allow for expansion.

## Major Objectives and Activities

The objectives of the CRF are to provide a state of the art, contained facility, allowing research with exotic pests. To meet these objectives, the CRF is designed to meet the conditions of safeguard necessary to maintain BSL3-Plant status.

The major activities at the CRF involve the research, rearing, and containment of exotic plant pests and pathogens (e.g., viruses, viroids, phytoplasmas, spiroplasmas, protozoa, bacteria, fungi, nematodes, insects, mites, parasitic plants, and weeds) that are under permit and regulated by state (CDFA) and federal (USDA/APHIS/PPQ) agencies.

The CRF affords researchers the opportunity to study exotic and invasive species under quarantine conditions that could not be studied under normal laboratory conditions.

## Location of the Facility

The CRF is located on the west campus (west of Highway 113) of the University of California at Davis. The street address is:

Contained Research Facility

College of Agricultural and Environmental Sciences University of California

555 Hopkins Road

Davis, CA 95616

It is adjacent to, and directly south of, the Foundation Plant Materials Service facility. Directions from Interstate 80 are as follows: exit on Highway 113 north (to Woodland); exit on Hutchison Road, turn left at the stop sign; go approximately 1.3 miles (west), turn (south) on Hopkins Road; go three-tenths of a mile; the CRF is located on the right-hand side of the road.

# Physical Containment Standards

## Site Diagram

The CRF and surrounding area inside the chain-link fence (depicted in black) is approximately seven-tenths of a hectare (1.73 acres). The land directly west of the site is earmarked for future expansion of the facility if needed (see Appendix 1a).

## Fence

The surrounding chain-link fence is eight feet tall and topped with two rows of barbed wire. It is set in a one-foot wide bed of 3/4-inch crushed gravel. The main gate (located on the south side) is a motor-operated sliding gate activated by proximity card or by remote control from within the Manager/Project Scientist’s office. A second gate (located on the east side) is locked at all times and accessible by Fire Emergency vehicles only. There is a walk-in gate located next to the main gate that is locked. CRF staff holds keys to the padlocked gates.

## Buffer Area

Inside the perimeter fence, the CRF is surrounded by a buffer zone, consisting of a patchwork of cement, asphalt, pea gravel and/or bare ground (see Appendix 1b).

## Demarcation of the Building

The CRF has two major areas: “clean” and “containment” (see Appendix 1c). The containment area is designated BSL3-P. The clean area is the section of the complex that is outside of containment. A locked outside entrance provides access (via proximity card) to this area, where there is an office, meeting area, building control room, and access (via proximity card) to men and women’s restroom/locker rooms. The clean area also includes a materials delivery/handling room (north side of the building) and fertilization room. Located outdoors (north side of the building) are separate mechanical and electrical rooms downstairs and a ventilation/filtration room upstairs.

The containment area comprises the remainder of the CRF. Access to the containment area is gained through a locked door interfacing the clean locker rooms and the shower areas. Inside the containment area are laboratories, greenhouses, growth chamber rooms, and equipment rooms for scientific studies, as well as the glass wash/media preparation, storage, quarantine breakout and liquid-waste sterilization rooms.

## Schematic Floor Plan

The CRF consists of six greenhouses, five laboratories, two growth chamber rooms and four shared-equipment rooms for researcher purposes (see Appendix 1d).

## Mechanical Floor Plan

(see Appendix 1e)

## Blueprints, Documents and Maintenance Manuals

The following are stored in the control room: as-built blueprints (i.e., corrected design drawings, reflecting any changes from the original design that have occurred during construction), construction documents (i.e., design specifications for the facility and equipment supplied by the project's architects and design engineers), and Operations and Maintenance (O&M) manuals (supplied by the general contractor, with the help of the various sub contractors, at the close of construction). The control room is reached through the Project Scientist’s office. A duplicate set of O&M manuals is located in the ventilation/filtration room (upstairs).

## Facility Safeguards

### Signage

A campus standard street sign (4 x 2 ft gold-colored sign with blue lettering) is located on the east side of the property at the corner of Hopkins Road and Apiary Lane, outside of the fence. The street sign identifies the building as the “Contained Research Facility.” The sign at the front gate reads:

USDA APHIS Inspected Containment Facility ONLY AUTHORIZED PERSONNEL MAY ENTER.

There is no sign at the entrance to the building. The sign at the entrance to the containment area reads:

USDA APHIS

Inspected Containment Facility

ONLY AUTHORIZED PERSONNEL MAY ENTER.

The signs at each of the four building exits read:

USDA APHIS

Inspected Containment

Facility EMERGENCY EXIT ONLY

ALARM WILL SOUND.

### Security

The following four levels of physical security regulate entry. These are at entry points to the: (1) fenced parking area, (2) facility itself, (3) clean locker rooms, and (4) BSL-3 Plant containment area. The first three require aggie access permission to gain access and the fourth requires a key. Only the Director, Project Scientist and the Manager have permanently assigned access and keys, and have authority to approve entry at any level.

### Walls, Ceilings, and Floors

The walls, ceilings and floors of the containment area are impenetrable to organisms and can withstand repeated cleaning and decontamination. The walls and ceilings in the containment area (excluding the greenhouses) are constructed of double layers of 5/8- inch thick smooth, water-resistant, fire-rated gypsum board. The seams of panels, corners, and joints with floor and ceiling are sealed with drywall tape and joint compound. The walls and ceilings are covered with one coat of primer and two coats of paint (off-white epoxy paint manufactured by Sherwin Williams). This color enhances detection of dirt, molds, small arthropods, etc. All penetrations, including utility pipes, ducts, electrical conduits, light panels, electrical receptacles, etc., are sealed with closed- cell foam and silicone caulk to prevent the escape of organisms and maintain negative pressure for proper air movement within the containment area.

For the Entomology Suite, the walls and ceilings in the greenhouse anterooms, laboratory access anteroom, and quarantine break-out room (Rooms 142, 171, 176, and 177) are painted black (1d). Air intake and exhausts are covered with 80-mm or 140-mm

mesh stainless steel panels, depending on the organism being studied at the time. Similar screens have been removed in the Plant Suite due to interference with the building air balancing.

Floors in the containment locker/shower/bathroom areas, greenhouses, anterooms, glass wash, growth chamber and quarantine breakout rooms are seamless and constructed of smooth epoxy with a clear coat of sealer, over a concrete base. Laboratory, shared equipment room, and hallway floors are covered with seam-welded linoleum. Floor drains and vents are protected with trap systems (100-mm stainless steel mesh screens) and HEPA filtration, respectively.

### Windows

Windows in the containment area are constructed of extra-strength glass (double- paned tempered) sealed in frames and permanently closed. All joints between the window and wall are sealed with silicone on both inside and outside surfaces.

Greenhouse glazing consists of a 9/16-inch thick, laminated glass sandwich of two 1/4- inch heat-treated glass panes with a 1/8-inch polyvinylbutyrol (PVB) middle. The greenhouse glazing units are sealed using neoprene glazing tape, between the glass unit and metal framing, and DOW Corning series 795 (grey) and 999 (clear) silicon.

### Exterior Doors

**Building Entrances.** The main-entrance door (1c) is used for routine entry and exit. It is self-closing and locked at all times. Authorized personnel enter via Aggie Access permision. A set of double doors leading into the materials receiving area is located on the north side of the building (1d). These doors remain locked and authorized personnel enter this area via card access.

**Emergency Exits.** There are four emergency exit doors in the containment area.

Rubber gasket material is installed on the edges of the 4.5 cm-thick doors to prevent

movement of organisms to the outside. Magnetic door closures press the doors firmly against these seals. To prevent unauthorized entry, the doors have no hardware on their exterior. The interior sides are equipped with von Duprin push-bar style hardware for easy opening in the event of an emergency. Audible alarms are activated when emergency exit doors are opened. All emergency exit doors are kept locked at all times. All emergency exits are posted with two warning signs: (1) USDA APHIS Inspected Containment Facility/ ONLY AUTHORIZED Personnel May Enter and (2) Emergency Exit Only/ Alarm Will Sound. Warning signs are posted at the entrances to the containment area to deter entry of unauthorized personnel.

### Heating, Ventilation, and Air Conditioning (HVAC)

Separate HVAC systems service the containment and clean areas. In the containment area, the HVAC system provides the following: (1) cooling and heating to maintain the temperature and humidity requirements of projects; (2) air for local exhaust systems, such as the fume hoods and biosafety cabinets; (3) gradients of negative pressure to control the direction of contaminants; (4) capability for diluting or removing undesirable airborne contaminants such as odors; and (5) acceptable air quality. The entire second floor is dedicated to air handling equipment.

**Heating/Hot Water System.** The heating/hot-water system supplies heat for building temperature control. It is managed through the Siemens control system. Upon enabling, one of two heating/hot-water pumps is engaged and runs continuously to maintain comfortable room temperature. The pump’s variable frequency drive (VFD) is modulated to maintain an end-of-line, differential pressure set-point. The two heating/hot-water pumps operate on a lead/lag/fail-over routine--i.e., one pump is

programmed to “lead”, or the first one to start up when called, and the other is designated as the “lag” pump. For example, if the lead pump is enabled and cannot keep up with the demand, the lag pump is enabled and both will ramp-up in unison to maintain the designated temperature set-point for the building. Also, if one pump is enabled and fails, the second is enabled and the first is locked out (i.e., “fail-over”). When fail-over occurs,

an alarm is automatically sent to the controls monitoring system and the campus Facilities Controls Shop.

The two heating/hot-water boilers function using the lead/lag/fail-over routine in much the same way as the pumps. When the “lead” boiler is enabled, the isolation valve is opened and proved open (i.e., confirmed open and status determined) by the Siemens system; then the water-flow switch detects water flow, and the boiler is enabled. From this point on, the boilers operate on internal controls and safeties. If more capacity is needed than one boiler can produce, then the “lag” boiler is enabled and both are used to satisfy the building’s temperature needs. Finally, as with the pumps, if one boiler fails, the other one is enabled and the first is locked out causing a “fail-over” to occur. In a fail-over situation, the controls monitoring system receives an alarm and the campus Facilities Controls Shop is notified.

**Steam Boilers.** The steam required for the three autoclave and two liquid waste sterilizer units is supplied by four stand-alone steam-boiler units. While the Siemens control system enables each boiler, the boilers operate using internal controls and safeties. The boilers maintain the building steam pressure between 60 and 90 pounds per square inch of gravity (PSIG). For example, when the building pressure falls below 60 PSIG (low set-point), the boiler turns on. Similarly, when the building pressure exceeds 90 PSIG (high set-point), the boiler turns off. To reduce scaling, a Culligan water softener is used to condition water supplied to the steam boiler system. Maintenance includes adding rock salt to the water softener as needed.

**Boiler-Feed Unit (BFU).** The boiler-feed unit serves several functions. First, it receives steam condensate from the liquid-waste sterilization system’s heat exchangers. Second, the BFU receiver tank is filled with water; when the levels recede in the steam boilers, it sends the water to them, by means of a booster pump, to make steam for the autoclaves and liquid-waste sterilization system. Finally, chemicals are added to the BFU water to prevent the formation of scale and sediment in the steam boilers.

**Chilled Water System (CWS).** The chilled water system functions to cool the building by providing chilled water to each of the nine air handling units (AHUs) and to the fan coil unit in the electrical room. In addition, it sends chilled water to the building’s

six growth chamber units for process cooling (i.e., chilled water is used to transfer heat from each growth chamber’s condenser unit via supply and return).

The CWS is redundant--that is, it consists of two 250 ton chillers, two chiller circulation pumps (constant volume), two building circulation pumps (modulating) and two chiller isolation valves. Thus, there are two complete chilled water systems at the CRF. Should one system (or component of the system) fail, the other is activated. The CWS is enabled continuously to allow the various building pumps to operate. The building pumps operate on a lead/lag/fail-over sequence to maintain an end-of-line differential pressure set-point. These pumps must operate continuously to provide process cooling for the six growth chambers.

When the building requires cooling, one of the chilled water systems is enabled by the Siemens control system. Once enabled, the chiller isolation valve is commanded open; once proven open, the chiller circulation pump is enabled. Once water flow is proven, the chiller is enabled to operate using internal controls. If there is a failure of these points or the chiller cannot provide the needed capacity of cooling, then the second chiller system is enabled and the first is disabled, locked out, and an alarm is sent to the Siemens control system and the campus Facilities Control Shop.

**De-ionized (DI) Water System.** The DI water system provides de-ionized water to the laboratories and greenhouses. Industrial water feeds into the DI water system; through a series of filters and a Reverse Osmosis process, DI water is produced. This system fills the DI water storage tank to a set level. The DI water is subsequently pumped throughout the facility at five gallons per minute (GPM) and can be expanded to produce seven GPM if needed.

**Water Booster System.** As water enters the building, it goes through the water booster system. The water passes through the staging of two pumps, thus increasing the building water pressure. This system is needed because the utility water supplied, before entering the booster system, is under reduced pressure.

**Greenhouse Air Handler Units (AHU)**. Each greenhouse has a dedicated AHU that provides comfortable, conditioned, filtered air. Based on the temperature inside the greenhouse, the Gemlink greenhouse environmental control system sends a signal to the

Siemens Apogee building control system to manage the operation of the heating and cooling control valves. *The Gemlink system compares the carbon dioxide (CO2) level inside the greenhouse to that of the outside air; if the CO2 level is low in the greenhouse, the Gemlink system sends a signal to the Siemens Apogee building control system to open the outside* air damper, thus increasing the CO2 to the desired level in the greenhouse.

Unlike most greenhouse or laboratory systems, the outside-air dampering and in/out air filtering allow the flexibility of pulling in outside air for 100% fresh air, as well as recirculation of the air without the concern of contamination.

Each greenhouse AHU has a dedicated Siemens Apogee control system that controls the greenhouse static air pressure by managing the speed of the supply and exhaust fans. The supply fan is controlled by a specific, air-flow set point measured in cubic feet per minute (CFM); the set point is currently 3,500 CFM. The exhaust fan controls the greenhouse differential pressure--that is, the difference between the pressure in the greenhouse versus that in hallway. The exhaust-fan system is connected to each greenhouse and maintains negative differential static pressure by pulling air from the system as needed. Each exhaust system has two fans and a bypass damper to control the static pressure. The air pressure system has many safety measures ensuring its proper operation; these include variable frequency drive (VFD) limiting, regulation of ramp speed, monitoring possible points of tampering, differing levels of filter pressures, the setting of extreme room pressures (high and low), and program equipment proofs of operation.

Each greenhouse AHU system includes two filter banks; one is for the air entering the greenhouse and the other for air exiting the greenhouse. Each filter bank consists of 70% pre-filters, 95% HEPA filters and 99.9995% ultra-HEPA filters. The latter filters particles up to 0.12 microns in size. Each HEPA filter has a “blade-in-gel” type of seal.

Magnehelic differential pressure gauges with transmitters monitor the air flow across the filter banks, as well as the total differential pressure across all of these filters. The transmitted values are monitored by the Siemens control system and have preset alarm points. Each filter bank is a bag-in/bag-out system that allows for changing the filters

without contaminating the outside environment. Each unit is also equipped with decontamination ports and hand-operated, bubble-tight dampers.

**Laboratory Air Handler Units (AHUs)**. The BSL-3 laboratories are serviced by two AHUs that are considered to be 100% outside air units. These AHUs pull in 100% outside air, filter it in the unit using a 30% filter, and condition it by modulating heating/hot-water and chiller-water control valves that are controlled by a supply air- temperature set-point. The supply fan is modulated to maintain a supply static pressure set-point; the set-point transmitter is located at the end of the ducting. The air then travels through a supply air control valve and reheat coil that control the room temperature. The exhaust is removed either through a general exhaust duct or fume hood exhaust duct in each room; each exhaust duct is equipped with a transmitter that is calibrated and set to maintain room pressurization. This series of supply and exhaust valves is controlled by both Phoenix Direct Digital Controls (DDC) and Seimens control systems. Both systems work in unison to maintain proper laboratory conditions. Air leaving the laboratories is HEPA filtered in the same manner as described above.

Each supply and exhaust duct entering and exiting a room or hallway is connected to a bubble tight damper. These dampers are controlled by the Siemens control system and will automatically shut and lock down each room whenever the AHU enable point is removed. Each bubble-tight damper, and associated ductwork from the room to the damper, is tested for leaks during the pressure decay testing of each area.

As the air leaves the BSL-3 space, it is contained in stainless steel, welded ducting up to the filter housing unit, which contains a bank of 70% pre-filters, 95% HEPA filters and 99.9995% ultra-HEPA filters. This filter housing unit is built for “Bag-in / Bag-out” filter changes and is equipped with decontamination ports and manual bubble tight dampers at the inlet and outlet. After passing through the air filtering system, the air enters the exhaust air system that is controlled by two exhaust fans; one fan is for constant volume and the other for constant pressure. The fans have a bypass damper that allows them to maintain a constant static pressure in the ducting system.

### Laboratory Benches, Cabinets, and Furniture

All work surfaces are constructed of epoxy resin, high pressure phenolic resin (acid resistant grade), or type 304 stainless steel. Cabinets are constructed of hardwood, with hardwood veneers and welded fiberboard, and treated with a chemically-resistant finish. Chairs and stools are constructed of non-absorptive materials for easy disinfection.

### Emergency Generator

The building electrical system has an automatic transfer switch. In the event of a power loss, it switches over to and starts the onsite electric diesel generator (emergency generator). This generator has the capability of providing power to the building for up to twenty hours, providing its self-contained fuel tank is full. All essential equipment in the building is powered by this system to ensure that containment and temperature control will be maintained.

### Liquid Waste Sterilization System

Effluent from the BSL-3 area must be sterilized before being discharged to the campus sewer system. Effluent from all lab sinks, floor drains, greenhouse floor drains, autoclave drains, BSL-3 showers, BSL-3 bathrooms and drinking fountain flows (via gravity) in a double-contained pipe system into the liquid waste sterilizer system. The contaminated liquid enters a 2,500 gallon collection sump tank that is located below ground level. When 385 gallons of contaminated liquid accumulates in the tank, a grinder pump is enabled that grinds and then pumps the liquid up to one of two 550 gallon sterilizer tanks. When full, the sterilizer tank is automatically locked down and the contaminated liquid is circulated through a steam-to-water heat exchanger that is programmed to maintain a temperature set-point of 121°C for one hour. The contaminated liquid is heated at this temperature for one hour, and then cooled through heat dissipation so as to lower the temperature of the liquid. In the drain mode, a drain valve and self-operating valve are modulated to achieve a final temperature of 60°C; at that time, the sterilized liquid is released into the campus sanitary sewer. As the tank is

drained, the flush valve is energized; this causes pulses of cool water to enter the sterilizer tank, thereby flushing the tank of any remaining debris. Once the sterilizer tank is empty, the system is reset to the standby mode until the next 385 gallon decontamination cycle.

### Communication System

Each laboratory and greenhouse anteroom is equipped with a shared telephone line and computer terminal. Because laboratory notebooks cannot be removed from the containment area, experimental data must be transmitted to the outside electronically or by fax. Fax machine is located in room 144.

### Air Compressor System

The air compressor system consists of a duplex air compressor and tank, air dryer and appropriate regulators. The system supplies air to the laboratories, greenhouse anterooms, greenhouses, bubble-tight dampers, and the room air-flow valve controllers. If there is no air pressure, the facility must be shut down. The air compressor works on a lead/lag/fail-over protocol.

### Solid Waste Sterilization System

All solid waste (e.g., soil, plant material, laboratory waste, etc.) must be decontaminated prior to leaving the BSL-3 area. This is accomplished through the use of the two steam autoclaves programmed for 121°C and 15 psi for 60 to 90 minutes.

Biological indicators are used bimonthly and autoclave tape is used in every load to ensure proper decontamination. Preventative maintenance is performed on all autoclaves every six months.

### Greenhouse Controls System

The greenhouses are controlled mainly *through the Gemlink control system* that uses Phoenix direct digital controls (DDC) to maintain designated room temperature, CO2 level, high intensity discharge (HID) lighting (through either klux or time), drip irrigation levels, fertilization levels, and soil temperature (using bench warming pads and sensors). The exterior greenhouse shade screen system is manually raised and lowered during the fall and late spring, respectively.

### Building Automation System

Facility operations are controlled using the Siemens Building Automation System.

These operations are monitored through a Siemens Apogee workstation.

1. **Air Filtration**

# Equipment Standards

The CRF utilizes Flanders/CSC BF-Series filters for air filtration. These filters are side servicing, bag-in/bag-out, with fluid-seal filter housings that contain prefilters, high efficiency particulate air (HEPA) filters (99.97% efficiency for removal of 0.3µm diameter or larger particulate matter [PM]), and ultra particulate air (ULPA) filters (99.9995% efficiency for the removal of 0.12µm diameter or larger PM). This system removes particulate matter from the air handling system prior to discharge of air to the outside air through stacks along the roofline of the building. These housings and their filters are designed to handle dangerous or toxic biological, radiological or carcinogenic materials. Once the initial filters are installed, all filters, dirty and new, are handled through a plastic bag system, thus minimizing contamination when replacing and handling dirty filters.

## Solid Waste Sterilization

The CRF utilizes two medium-sized gravity-process sterilizers (AMSCO Eagle 3000 series; chamber size, 24" x 36" x 60"; double-door, pass-through, steam-jacketed). These are designed for sterilization of non-porous heat- and moisture-stabile goods, liquids and media in borosilicate glass containers with vented closures, and supplies used in laboratory experiments. They are supplied by building steam generators, and are intended for routine treatment of solid waste prior to removal from the containment area.

## Biosafety Cabinets

The CRF is equipped with two types of Microzone biosafety cabinets. There are two 55-inch, Class 2, Type B2 cabinets, one in the Tissue Culture Laboratory (Rm. 143), and the other in the Plant Laboratory (Rm. 161). These cabinets are equipped with an exhaust air connection to the air ventilation and filtration system. There are five 55-inch, Class 2, Type A2 recirculating-type cabinets. Two of these are located in the Tissue Culture Laboratory (Rm. 143) and the remaining three are located in the Plant and Entomology Laboratories (Rm. 162, 163, and 171).

## Chemical Safety Hoods

The CRF is equipped with four Kewanee supreme air, model H05 safety hoods. These are vertical sash, restricted by-pass, bench-type fume hoods, located in the Plant and Entomology Laboratories and are located in rooms 161, 162, 163 and 172.

## Growth Chambers

### Double Shelf

The CRF is equipped with three double shelf growth chambers (Conviron model MTR30) for holding smaller plants (Rm. 164 and 173A). Each unit has two reach-in

doors (30"W x 54"H) with keyed magnetic locks, and provides approximately 31square feet of culture area on two shelves. These units are equipped with fluorescent lights that provide balanced-spectrum lighting, with an intensity of 690 micromoles/m2/s and 56,000 lux over each shelf. Temperature control ranges from 10°C to 45°C (with lights ON and FULL fresh air).

### Single Shelf

There are also three single-tier growth chambers (Conviron model PGR15) for holding larger plants (Rm 164 and 173A). Each unit has two reach-in doors (30"W x 54"H ) with keyed magnetic locks, and provides a growing space with the following dimensions: 73 1/2"W x 31 3/4"D x 65 1/4"H. These units are equipped with fluorescent lights providing balanced-spectrum lighting with an intensity of 980 micromoles/m2/s and 80,000 lux over each air shelf. Each unit allows temperature control from 10°C to 45°C (with lights ON and FULL fresh air).

## 7. Greenhouse Equipment

There are six fully equipped greenhouses (Rm. 166A, 167A, 168A, 169A, 176A, and 177A). Five greenhouse compartments are equipped with six metal tables (4.5 x 6 feet) and one greenhouse compartment has five tables to allow wheelchair access. There are 18, 600 watt, high pressure sodium (HPS) lights and a CO2 elevation system in each. The control system consists of the base station computer in room 106 and peripherals, the alarm system, the weather station, and a series of Grower's Choice environmental controllers interconnected via a two-conductor communications bus. Each controller includes a LCD display and keyboard for local status information and programming. The status for all of the controllers and their programming can also be done at the host computer located in the control room (Rm. 106). Each greenhouse has one Grower's Choice (model GC-2400). Two additional controllers (model GC-600) are used for the

control of bench heating. These are shared between two greenhouses, with four benches being controlled by each.

# Personnel

The chief of the CRF is designated as Director. A Project Scientist/Containment Officer directs the daily operations of the facility and has authority to enforce the Standard Operating Procedures. A Manager assists the Project Scientist and stands in when the latter is not on site. A Computer Programmer (0.5 FTE) provides support for the computer systems. Two Administrative Assistants (0.2 FTE) for the Director and the Project Scientist are housed in the CAES Dean's Office.

## Director

Dr. Joanna Chiu

Professor and Vice Chair Department of Entomology and Nematology

University of California Work address:

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Davis, CA 95616 Telephone:

(530) 752-1839 Office

E-mail: [jcchui@ucdavis.edu](mailto:jcchui@ucdavis.edu)

The Director’s overall responsibilities are determined by the CAES, and include interactive management of the CRF budget, operations, and planning. The Director regularly interacts with the Project Scientist regarding current and planned research projects, chairs the CRF Advisory Committee, and represents the CRF to the UC

administration, regulatory and granting agencies, and the public. Together with the Project Scientist and the CRF Advisory Committee, the Director shares responsibility for authorization of proposed projects.

## Project Scientist

Dr. Kris Godfrey

Project Scientist, Contained Research Facility College of Agricultural and Environmental Sciences University of California

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The Project Scientist is responsible for the daily supervision of the activities and operational functions of the facility. The Project Scientist interacts directly with the Director and is a member of CRF Advisory Committee. The Project Scientist’s responsibilities include the following: (1) facility operations, security, and maintenance, including enforcing compliance with containment protocols, the safety program, and the standard operating procedures; (2) conducting daily checks of containment integrity, building security, and environmental control systems, and coordinating repairs and maintenance with maintenance personnel; (3) acting as liaison with federal and state regulatory representatives; (4) authorizing and training personnel that are allowed entry

into the CRF and assigning space in BSL3-Plant; (5) handling incoming material and assigning accession codes to such material; (6) keeping permanent records including, permits, notifications of intent to bring permitted material to the facility, introductions, identification of incoming organisms, and fate of organisms; (7) developing and maintaining an interactive web site for the CRF; and (8) preparing an annual report summarizing the activities at the CRF.

## Manager/Containment Officer (CO)

Tiffanie Simpson

Manager/Containment Officer, Contained Research Facility College of Agricultural and Environmental Sciences University of California

Work address:

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The Manager assists the Project Scientist and assumes the latter’s responsibilities when necessary (e.g., illness, vacation, extra hours). Generally, the Manager shares the day to day responsibilities for operations.

## Computer Programmer

Darrell Joe

Systems Architect, Dean’s Office

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The computer programmer is responsible for operating, maintaining, and updating (as necessary) the computer systems (e.g., data firewall, security system, building operating system, greenhouse operating system, LAN) which operate the CRF.

## Administrative Assistants

**Administrative Assistant**

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**Budget Analyst**

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## CRF Advisory Committee (CRFAC)

The CRFAC is chaired by the Director, and includes the Project Scientist, Manager and representatives of the research groups that might utilize the facility, the campus Biosafety Officer, as well as Solano and Yolo County Agricultural Commissioners, and representatives from the CDFA and APHIS. The CRFAC is charged with advising the Director and Project Scientist on facility operations, approving proposed research projects, enforcing the SOP, and providing scientific and regulatory support and expertise. A sub-committee of six CRFAC members approves proposed research projects.

## Principle Investigators, Research Associates, Student Assistants and Visitors

Principal Investigators (PI’s) are responsible for obtaining and maintaining active permits and BUA’s for work in the CRF, when required. PI’s are also responsible for laboratory safety training, enforcing safety protocols, and ensuring building protocols are followed in their assigned spaces. PI’s are responsible for anyone (Research Associates, Students Assistants, and Visitors) who works in or visits their assigned space. PI’s are responsible for any and all PPE (personal protective equipment), specific safety training on lab equipment, proper disposal of chemical waste, providing detailed protocols for laboratory procedures and maintaining their assigned space to comply with campus safety protocols.

Research Associates, Student Assistant and Visitors are responsible for following all building protocols as per their CRF training. In addition, they are responsible for following any and all procedures required by their PI to conform with campus safety policies.

# Standard Operating Procedures

## Application Checklist

* + Work with infectious agents or recombinant DNA requires a current Biological Use Authorization (BUA) (or exemption on file) specific to this project from UC Davis Department of Environmental Health and Safety.

Web site for a BUA application: <http://ehs.ucdavis.edu/biosfty/baua.cfm>

* + Work with exotic and/or quarantined pests/pathogen requires a current APHIS 526 permit and/or CDFA 66-026 permit for research organisms.

Web site for an APHIS 526 form: <http://www.aphis.usda.gov/ppq/forms/ppqform526.pdf>

Web site for a CDFA 66-026 form: <http://www.cdfa.ca.gov/phpps/permitsandregs.htm>

* + Completed Application for Space form after BUA (or exemption) and APHIS/CDFA permits issued.

Application for Space form available from MCO or CRF web site: [http://www.crf@ucdavis.edu](http://www.crf@ucdavis.edu/)

* + Application reviewed by the CRF Advisory Committee (CRFAC).
  + PI notified of the CRFAC’s decision.

## Accessing the facility

Normal CRF entry hours are from 8:00 a.m. until 4:00 p.m., Monday – Friday.

Entry outside these hours is approved for authorized users only. Project Scientist must be notified of entry outside normal hours.

### Authorized Users

Authorized users (AU) are those persons named in the Application for Space that have been trained by the Project Scientist to work in the facility. Each AU will be issued a proximity card to access the gate, building entrance and clean locker room, and a key to access the containment area. Work clothing will be laundered inside the containment area. No food or drinks are allowed in the containment area. There is one water fountain for the entire containment area; it is located in the hallway outside the containment locker rooms. Lunches, snacks and drinks can be stored in the refrigerator located in the receiving area but must be consumed in this area. A microwave situated to the right of the refrigerator is available for food preparation.

Entry areas are equipped with warning lights and buzzers that operate when a containment entry or egress door is being opened. This is to assure that more than one entry and/or egress door is never opened at the same time. DO NOT use the proximity card to open the entry when the red warning light is flashing and/or the buzzer is sounding. For doors that do not need proximity cards for entry, DO NOT open the entry when the red warning light is flashing and/or the buzzer is sounding.

### Before entering the facility

A UCD parking permit is required to park in CRF parking lot. A daily permit may be purchased at any campus parking lot permit machine. Monthly permits are sold at the Transportation and Parking Services (TAPS) office located on the main campus. Use the proximity card to enter front gate and the front door.

### Entering the clean area

* + Sign-in (print first and last name, and time in) on white board located in meeting area.
  + Sign log book (write first and last name, date, time in) located on table in meeting area.
  + Verbally check in with Project Scientist. If the Project Scientist is in containment area, use walkie-talkie (located on wall outside Project Scientist’s office) to make verbal contact.

### Entering the clean locker room

* + Enter appropriate clean locker room (men’s or women’s) using proximity card when no red warning light is flashing and no warning buzzer is sounding.
  + Remove all items of clothing (including undergarments) and place them along with all personal items (cell phones, watches, bracelets, etc.) and proximity card (not needed in containment) in assigned locker. Eyeglasses and rings may be worn inside containment.
  + Prepare to enter the containment area unclothed. Experimental materials or equipment must be logged in and the Project Scientist notified. Remember, whatever you take into containment cannot come out with you; it must first be decontaminated by autoclaving at 121° C for a minimum of thirty minutes.

### Entering the containment area

* + Use the key to enter the BSL3-Plant containment area. Do not open the door if a warning light is flashing and/or buzzer is sounding. Pass through the shower area. *Passage through the shower area is considered entry into containment, and a shower is required before exiting.*
  + Enter the containment locker room and put on work clothing and shoes. These items of clothing are intended to remain in the containment section of the facility throughout the duration of the project; they will be laundered using the washer and dryer located in Room 141.
  + Pass into the containment work area when no warning lights are flashing and no buzzer is sounding.

### Inside the containment area

* + AUs are responsible for adherence to the work plan and methods described in the approved project description and are responsible for all clean up associated with assigned and shared space.
  + Upon entry, go directly to the appropriate assigned space. AUs are restricted to designated workspaces and shared workspaces only.
  + Knock on each door to any assigned or shared workspaces prior to opening and entry. If there is no response or a positive response “OK”, open and enter. If there is a negative response, “No, wait”, someone else is either in passage or is in the middle of an operation that should not be disturbed. Wait for a positive response “OK”, before opening the door.
  + All counter surfaces must be cleansed before and after use, and must be left clean prior to egress of the assigned or shared space. Use appropriate cleaning methods for your project (e.g. bleach, greenshield, etc.).
  + Containment within assigned space will be defined in the approved project description.
  + Shared space requires separation of organisms in time and/or space. Use of shared space is restricted to certain AUs.
  + All organisms that are to be taken from assigned to shared space for examination, photography, etc., must be carried in non-breakable, closed containers. Any spillage in transit or in the shared space must be reported to the Project Scientist and cleaned up immediately.

## Exiting the containment area

* + No material, supplies or organisms may leave the containment area with the AU. Material, supplies and organisms exit only under supervision of the Project Scientist and as described in the project and Application for Space.
  + Enter the appropriate containment locker room (men’s or women’s) when no warning lights are flashing and no warning buzzer is sounding.
  + Remove all clothing and place into laundry bins. A mesh bag is provided for undergarments and socks. Store shoes on racks in locker room after disinfecting (inside and out) with greenshield.
  + Be certain about possession of the key before leaving the containment locker room.
  + Enter the shower and wash completely, including hair, fingernails, eyeglasses, and rings (towels, shampoo/conditioner and body soap are provided).
  + Towel dry completely; leave wet towel in laundry bin in shower area. *Do not remove towel from shower area.*
  + Move from shower area to clean dressing room when no warning lights are flashing and no warning buzzer is sounding.
  + Put on street clothing.
  + Only Materials described and approved in the project application may be removed. These must be noted in the log book and the Project Scientist must be notified.

### Exiting the clean locker room

* + Move from clean dressing room to administration area when no warning lights are flashing and no buzzer is sounding.

### Exiting clean the area

* + Sign-out on white board located in meeting area (erase name and time in).
  + Indicate time out in logbook located on table in meeting area.
  + Verbally check out with Project Scientist. If the Project Scientist is in containment area (use walkie-talkie located on wall outside Project Scientist’s office) to make verbal contact.

### Exiting the facility

* + Drive up to gate; it will automatically open and close. If riding a bicycle, the Project Scientist will open front gate from the office.

### Others

Other persons that may need to enter the containment area include emergency personnel, facility maintenance and janitorial staff, vendors and visitors. These individuals must follow the same access procedures as AUs, with the following exceptions: (1) the visit must be prearranged with the Project Scientist; (2) clothing, (i.e., scrubs, and shoes) will be provided; and (3) the Project Scientist or CO must accompany the individual while in the containment area. Further exceptions pertain to emergency personnel (see Section 6: Emergency procedures).

## Entry and removal of materials

### Taking items into containment

* 1. **Experimental organisms**

All experimental organisms entering the CRF, whether from foreign or local sources, will be received and processed by the Project Scientist. Only those organisms listed on the Application for Space will be allowed to be brought into the facility. The AU will coordinate the arrival of experimental materials and provide the Project Scientist with the following: 1) notification (at least one day) that material is being sent to the CRF; 2) all necessary information including the date sent, carrier used and tracking numbers, sender’s name and contact information, contents of package(s), APHIS receiving station and address; etc.; 4) dates when the foreign materials arrive at and depart the APHIS receiving station; and 5) date and estimated time of arrival of the package at the CRF. The Project Scientist will notify the AU as soon as the package arrives at the facility. The AU is present when the package is processed.

Specimens transported to the CRF by the AU must be enclosed in appropriate primary and secondary containers. Arthropods in plastic vials must have one end covered with mesh and the other covered with a removable lid and placed in another unbreakable container or ice chest. Microorganisms in/on plant material should be in double bagged zip lock plastic bags within a secondary container or ice chest. Cultures should be in

non-breakable screw cap tubes or an equivalent vessel and housed in a secondary

container. The AU must prearrange with the Project Scientist when bringing experimental organisms to the facility. Only those organisms listed on the Application for Space will be allowed in the CRF.

The Project Scientist will decontaminate the surface of the package or container of experimental organisms and carry it, via the locker room, to room 143 and opened in a biosafety cabinet and the contents examined. If the AU’s laboratory space contains a biosafety cabinet, the contents can be examined in their laboratory. The AU will be present during the inspection and identification procedure. After the research items have been properly identified and documented, they will be placed in a clean, enclosed, non- breakable container and transported by the AU to the assigned research space. All packing material and transport containers must be either autoclaved or disinfected as soon as the research items are removed. Excess plant materials or cultures must be autoclaved prior to disposal. The biosafety cabinet can be decontaminated by an appropriate disinfectant.

### Plants and soil

All plants to be used in experiments must be grown from seed in the containment area. If plant materials must be brought into the CRF, these must be treated to insure that no unwanted organisms are accidentally introduced. This must have approval of the FCRAC.

A separate greenhouse (Room 177) is designated as the ‘clean’ house where only healthy plants are grown. The CRF provides soil, Sunshine Basic Mix #2, for planting. It is composed of Canadian Sphagnum moss, perlite, gypsum, dolomitic limestone and a wetting agent. If the AU requires a different soil type, it must be listed on the Application for Space and the AU is responsible for supplying the soil substitution.

### Supplies and equipment

Certain greenhouse and laboratory supplies/equipment are provided by the CRF (see Project Scientist for list); however, those supplies and equipment not provided should be listed on the Application for Space. Consult the Project Scientist before taking any items into the containment area.

Cages used in containment must conform to certain guidelines and be approved by the Project Scientist. They must be constructed in a way to withstand repeated washing and decontamination. For example, cages made of wood must be completely sealed with at least one coat of primer and two coats of semi-gloss latex or epoxy paint.

### Removing items from containment

* 1. **Experimental materials**

Only certain experimental materials can be taken from the CRF; these include purified DNA and RNA, proteins, and some seed. The decision as to the nature of materials that can be removed from the CRF is based on the collaborative efforts of key APHIS, CDFA, and UCD personnel including the FCRAC. All materials to be removed are considered on a case by case basis and must be listed on the Application for Space. *Always consult and prearrange with the Project Scientist before removing any experimental materials from containment and note it in your “Items Removed” log.*

### Other

No supplies and chemicals will be allowed out of the containment area, so plan ahead and bring in only what will be used. At the completion of the project, clothing and other personal items can be autoclaved and then removed from the CRF. All heat sensitive items taken in by the AU can be removed after decontamination by VHP.

There is a charge for the VHP decontamination procedure (see the Project Scientist for details).

## Standard laboratory procedures

**(See Laboratory Training/Safety Manual)**

## Sanitation within containment

### Articles and equipment

Various articles and equipment in the containment area are cleaned and disinfected using any of the following methods: 10% bleach solution (made fresh daily), 70% ethanol, and Cidecon or Lophene phenolic disinfectants.

### Cleaning and disinfection

The containment area is constructed of materials that facilitate cleaning and disinfection. Entire laboratories and greenhouses can be decontaminated by VHP at the conclusion of each research project and in the event of an accidental contamination.

Greenshield, ethanol and bleach solution is available to decontaminate the work surfaces of laboratory benchtops, BSCs and fume hoods after each procedure and before leaving the area for the day.

## Emergency procedures

### General response

The protocol below can be used for the following emergencies: fire, explosion, earthquake, flood, airplane crash, medical, chemical spill (inside and outside biosafety cabinet), hazardous materials, utility failure (water, electricity, gas), civil disturbance, theft/burglary/possible crime, unauthorized intruder/workplace violence, terrorism, mechanical systems failure and breach of containment (accidental or intentional).

Dial 9-1-1 (from campus phone) or 752-1234 (from cell phone) and calmly state the following to the emergency dispatcher:

* + Your name,
  + The building and room location of the emergency,
  + The nature of the emergency (e.g., fire, chemical spill, medical, etc.),
  + If any injuries have occurred,
  + Hazards present which may threaten persons responding, and
  + A phone number where you can be reached, or a location at the scene where you can be contacted when emergency personnel arrive.

Note: While waiting for assistance, remain calm; the dispatcher will contact the necessary emergency services. The dispatcher may ask you to stay on the phone; otherwise keep the line free.

### Power outage

The CRF is equipped with a back-up, emergency generator to ensure that containment is not compromised in the event of a power outage. When a power outage occurs, the generator starts within seconds and supplies power to designated areas. A list of the areas powered is available in the Project Scientist’s office. The back-up generator has the capacity to supply power to these sections for twenty hours. In the event of a power outage, call facilities maintenance at 752-1655, secure all organisms, and exit following normal shower-out protocol.

### Loss of containment

In case of loss of containment, it will be necessary for all personnel to act quickly and efficiently to prevent accidental contamination of the external environment with biological materials from research projects. Examples include flooding, glass (window) breakage, and earthquake. In the event of a loss of containment:

* + Dial 9-1-1 and Facilities maintenance at 752-1655 to report the incident.
  + Contact the Project Scientist.
  + Secure organisms when possible.
  + Inspect the facility for damage.
  + Identify all breaches of containment (i.e., openings in exterior glass and doors).
  + Cover openings, if possible, using the patching materials located in the Ventilation/Filtration room.
  + If opening is too large to cover, move materials to a contained area (e.g., hallway, another greenhouse or laboratory).
  + Notify the following within twenty-four hours: campus Biosafety Officer (Chelsea Schiano, 530-601-6360); Yolo County Agricultural Commissioner (John Young, 530-666-8140 ext. 8148); Solano County Agricultural Commissioner (Jim

Allen, 707-784-1310); CDFA (Laura Petro, 916-654-1017), and APHIS (Ingrid Asmmundson, 301-851-2235).

Opening an exit door is also considered a breach of containment. In this event, make certain organisms are secured and notify the Project Scientist immediately. No emergency exit should be opened except in the case of a life-threatening incident.

### Unauthorized entry

In the event of an unauthorized entry, Dial 9-1-1 (from campus phone) or 752- 1234 (from cell phone) and report the incident immediately. Notify the Project Scientist and others on site. Appraise the situation but do not attempt to confront the intruder.

Take precautions for personal safety while waiting for the police to arrive.

### Medical emergency

First priority is saving human life. Consistent with rapid medical intervention, all possible actions must be taken to maintain containment integrity.

### Minor injury

Notify the Project Scientist immediately. Apply first aid and seek additional medical care as needed. Exit the facility following shower-out protocol.

### Serious injury

Call 9-1-1 to request emergency medical assistance.

* + Notify the Project Scientist immediately.
  + Do not move a seriously injured person who is not in immediate danger.
  + Stand-by and be prepared to meet and update emergency responders when they arrive.
  + Emergency responders entering the containment area will be asked to put on gowns, hair caps, and booties that are located in a plastic bin in the receiving area labeled EMERGENCY CLOTHING. Emergency responders will enter through interlock 123 (double doors next to autoclaves) by opening the outer door and closing it behind them before opening the inner door.
  + Emergency responders will be asked to exit through interlock 123 by opening the inner door and closing it before opening the outer door; they must remove and deposit their gowns, hair caps, and booties and in the interlock room receptacle
  + Drape a clean gown over the victim before leaving the facility.

### Where to seek medical care

For injuries or illnesses that are sustained during work hours but are not an emergency, all employees/users must seek medical treatment from Employee Health Services, 501 Oak Avenue in Davis (752-2330). After work hours, employees should seek treatment at Sutter Davis Hospital, Covell Blvd at Hwy 113. Employees/users who want to be treated by their personal physician (or other specific physician) must have completed a Designation of Physician Form prior to sustaining an injury or illness (Form available in the Project Scientist’s office). Students/Authorized Users not employed by the University should seek care from Sutter Davis Hospital. When returning to the CRF to continue work or clean up, users must check in with the Project Scientist and provide medical consent that it is safe to do so.

### Reporting procedures

After receiving medical treatment for an injury or illness, the employee/Authorized User must report the injury or illness to his or her supervisor within 24 hours and fill out an Employee’s Claim for Workers’ Compensation Benefits Form (Form is available in the MCO’s office). After being notified by a User of an injury or illness, the supervisor must inform the campus Biosafety Officer and the Benefits and Risk Managements office by phone (752-1774) within 24 hours, and complete the UCD Employer’s Report of Occupational Injury or Illness Form (Form available in the Project Scientist’s office). An injury on Friday afternoon may be reported on the following Monday.

### Fire emergency

When fire/smoke is detected, supply fans shut off for the affected area, and exhaust fans remain on. In case of fire, leave the immediate area; be sure that other people are out. Secure organisms, if possible.

### Life-threatening emergency

Leave the building through the nearest emergency exit. If you cannot safely exit the building, call 9-1-1 immediately.

### Non life-threatening emergency

Proceed as follows:

* + Close the doors,
  + Activate the nearest fire alarm,
  + DIAL 9-1-1,
  + Leave through the showers following normal exit protocol,
  + Assemble at the southwest corner of the facility grounds and check in with the Project Scientist,
  + Contact the Project Scientist, if necessary, to obtain information on any chemicals or hazardous materials that may be in the lab (if after hours, call Project Scientist or other person on call), and
  + Update fire personnel as they arrive on the scene; be prepared to advise them of any chemicals or hazardous materials involved in the fire.

If the fire is small, attempt to extinguish it without endangering yourself or others.

* + Secure the nearest fire extinguisher (fire extinguishers at the CRF are type A-B-C) and keep yourself low, with the exit to your back, so that you have an escape route.
  + Pull the pin in the handle and aim the extinguisher at the base of the flames.
  + Squeeze the handle with short bursts while sweeping the nozzle back and forth.

If the fire becomes too large**,** *get out and close the door!* If hazardous chemicals are involved, *stay out of the area and out of the smoke!*

* + Activate the nearest fire alarm,
  + DIAL 9-1-1,
  + Secure organisms if possible,
  + Leave the immediate area; be sure that other people are out,
  + If you cannot safely exit the building, call 9-1-1 immediately,
  + Use the nearest emergency exit if the emergency is life-threatening,
  + If the emergency is not life-threatening, exit through the showers following proper protocol, and follow same procedure as above for non-life threatening emergency.

### Glass breakage

In the event of a greenhouse glass breakage, there are plexi-glass panels (of various sizes) available as temporary patch replacements. They can be secured in place with duct tape and/or temporary caulking. Also, peel and stick patch materials are available on site for small holes and cracks.

### Earthquake

In the event of an earthquake, appropriate efforts must be made to maintain or re- establish containment integrity. The following safety precautions should be observed:

* + Crawl under a table, door arch, etc., during the shaking.
  + If in the greenhouse, *leave immediately!*
  + If inside the building, remain under cover until the shaking subsides.
  + Secure organisms, if possible.
  + Evacuate the building once the shaking is over; be sure that other people are out.
  + Use the nearest emergency exit if the emergency is life-threatening.
  + If the emergency is not life-threatening, exit through the showers following proper exit protocol.
  + If you cannot safely exit the building, call 9-1-1 immediately.
  + Assemble at the southwest corner of the facility grounds; check in with the Project Scientist.
  + Report any ruptured pipes, broken utility services, or broken glass

to Facilities maintenance at 752-1655 and/or call 9-1-1 immediately. Also, contact the Project Scientist.

* + Assist injured persons in securing medical attention.
  + Project Scientist will stand by to meet and update Emergency Responders when they arrive.

### Chemical spill

When a serious chemical/hazardous material spill occurs, hold your breath, evacuate the area, and close all doors. Then, proceed as follows:

* + Call 9-1-1 to report the incident.
  + If you or someone has been splashed with the chemical, begin flushing the contaminated area immediately with water (use emergency shower and eyewash when needed). Remove contaminated clothing. Continue flushing the affected area for 15 minutes. Check for signs of irritation.
  + Notify people in the immediate area and the Project Scientist of the spill.
  + Notify EH&S of the spill at 752-1493.
  + If the spill is hazardous, more than one pint, or the spill area is larger than an 8.5” x 11” sheet of paper: evacuate the area, close the doors (do not lock), call 9-1-1 (from a campus phone) or 752-1234 from a cell phone and EH&S at 752-1493, and tell others about the spill.
  + If the spill is not hazardous, less than one pint, or the spill area is smaller than an

8.5” x 11” sheet of paper: notify the Project Scientist at 754-2104; initiate clean- up; make certain you understand the hazards involved and the proper clean-up procedure for the particular chemical spilled (consult MSDS sheet); use the spill kit; put on personal protective equipment (proper gloves, goggles, and mask if necessary).

* + Re-enter the area only after the spill is cleaned up and clearance given by Fire Department and/or EH&S personnel (in the case of a large hazardous spill) or the Project Scientist (when the spill is not hazardous).
  + If a gas, smoke, mist, vapor or other material is released in such a quantity as to endanger anyone outside your immediate area, call 9-1-1 immediately. Advise

people to stay upwind or as far away from the airborne material as possible. Remember directional airflow when opening doors.

# Appendix

### Figures and illustrations

* 1. Site
  2. Buffer area
  3. Building demarcation
  4. Schematic floor plan
  5. Mechanical cross-section

### Forms

* 1. Biological use authorization
  2. Application and permit to move live plants pests or noxious weeds:

USDA/APHIS/PPQ form 526

* 1. Application and permit to move and use live plant pests or insects or noxious weeds: CDFA/PHPPS form 66-026
  2. Application for Space
  3. User Agreement

### Acronyms

The following is a list of acronyms used in this document. AHU = Air handling unit

APHIS = Animal and Plant Health Inspection Service AU = Authorized user

CAES = College of Agricultural and Environmental Sciences CDFA = California Department of Agriculture

CFM = Cubic feet per minute CO= Containment Officer

CRF = Contained Research Facility CWS = Chilled water system

DDC = (Phoenix) direct digital controls DI = Distilled water

GMO = Genetically modified organism GPM = Gallons per minute

HEPA = High efficiency particulate air (filter) HID = High intensity discharge

HVAC = Heating, ventilation and air conditioning

K LUX = Unit of illumination; lux is equal to one lumen per square meter MCO = Manager/Containment Officer

PHPPS = Plant Health and Plant Protection Services PPQ = Plant Protection and Quarantine

PSIG = Pounds per square inch of gravity PVB = Polyvinylbutyrol

SOP = Standard operating procedure

USDA = United States Department of Agriculture VFD = Variable frequency drive