IPM ACTION PLAN

I. INTRODUCTION:

A. IPM Methods. Integrated Pest Management (IPM) is a coordinated use of pest and environmental information that uses modern pest control methods to prevent unacceptable levels of pest infestation and damage with the least possible hazard to people and the environment. This approach uses multiple methods of control, decision making processes, and risk reduction systems that are both cost effective and site specific. In contrast to single methods of control (spraying, fumigating, etc.), the IPM approach uses a combination of tactics such as sanitation, monitoring, habitat modification, and (only when needed) the judicious use of pesticides.

B. Plan Objectives. All actions reducing rodent and other pest problems at the facilities in order to prevent health hazards or structural damage must focus on two main objectives:

(1) Restricting pest populations by limiting available food, water, and harborage, and by removing animals causing problems.
(2) Making the structures as bird and rodent proof as possible while still preserving historic fabrics and aesthetic appearances.

To best achieve those objectives, the main goals of the Plan are to:

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

- Develop Action Thresholds (points where pest populations or environmental conditions indicate some control action must be taken).

- Provide rational, safe, and effective IPM alternatives for control of pests by describing the actions necessary to reduce site carrying capacity: modifications of pest habitats, exclusion of pests, and making sites incompatible for the biological needs of pests. Also provide guidance for preventing pest populations and their inherent potentials for structural damage and health hazards.

- Reduce use of pesticides and establish that acceptable applications within the facilities will occur only when necessary. When pesticides are used, only the least toxic, most effective, and most efficient formulations and application techniques will be utilized. Technique criteria will include least possible impact on persons, property, and the environment.

- Establish regularly scheduled site inspections and site monitoring to determine if Action Thresholds are exceeded, or to evaluate actions previously taken.

- Establish needs and benefits of periodic site and pest population assessments for evaluating the results of habitat modification or pesticide treatments. Establish value of written site inspection records which document pest activity levels, reported pest activity, conditions conducive to pest activity, and results of specific pest management systems.

- Develop a model Plan to serve as guide for pest control at other Client sites.

II. MAJOR PESTS - IDENTIFICATION & DESCRIPTIONS

A. Pigeons.

(1) *Description.* Typically, pigeons are medium to large sized, gray colored birds with short, colored legs, rounded head, pointed wings and fairly long fanned tail. Also have white rump, two black bars on secondary wing feathers, dark tail band, and frequently a purple head. Due to interbreeding, some pigeons are gray, white, tan, black, or of mixed colors. Female coloring is always duller than males. Pigeons glide with wings raised at an angle and bob their head when walking. They are rather sedentary birds that spend much of the day preening, sunning, and often make cooing sounds.

(2) *Distribution.* Introduced into North America during the 17th century as a food source. Now common throughout, particularly in urban environments where buildings provide abundant food, water, and nesting habitat.

(3) *Social Structure.* Pigeon flocks consist of several hundred birds, usually half of which are female. Most wild birds survive 3 to 4 years, though some female birds have been known to survive up to 15 years in urban settings. Behavior is habitual as the birds consistently nest, roost, and feed in the same locations, but daily movements may be extensive as birds will feed and water within a three mile radius of the nest.

(4) *Food.* Grains and food provided (deliberately or accidentally) by people are primary food sources, but birds also feed on garbage and other sources if primary sources are unavailable. Early morning and late afternoon hours are peak feeding periods. Each bird consumes about a pound of food per week. Even though birds can fast for several days at a time, they must have water daily. Pigeons have been known to eat mortar in brick walls to satisfy the need for lime in their diet.

(5) *Senses.* Pigeons have acute vision and much lower range (200 to 700 cps) hearing than people, but sonic repellent devices have proved ineffective. Pigeons rapidly learn to recognize individuals that feed them and navigation in restricted surroundings.

(6) *Reproduction.* Pigeons are monogamous. Females breed at 6 months and 8 to 10 days after mating, produce 1 to 2 eggs which hatch in about 18 days. Young birds are fed "pigeon milk" daily up to 10 days after birth and are weaned as adult female birds begin bringing grains and other foods to the nest. Additional eggs are laid before the first young are weaned. The male cares for the female and guards the nest. Young birds are fully grown in less than a month and leave the nest when 4 to 6 weeks old. Main breeding season are from May to June and from August to November, although some birds breed all year. Adult and young mortality rates are about 30% and 50% respectively.

(7) *Damage.*

(a) Pigeons pose the greatest pest threat to human dwellings. Droppings deface and speed up deterioration of buildings and increase routine maintenance costs. Droppings can kill vegetation, create odor problems, and, due to alkaline minerals used in some construction materials can cause structural damage.

(b) Diseases such as pigeon ornithosis, istoplasmosis and salmonella are carried and spread through droppings. Dusty accumulations may harbor airborne spores or organisms that cause a variety of fungal diseases.

(c) Droppings and nests also provide harborage for other pests such as mites, ticks, fleas and other parasitical and scavenging pests.

B. Mice. A variety of native mice are common in the area. Generally, all are small primarily nocturnal mammals which closely resemble deer mice in both appearance and habit. As deer mice are closely related to other species in the area, and for which considerable data on small mice is available, they are used as an example of the biology of other small rodents.

Description. Deer mice are medium size. The body is slender and weighs 1/2 to ¾ ounce. The body and head 2 1/2 to 3 1/2 inches. The tails are usually the length of the head and body combined, generally 5 1/2 to 7 1/2 inches. Nose is pointed and ears are prominent, about 1/2 inch long. Eyes are large. Droppings are small (up to 1/4 inch) and are rod or spindle shaped with both ends tapered. Can be confused with American cockroach droppings which are similar in size, however ends of American cockroach dropping are blunt.

(2) *Distribution.* Cactus mice, white footed mice, deer mice, and brush mice potentially inhabit the area. One or all of these species occur in the American Southwest. Deer mice occur over all of the United States, except in lower southeastern states.

(3) *Habitats.* Outside, mice may flourish in weeds, rubbish, grasslands, or in small burrows. These burrows may be beneficial for increasing soil porosity and fertility. However, burrows also enhance soil erosion and attract other pests. Deer mice commonly use burrows of other rodents. Indoors, mice live in any convenient space between walls, cabinets, furniture, ceiling voids, or stored goods areas.

(4) *Food.* Although mice prefer cereal grains and seeds; they will consume fruits, nuts, roots, insects, fungi, green vegetation, snails, and small birds, mammals and most edible materials. Food and water requirements are about 1/10 oz and 3/10 oz per day respectively. (Mice can utilize metabolic water from food). Food caches are established near nesting sites, especially during the fall.

(5) *Habits.* Deer mice do not hibernate, but do become dormant a few days at a time during severe winter weather when temperatures fall below 59 degrees F. Home range size varies from 1/3 to 4 acres, and mice commonly move 200 feet or more per day between nest and food source. Indoors, home range can be 10 to 30 feet.

(6) *Reproduction.* Nests are built at ground level under shrubs, boards, logs, tree roots, and in structures. Typically made of stems, twigs, leaves, grass roots and fibrous materials, but may be lined with fur, feathers, and shredded cloth. Usually mated pairs remain together during the breeding season and family groups remain together during winter. Populations are highly cyclic and vary seasonally, but fall populations are always the largest.

(7) *Damages.* Mice pose the greatest problem when they invade structures causing damage to walls, cabinets, furniture, stored goods, and other items. Outside, mice dig burrows, gnaw on structural

elements, and food caches attract other rodents and pests. When mice burrows are numerous, they increase soil erosion, attract predators, and other larger animals which may enlarge burrows.
Mice carry microorganisms which can contaminate foodstuffs. Harbored parasites include fleas, tapeworms, pinworms, flukes, mites, and lice. Diseases spread by mice include salmonellosis and typhoid. Deer mice are resistant to but spread Rocky Mountain spotted fever. Deer mice are the principal carrier of the Hantavirus Acute Respiratory Syndrome transmitted through contact with mice nests and dried mice feces, urine, and body fluids. Thirty percent of deer mice examined in the Four Corners area in 1993 were positive for the Hantavirus Syndrome.

C. Cockroaches. A number of species of cockroaches inhabit the Southwest United States. Four species that are immediate or immediately potential threats are the German, American, Brown Banded, and Oriental cockroaches.

(1) *German Cockroach.*

(a) Description. Cockroach is light brown with two dark longitudinal stripes at the thorax. Adults grow up to 5/8 inch long and have fully developed wings.

(b) Distribution. German cockroaches are found worldwide. They are usually imported into sites by normal deliveries of goods, or can be unwittingly imported by people coming from an infested location.

(c) Foods and Feeding. German roaches consume a wide range of materials produced, stored, consumed, discarded, or excreted by humans.

(d) Reproduction. After mating, the female carries an egg capsule that may contain between 18 to 50 eggs. After a gestation period of approximately 30 to 50 days, the female drops the capsule and the nymphs emerge.

(e) Nesting. German roaches prefer to nest in warm, moist areas such as kitchens and bathrooms. Within these areas, they tend to remain in cracks and crevices during the day and forage for food and water nocturnally. When these site are overpopulated, roach populations will move and survive in less desirable areas. When German cockroaches are observed on a regular basis during the day, a serious problem is likely to exist.

(f) Damages. Cockroaches pose a health hazard in that they acquire bacteria simply by walking over bacterial sources, and transmitting bacteria in their travels. These travels may include food handling surfaces and implements which can result in transmission of bacteria and diseases to humans. As populations multiply, the potential for damages can increase exponentially.

(2) *American Cockroach.*

(a) Description. American Cockroach is reddish brown to dark brown with light markings on the thorax. Adults are 1 1/2 to 2 inches long and have fully developed wings. Droppings closely resemble mice droppings, except ends of dropping are blunt rather than tapered.
(b) Distribution. American cockroaches are found in most of the United States from Mexico to Canada.

(c) Foods and Feeding. See Foods and Feeding for German Cockroach.

(d) Reproduction. Females retain egg capsules for several hours or days before depositing them in preferred locations. Capsule may contain up to 16 eggs. Maturity may be reached within 7 months under ideal conditions, but can take up to 1 or 2 years.

(e) Nesting. American cockroaches are conducive to breeding in a cool, damp environment. This trait makes basements, sewer lines, crawl spaces, and other damp locations ideal for infestation.

(f) Damage. See Damage for German Cockroach.

(3) *Oriental Cockroach.*

(a) Description. Cockroach is dark brown or black. Female is 1 to 1 1/2 inches long and only has rudimentary wings reduced to mere lobes. The male is shorter and has fully developed wings that do not reach to the end of the abdomen.

(b) Distribution. Cockroach is widely distributed throughout United States.

(c) Foods and Feeding. See Foods and Feeding for German Cockroach.

(d) Reproduction. Female carries egg capsules (containing up to 16 eggs)
for several days before depositing them where food is available for the nymphs. Full life cycle requires 300 to 800 days.

(e) Nesting. Like the American cockroach, Oriental cockroach prefer cool, damp locations (such as basements or sewers) and are not often seen in other than damp locations. May also be found near floor drains, and the grease traps in food preparation areas.

(f) Damage. See Damage for German Cockroach.

(4) *Brown Banded Cockroach.*

(a) Description. Cockroach is light brown with mottled reddish brown wings on the female and lighter, longer wings on the male. Wings are banded twice with brownish yellow horizontal stripes. Adults are 1/2 inch long.

(b) Distribution. Cockroach is widely distributed throughout United States.

(c) Foods and Feeding. See Foods and Feeding for German Cockroach.

(d) Reproduction. Female carries capsule 24 to 36 hours before attaching it to an object. Capsule contains up to 18 eggs. Complete development from nymph to adult occurs from 95 to 276 days.

(e) Nesting. Brown Banded roaches can live in much drier environments than German, Oriental, or American cockroaches. Brown Banded roach is a frequent flier, and because of its free movement through buildings, can be more difficult to control than the German cockroach. Among its behavior traits, remaining on the underside of upper surfaces aids its ability to avoid exposure to pesticide treatments.

D. Paper Wasps, Honey Bees.

(1) *Description.* Stinging flying insects that may be found in the area include paper wasps and honey bees.

(a) Paper wasps have long rear legs that hang down in flight. Nests are almost always placed under the eaves of buildings, in hollow fence posts, or under dead plant material where they are protected from light an weather. Nests are single combed, and are not covered by an exterior, protective paper like envelope as are hornet nests.

(b) Honey bees range in color over various shades of yellow, black, or brown. Length is about 2/3 inch with a pollen basket on the rear legs and have light colored hairs covering their body. Honey bees construct open comb nests in a site protected from the weather (holes in trees, rocks, or buildings); under rock overhangs, etc.

(2) Distribution. Nationwide.

(3) *Nests.* (a) Paper wasps build nests (can be basketball size or larger) in cool, but always protected spots beginning in late May to early June when day and night temperatures are warm. At maximum size, nests usually contain less than 250 insects, are readily visible, and usually are attached under overhangs. Paper wasps are usually not aggressive until late season (when human stinging incidents normally occur) but are always protective of the nest.

(b) In nature, honey bees nest in tree cavities and natural voids. These nests may contain between 60,000 and 80,000 bees at full strength and demonstrate elaborate social divisions in work. The more common European bee is not particularly aggressive and only protects its nest out to a distance of 10 to 20 yards. Africanized honey bees are much less selective of nest site. Other than locations used by European honey bees, Africanized bees may also place nests in holes in the ground, culverts, pipes, covered water meters, overturned flowerpot, etc.

(4) *Foods and Feeding.* Social wasps prey on small insects (mainly flies but also caterpillars and beetles) which are fed to developing larvae. Adult wasps feed on items rich in sugars or carbohydrates (flower nectar, tree sap, fruits, honeydew, etc.), and will scavenge human foods from garbage cans. Honey bees feed on flower nectar, pollen and honeydew residues, and may also be attracted to some types of human garbage.

(5) *Habits.* Life histories and habits vary. Although honey bee colonies may be long lived in one specific site, wasps construct new nests each year. Both paper wasps and honeybees will use protected holes, cracks, or crevices in structures as sites for nests.

(6) *Damages.* Stinging wasps and honey bees have not been responsible for appreciable damage to structures, however, nests located in buildings could endanger employees and the public. Stings are painful and most people are so fearful of being stung they may injure themselves trying to escape. Some people are allergic to stings and become very ill or die from even a single sting.

The recent invading Africanized honey bee is much more defensive of the nest, and will protect it out to a distance of 150 or more yards. Additionally, ten or more times as many workers will respond to

disturbances. As there is no visual difference between the European and Africanized honeybees, all bee sightings will be treated as Africanized honeybees.

Although honey bee venom is relatively toxic to man, honeybee aggressiveness is confined to nest protection and, fortunately, not too many workers respond to disturbances.

E. Scorpions.

(1) *Distribution.* A number of genera of scorpions occur in the Southwest United States and various types may be found near the facilities.

(2) *Habits.* Scorpions are nocturnal predators that search for insects and other small organisms under loose bard, objects lying on the ground, and in woodpiles and crumbling stone foundations. Scorpions are strongly attracted to free water and moisture, but heavy rains may force them to higher ground.

(3) *Damages.* Scorpions sting when crushed or contacted. Aside from two species in southern Arizona, most scorpions are relatively non-venomous with the sting being no more poisonous than a bee or a wasp. The two potentially lethal species are Centruroides sculpturatus (particularly common in Southern Arizona) and C. gertschi. Although scorpion venom is neurotoxic and can be fatal in young children, elderly, and sick, these species have only caused 64 deaths in the last twenty years. Symptoms of a toxic sting are rapid respiration, salivation, vomiting, epigastric pain, and tenderness (*but without swelling or discoloration)* at the sting site. Antivenin for C. sculpturatus is available only at larger medical institutions.

F. Centipedes.

(1) *Description.* Centipedes are multi-segmented arthropods with only one pair of legs attached to each body segment. They live under stones and debris, and feed on insects and other living organisms.

(2) *Habits.* Centipedes kill insect prey by injecting venom with modified claws located on the front pair of legs. Extended periods of dry weather often force centipedes to wander into cooler, moister habitats such as buildings.

(3) *Damages.* Although centipedes frighten people, they are not responsible for appreciable damage. Pain from the sting of a small (1 1/2 inches) green centipede is somewhat greater than an ant, than less than a bee's. Some hypersensitive people are allergic to the sting of house centipedes. The sting of a giant desert centipede can be painful, may cause the area around the sting to swell, and become feverish; but is not usually considered serious. When crawling of people, the sharp claws may puncture the skin and spread bacteria (which comes from moist habitats) and cause infection. Scratches and bites should be cleansed and treated with an antiseptic.

Spiders.

1) Description. Spiders are eight legged invertebrates with a body composed of two sections and up to eight eyes. There are hundreds of different kinds of spiders in the United States with a wide variety of sizes and colors. The only two hazardous spiders in the desert Southwest are black widow and brown recluse spiders.

(a) Black widow spider. The female adult has a shiny black abdomen and is usually has yellow-red hourglass patterned markings. Males are small with red, white, or yellow streaks. Unlike the female, males pose no hazards to people.

(b) Brown recluse spider. The brown recluse group of spiders includes various species. These spiders are more dusky tan or brown colored, and have a violin shaped pattern on the cephalothorax.

(2) *Habitats.*

(a) Black widow spider. The female is mainly nocturnal and rarely leaves the web. Prey is killed by poison secreted from glands and fangs. The venom from the female can be dangerous to humans. Web patterns are highly irregular. Black widows may be found almost anywhere inside structures where human traffic is at a minimum. Outdoors they may be found in holes, voids, rodent burrows, and behind/under rocks or materials stacked against walls.

(b) Arizona Brown spider. Normally a nocturnal outdoor spider. Due to higher moisture requirements than other spiders, brown recluses are found in moist areas of buildings or beneath objects stored on the floor or ground. Even though brown recluses construct fine, irregular webs, they commonly wander the area in search of prey.

(3) *Damages.* Most spiders are beneficial predators that prey on insects. Most are harmless to people as spider fangs cannot pierce human skin.

(a) Black widow spider. Bites are rarely fatal in strong, healthy adults, but young children and the elderly can be more vulnerable. Severity of bite depends on amount of venom injected, spider's and victim's age and health, part of body bitten, degree of immunity in victim, and treatment rendered after bite.
(b) Arizona Brown spider. Bites are rarely lethal but frequently cause severe, lasting wound and festering sores. Brown recluse bites carry a gangrene potential and grafts are sometimes required to close wounds.

Termites.

(1) *Description.* Termite are native, social insects that play an ecological role in wood decomposition. Usually, the first indication of termites is when insects swarm during spring and are mistaken for "flying ants." Termites have two pairs of wings of nearly equal size (ant wings are of different sizes), straight (as opposed to elbowed) antennae, and thick rather than "pinched" waists.

(2) *Habits.* Termites are very destructive to wood with 20% or more moisture content. Termites survive in sandy loam soil with 3 to 30% moisture (saturation point) and in sand with 1 to 20% (saturated) moisture levels. Humid enclosed areas allow for termites to construct longer shelter tubes than in drier areas. If moisture is available, termites may form secondary nests above ground. Although various types of termite may occur at the site, the following are probably the most common:

(a) Subterranean Termites. Most wide spread and destructive native termites. Subs nest underground but are always within easy reach of a wood food source. Colony may last 25 years or more. Only queen

lays eggs. Worker termites venture from nest to find wood through mud tubes that connect with the nest. Without relatively high humidity in living and feeding areas, adequate shelter and temperature, and a plentiful food source, the colony will not flourish. Even if all necessary factors are present, it takes many years before termites cause significant structural damage.

(b) Drywood Termites. Live in moderately dry wood and require no moisture or contact with the earth. Colonies are much smaller than subterranean varieties and damage is confined to much smaller areas. Drywoods do not construct mud tubes. The first indication of their presence is usually masses of sand like six sided fecal pellets approximately 1/25 inch long. These are ejected from termite galleries through round "kick holes".

(3) *Damages.* Termites are very destructive to wood having contact with moist soil. Moist or wet wood within structures can attract termites which will burrow through foundations to get at the food source.

III. LOCATIONS OF PEST PROBLEMS.

This plan is designed to cover all structures designated in the proposal.

IV. PREVIOUS TREATMENTS AND EFFECTIVENESS.

A regularly established IPM Program has existed for these facilities.

V. ACTION THRESHOLDS.

An action threshold is considered to be the size of a pest population where management action must be taken to prevent the population from reaching an Injury Level (a level where unacceptable damage or health hazard is caused). The object of an IPM program is to suppress and ultimately eradicate the pest from the structure, and if possible, prevent reintroduction of the pest into the structure. Outside of structures, the object of an IPM program is to suppress the pest population at sites from which they may invade structures or pose a threat to people.

A. Mechanical Or Physical Controls.

(1) *Mice.* Summer reproduction allows mice populations to increase 25 or more times before fall, even when allowing for expected natural mortality that removes 90% or more of the young. Although large mice populations cause considerable damage to structures and pose a health hazard, their small size and tendency to proliferate makes control difficult except in limited or enclosed areas.

When <u>any</u> mice or fresh evidence of mice activity are observed in the structures, <u>intensive trapping</u> will be employed as the means to remove the mice from the building. Trapping (by glueboards or mechanical mouse traps) will pose the least possible hazard to management, staff, and visitors. Mouse entry and exit points will be determined, and appropriate action to prevent further mouse entry will be taken.

(2) *Pigeons.* Recently some of the campuses have undertaken an exclusion programs at perching and nesting areas at some of the campuses. These previous installed programs are inspected on a regular basis.

In order to prevent attracting pigeons in the future, the occurrence of 6 pigeons that spend substantial time at the structure will warrant further control actions.

(3) *Cockroaches.* Due to the potential health hazard posed by cockroaches, an ongoing effort to deny food, water, or habitat should be instituted at the county facilities. Proper sanitation and food storage practices will be emphasized. Habitat denial options range from caulking cracks to structure modifications. If infestations are identified and located, they will be removed by non-chemical means (such as vacuums) when feasible. When any cockroaches are reported in a sensitive areas (areas where is food is handled, stored, prepared, served, or consumed; break rooms, or lounge areas) warrant control action.

(4) Wasps, Honey Bees. Wasp or honey bee nests which are located on, in, or near the structures, or nests on the Client's grounds that pose a threat to staff or public will be removed.

(5) Scorpions, Spiders. Any scorpions or spiders in the structure that pose a threat to the public and staff will be removed.

(6) Termites. Any active termite activity or damage to ruin structures will justify corrective and/or preventative actions.

B. Chemical Controls. When physical or mechanical means of pest control are inadequate and needs for control/eradication still exist, University Termite & Pest Control will advise the Management or designated Staff. If University Termite & Pest Control determines that an immediate application is necessary (pest situation poses an immediate hazard to structure or health), application will be made (in accordance with Management's Policy, Federal, State, and Local laws) and Management or designated Staff notified.

VI. INSPECTIONS AND MONITORING.

"Inspecting" in this plan implies a formal examination to reveal deficiencies or pest occurrences. "Monitoring" implies installation of a system to check pest and rodent activity. Inspections and monitoring for pests and pest damage at the facilities will be keyed around obtaining information on:

- Existence, extent, and severity of pest infestations.
- Locations of pest harborage, food, water, and activity areas.
- Reproductive and life history information of pests.
- Safest and most appropriate control strategies as based on site limitations.
- Ultimately pest proofing the structures.

A. Rodent Inspections.

Rodent populations depend on food, water, and habitat. Site provides many sources of food and water, particularly in classrooms where cereal or grain type food is kept in plastic bags, in closets that are rodent accessible. Water sources are primarily in the sink areas, although moisture from plumbing is an alternative source. Rodent monitoring will consist of placing pre-baited gluetraps in discreet areas where water is available. Traps will be checked on a routine basis, with "inspectors" placing their initials and date checked on the trap. Trapped rodents will be recorded as to where and when trapped, and used or unusable traps will be replaced.

B. Pigeon Inspections.

Pigeon populations will be monitored visually on a routine basis. All roosting/nesting areas will be checked for fresh bird activity. Structures will be inspected to note any bird activity in new areas, and ascertain areas of potential activity. Results of monitoring and inspections will be recorded in the "Quality Assurance Pest Control Log".

C. Stinging Insects.

The location, number, relative size, and aggressiveness of wasp and honey bee colonies will be monitored. Monitoring of honey bee colonies will be especially close for sudden or unusual changes in behavior that could indicate presence of "Africanized" honey bees.

D. Crawling Pests.

In order to monitor the presence of crawling pests inside the structure, "Insect Monitors" will be installed throughout the building in discreet areas where pests are most likely to travel, breed, or harbor. Installation will most likely be near water sources and areas where pest problems could start (Example: kitchen storeroom).

E. Safety.

All personnel involved in rodent trapping or monitoring and who come in close contact with rodent debris will wear personal protective equipment and follow Arizona Department of Health or Federal Centers for Disease Control (CDC) guidelines. At a minimum, personal protective equipment will include rubber gloves, coveralls, and a dust mask utilizing HEPA filters.

Prior to disturbance/removal, feces are other animal debris will be disinfected in an approved manner.

CDC guidelines for preventing possible disease transmission will be followed when persons handling traps or other items soiled by rodent debris. Traps that have captured rodents will be soaked in disinfectant and sealed in plastic bags for disposal.

F. Post Treatment Monitoring and Evaluations.

Prompt analysis of data gained after having performed pest control actions will be made to evaluate the effectiveness and efficiency of treatments and to provide guidance for future actions.

VI. MANAGEMENT ALTERNATIVES.

To best preserve resources, consistent efforts must be made to prevent damage and health hazards at the sites. In order to be effective, controls must:

- Change environmental conditions to discourage pest populations from moving onto the grounds and into the buildings.

- "Harden" structures to exclude pests.

These actions are best achieved through methods fitting each local environmental condition and pest biology.

A. Prevention and Sanitation. The most enduring and cost effective rodent control is achieved by making environments as hostile as possible without affecting operations.

It is usually necessary to reduce insect and rodent populations through appropriate lethal means both before and after habitat modification to prevent their dispersal into untreated areas and re-invasion. After insect and rodent population controls are achieved, habitat management and preventative controls usually prevent problem recurrence.

(1) *Habitat Management.* Control based on environmental cleanup and sanitation basically requires reducing or eliminating all sources of food, water, and harborage. Careful and frequent monitoring of all available resources that attract rodents is very important. To this end, the following guidelines are offered:

(a) Eliminating Food. Dispose of any human trash, garbage, or excess food that would support animals. Assure that employees/public do not accidentally or willfully feed animals. If possible, remove fresh fecal waste from larger animals, carcasses, and all fallen fruit, nuts, or other plant materials that could serve as a rodent food source. Birds that roost on walls may help support rodents through dropped food particles and feces. Discouraging bird roosts would both better protect the structures and reduce potentially available rodent foods. Best, non-lethal, most permanent results are achieved with a permanently installed behavior modification system.

(b) Eliminating Water. Encourage evaporation of surface water; prevent water infiltration; place drains in low spots that make long lasting puddles.

(c) Eliminating Harborage.

Inside and outside the structures - Clean up all possible debris, rubble, building materials, and trash which may provide harborage for insects and rodents.

Around structures and grounds - Remove, thin, or minimize weeds, grass, shrubs, or other vegetation in and around the structures; establish vegetation-free zones around buildings; trim tree or shrub limbs back from buildings, walls, and fences. Remove vegetation in ways that do not loosen/impact soil surfaces to invite pest burrowing or new plant establishment.

Once burrows are established, rodents rarely abandon them. When abandoned, burrows are promptly reoccupied by the same or another species. Plugging or filling of burrows is ineffective (and may cause

additional burrows to be opened) unless burrow occupants are first eliminated. Rodents should never be allowed to become reestablished in burrows; the longer a burrow is used, the more extensive it becomes, the more soils are disturbed, and the greater the likelihood new animals will occupy the burrow after the resident.
(2) *Pest Proofing.*

(a) Exclusion. Pest proofing means to exclude pests from possible harborage and prevent their attaining food or other resources; this is an important part of habitat management and requires barriers to keep pests from entering or moving between adjacent areas. Methods of pest proofing range from caulking small cracks and crevices with a clear silicon caulk to mesh and screen installations for appropriate areas and target pests.

(b) Repellents. Chemicals labeled by the Environmental Protection Agency (EPA) as vertebrae repellents are available for excluding pests from specific sites; however, their effectiveness is of short duration and labels may not describe a desired site. Before using repellents or pesticides, check for EPA labeling, possible fabric or resource damage, or odors noxious to people.

- Stinging insect repellents. Diluted ammonia, when used to disinfect trash cans, dumpsters, and outdoor tables is said to repel wasps and bees.

- Invertebrate repellents. A residual insecticide applied to the outside threshold of a doorway, in cracks, crevices, or voids repels most invertebrates for up to three weeks.

- Termite repellents. Treating wood with borate based materials helps prevent termite invasion.

- Behavior modification systems. Effective behavior modification systems for bird problems are available. Their high initial cost are offset by their longevity and low maintenance.

(3) *Population Reduction.* Population reduction should be used to suppress high pest populations both prior to and after environmental cleanup or improved sanitation measures. To be effective, population reduction must reduce the insect and rodent population (particularly females) by at least 85 to 98%. The process used to achieve desired immediate reduction is known as "knockdown" or "clean out".

(a) Rodent Control. Population reduction/elimination is best accomplished in the early spring before the reproduction cycle begins. Within structures this will be done by glueboard or mechanical multiple capture traps. Absolutely no rodenticides will be employed inside structures. Rodenticides may be used outside structures, but only when all safety concerns have been met. Early spring population reduction greatly decreases the numbers of adults, seasonal reproductive potentials, and lessens pressures by maturing young to find winter harborage. A variety of available poisons are available for rodent control:

Rodenticides and Fumigants. At first may seem an easy way to control rodents, however, they pose significant disadvantages:

- Rodents develop resistance to poisons.

- Poisons post hazards of secondary poisoning in non-target species (including humans and pets, especially when rodents move and store them in hidden locations).

- Many rodents are nibblers and small amounts of poison only makes them sick and/or causes aversion before they eat a lethal dose.

- If rodents die in hidden areas of a structure, decomposing bodies produce noxious odors and attract insect pests that later may infest other parts of the building

- Without additional mechanical/physical controls, poison only temporarily reduces a population; when a population rebounds, it often does so in greater number than before because of enhanced reproductive potential and available harborage.

- Fumigants are similar thought less pervasive in the environment than poisons but also pose disadvantages and hazards:

- Poisonous gasses may seep into buildings if rodent burrows near foundations are treated.

- Fumigants kill other/non-target wildlife that may be present in rodent burrows.

- Fumigants may pose hazards to applicators.

- Fumigants are not 100% effective; some animals seal up burrows behind them when detecting gasses or strange odors.

Lethal traps. Are effective, mechanical methods of rodent control and can be made relatively selective. Hazards to people and domestic animals can be kept to a minimum (by covering traps) and do not pose problems with animals dying in inaccessible voids. Effective trapping depends on placement of a large number of traps that are not feared by rodents in areas where the animals will find them (mouths of burrows, along walls). Use natural or preferred foods as bait when necessary.

Multiple capture live traps are available for both mice and larger rodents. Rodents seeking shelter or food enter traps but are unable to escape. Traps are placed in runways where activity is high (or when doors are continually left open (such as a warehouse loading dock)). While some multiple capture traps can hold up to 30 mice without being emptied, cannibalism of one rodent by another is common. University Termite and Pest Control, Inc. employees tending live-capture traps are required to wear personal protective equipment as recommended by CDC.

Glueboards are heavy duty, sticky traps that are effective for mice and rats, and pose no health hazard to humans. When placed, glueboards should be closely monitored and immediately disposed of (by disinfecting and sealing in plastic bags) when rodents are caught.

(b) Insect Control. Control or suppression of insect populations may require use of pesticides. Various types of formulations including growth regulators are available. If pesticide treatments are deemed absolutely necessary, the following types of pesticides may be used:
Baits, Dusts, Crack & Crevice Residual & Flushing Agents, Wettable Powder & Emulsifiable Concentrate Formulations, Growth Regulators, Zone Monitors, Glueboards, and other materials as required.

Labels and Material Safety Data Sheets are, as a matter of course, provided before their use, and may be found in the back of the Quality Assurance Log Reporting System.

Selection criteria for formulation and type of application includes target pest, severity of infestation, and impact of application on local conditions (i. e. keeping employee and public exposure to a minimum).

Since populations quickly rebound after any control, it is imperative that effective habitat modifications take place as soon as insects or rodents are removed. Knockdown should never be considered a long term solution to a problem, but rather a starting point to an active control problem. Following knockdown, "preventive maintenance controls" (long-term, low intensity controls designed to maintain environmental sanitation and pest/rodent proofing, and keep suppressed populations at an acceptable level) will be implemented by University Termite & Pest Control and the Client.

(c) Wasps and Honeybees. Usually there is no need to control nests located high above areas of human use. However, if controls need to be taken, nighttime or early morning is ideal as insects are not active. Various controls include:

Soapy water spray (1 part dish detergent to 4 parts water) removes the waxy coating and surface tension from an insect's cuticle and drowns it when water enters spiracles. Use a strong stream of water from a high pressure pumper to destroy combs and kill all the bees.

For bees residing within cracks and crevices on structures, treat nest interior with Delta Dust using an extendible bee pole with pump duster. Leave nest in place for 24 hours to assure any returning workers are killed. If nests have been well established over a long period of time, nest interiors may have to be entered to clean up any honey. (Honey produced by colony is kept cool by bees flapping their wings. When bees are removed, honey heats up, runs, and can pose a health hazard.

Aerial nests and combs may be destroyed with Wasp Freeze, however, Wasp-Freeze is less effective on honey bees than wasps.

After removal of nests, either clean attracting odors and pheromones from the site (using soap, ammonia, etc.), or seal off access into structure as appropriate.

VII. PLAN INTEGRATION.

A. General Guidelines.

University Termite & Pest Control will conduct IPM inspections, monitoring, and if pesticides are required, be the sole appliers of pesticides at the facilities. The Client will supplement the IPM program by designating at least 1 person to aid in program continuation. Duties and responsibilities of designated staff will encompass maintaining a "Log of Reported Pest Activity" to record pest sightings (in detail) that occurred since the last service visit, and to aid in glueboard/ insect monitor placement and monitoring.

B. Inspections and Monitoring.

University Termite & Pest Control will conduct inspections of the facilities (as a minimum) on a monthly basis. Results of University inspections and corrective actions taken during visit will be recorded on the "Quality Assured Pest Control Log". Logs will be kept in the "Quality Assurance Log Report System" logbook, filed behind the month when the inspection was performed. As stated earlier, monitoring will be accomplished using Insect Monitors and glueboards in appropriate locations.

C. Identification.

All pests observed, and areas pests observed at the facilities will be identified as closely as possible (Example: Cockroaches will identified as to type; if seen in office, area within office will be identified as specifically as possible). Records will be kept on frequencies of pest sightings, dates of sightings, and who reported sightings. Sightings will be recorded on the "Log of Reported Pest Activity" by designated employee, and "Log" will be maintained in a area accessible to the Route Manager. When pests found on the facilities cannot be properly identified, areas where pests are spotted will be monitored until specimen is trapped and identified.

D. Action Thresholds.

Based on inspection and monitoring findings, previously noted Action and Injury Thresholds will determine the need for action. University Termite & Pest Control and the Client may set or modify threshold values or preferred control methods to meet needs or management objectives.

E. Preferred Control Measures.

(1) *Rodents.* Where damage or hazards exceed Action Thresholds, the preferred control for pest rodents for within the structures will be with glueboards or multiple capture live traps of an appropriate size. Outside of structures, if necessary, a limited rodenticide program will be instituted using secure, tamper proof bait stations (with bait wired inside stations); monitoring, and recording bait consumption at regular intervals.

(2) *Birds.* If needed, an upon approval by the Client, preferred methods of control will include exclusion from roost/nesting sites, and/or installation of behavior modification systems.

(3) *Crawling Invertebrate Pests.* When Action Thresholds are met or exceeded, the preferred controls will be non chemical where possible, and chemical when absolutely necessary. Chemical controls include baits (containerized, paste, and dust formulations), crack and crevice applications, dusts, residual spot treatments, dusts, and other formulation as needed. If chemicals need to be applied, they will be applied in such a manner as to virtually eliminate human exposure to them, and primarily in the resource and reservoir sites where pests breed and harbor.

F. Sanitation and Habitat Reduction.

In conjunction with Plan objectives, all possible vegetation will be removed from around the structures or trimmed and cut as needed. This is to eliminate harborage and plants/seeds serving as insect and rodent food sources. All debris such as rocks and other non-functional items lying in or around the facility will be removed and good general area sanitation will be practices. Proper grade for adequate water drainage will be established.

G. Record Keeping.

Accurate record keeping and written instruments of communication are essential to the successful implementation and continuation of an IPM program. This will be accomplished by the "Quality Assurance Log Report System." This system consists of a logbook, which is available for an additional cost to the requesting facility, contains:

- "Log of Reported Pest Activity" on which pest sightings are reported to the University Termite & Pest Control Route Manager.
- Detailed outline of service with maps showing locations of pest control devices.
- Pest Identification Guide. To assist all personnel in pest identification.
- Tabbed filing system to allow quick access to these reports. The records become a complete service history and insure a uniformity of service.
- Labels and Material Safety Data Sheets (MSDSs) for any pesticides used.

"Quality Assured Pest Control Log" Pest Control Service, Inspection, & Sanitation Reports with recommendations to be reviewed with the Staff at the completion of each service visit. One copy of each report may also be forwarded to University Termite & Pest Control's Technical Director.

H. Employee Training.

Prerequisite training for University Termite & Pest Control personnel performing services includes at least 6 certifiable hours of annual training needed to maintain State Certification. UTPC personnel also complete "in house" IPM training programs, Bi-weekly Quality Assurance meetings, and the National Pest Management Associations' ***Quality Pro***, ***Quality Pro Schools***, and ***Green Pro***. UTPC personnel undergo at least four hours of in-house training per month covering IPM, monitoring and structural inspection methods, rodent control, pest control, entomology, familiarity with appropriate pesticides, state of the art applications techniques, safe equipment use, and proper methodologies. In house training sources include videos and informal classroom training. Appropriate Client employees could receive training on inspection methods, disease prevention, and general sanitation if so requested.