Section 2

Narrative

PAGE

Narrative

INTRODUCTION:

Overview

Critical features for future new animal facilities will be the capacity to provide for the health, safety and comfort of the human work force and to provide an environment for highly sensitive animal subjects compatible with their needs. This dictates that the work environment be devoid of unpleasant animal odors and animal allergens; aesthetically pleasing to employees and visitors; and consistent with the needs of investigators engaged in animal research. The design should be such that animal housing and animal procedures are accomplished in the Veterinary Medical Unit (VMU) away from the areas of human/patient traffic and other activities not related to animal research.

The Public Health Service Guide for the Care and Use of Laboratory Animals and the most recent regulations promulgated by the United States Department of Agriculture under the Animal Welfare Act establish criteria to be met through all phases of the design process, unless otherwise noted. The design must also be consistent with requirements of the American Association for Accreditation of Laboratory Animal Care (AAALAC).

Animal Research Trends

A continuing decline in use of dogs, cats, and primates as research subjects is probable, however the rate and extent of decline will vary depending on the nature of research at a particular VA medical center. Future animal research will require greater emphasis on precise environmental control for a smaller number of expensive microbiologically and genetically engineered rodent species.

Virtually all medical advances of the past have been based on the use of animal subjects and this will continue to be the case for the foreseeable future. AIDS research and organ transplantation will continue to have a significant impact on the need for research using laboratory animals. Animals will serve a vital role in unraveling the mysteries of maladies of the elderly, the addicted, and the mentally disturbed, as well as numerous other human health related problems.

Transgenesis is now a common investigative technique requiring special needs. Because of its genetic diversity the laboratory mouse provides a practical means for studying mammalian gene function. Due to the need to protect unique animal subjects from adverse environmental influences, housing conditions are more critical for transgenic animals and immunologically deficient rodents than for conventional research animals. The growing use of virus antibody free (VAF) animals further dictates that facility design provide rigid environmental controls.

ARCHITECTURAL ASPECTS:

Siting

Accessibility to other research laboratories, delivery of supplies and control of access by visitors are of prime concern in siting design. If possible, the animal facility should be located within or near the main hospital building but well separated from public and patient areas. Ideally, the animal facility is confined to a single floor at ground level. This is cost effective and advantageous from a user's standpoint for receipt of animals and supplies, and for waste disposal.

Environmental Requirements

The care of animals supporting high technology research requires facilities that provide precise environmental control yet are flexible to accommodate ever changing research needs. Environmental considerations most critical to an animal's well being include temperature, humidity, ventilation, light, sound, odor control, and protection from microbial and chemical contamination.

Facility design has a profound effect on the efficiency and effectiveness with which needed environmental conditions can be met. Design features deserving particular attention include:

- Room Relationships
- Heating, Ventilation, and Air Conditioning (HVAC) System
- Cage Sanitation Capability
- Interior Surfaces and Finishes
- Modularity of Design/Flexibility
- Security
- Containment/Isolation System

Flexibility

Flexibility is an important consideration in design of a Veterinary Medical Unit. As investigators leave a VA medical center and are replaced by new investigators with diverse research priorities, space needs in a VMU change. The design should permit adaptation to changing needs at minimal cost; however the provision of flexibility in itself often adds to construction costs. The initial cost of features that add flexibility must, therefore, be weighed against potential future savings.

A VA medical center must also have flexibility in adapting criteria, specifications and guides to meet projected local needs. Care must be taken that the plans for adapting to local needs are driven by the best estimates of present and future needs guided by those with expertise in construction and operation of animal facilities.

Space Planning Criteria

Space planning criteria for the Veterinary Medical Unit are addressed in VA Handbook H-08-9. It is the basis for developing all VA projects and represents a planning guide that is fully integrated with all components of health care delivery systems or subsystems. It provides the net square foot program recommended to meet the needs of a VA medical center. A significant feature of the Handbook is its flexibility in permitting the accommodation of particular requirements of specific VA research programs. The following means of increasing the efficiency of space utilization merit consideration:

- Sharing of resources, such as incinerators, with either the VA medical center or the affiliated university medical center,
- Use of portable equipment (e.g., use portable radiographic equipment rather than fixed equipment),
- Use of special equipment rather than separate rooms to meet modest barrier and containment requirements,
- Use of easily removed equipment rather than built-in animal pens,
- Use of cubicles in some portion of the animal facility,
- Combining spaces in small facilities such as the Post Operative Intensive Care Room and the Animal Surgical Preparation Room
- The use of moveable partitions in large operating rooms to accommodate special needs, and
- Contracting for services.

Room Relationships

Traffic flow patterns are determined by the spatial arrangements of functional areas within the animal facility. Personnel, equipment, and supplies should move from areas of least contamination to areas of greater contamination. Soiled cages should move from animal rooms to the "dirty" side of the cage wash area and pass through to the "clean" side. The cages then return to animal rooms with minimal opportunity for

contamination. There are two basic types of corridor systems, the single corridor system and the dual corridor system.

The 7 foot wide single corridor system is commonly used for smaller facilities and is the style usually adopted in VA animal facilities. Dual corridors are generally avoided in small to medium size facilities due to the space required by corridors in facilities with this design. The main advantage of the single corridor design is efficient use of space. The disadvantages of the single corridor are:

- Personnel, animals, cages, equipment, and supplies move in both directions, possibly leading to disruption of traffic flow;
- Contact between clean and dirty materials may result in cross contamination.

The VA design standard is the single corridor system with the appropriate contamination barriers to insure an effective facility.

The dual corridor system's main advantage is a reduction of contamination of clean equipment. The primary disadvantage of the dual corridor system is that additional circulation space is required for the same amount of functional net space. This factor is particularly significant in smaller facilities.

Receiving:

Animals and supplies should be delivered to a dedicated "clean" receiving dock. From the dock, animals are usually transported to a receiving and examination room. After examination, small animals are transferred from shipping containers to clean cages and taken either to a quarantine room or to an animal room equipped with a containment housing system. If dogs are used, the receiving and examination room may provide facilities for bathing. Following initial examination, large animals should be placed in a nearby quarantine room, unless they have undergone quarantine elsewhere.

Disposal:

The necropsy room, carcass storage room, and incinerator room should be readily accessible to the "soiled dock" area. Separate clean and soiled docks are desirable, and should be isolated from public view. In ideal situations, the dock should be used mainly for the VMU to prevent contamination of supplies destined for other areas within the medical center. Waste from other hospital areas must not pass through the VMU. Equally unacceptable is transport of animals and supplies through other hospital areas during transportation to or from a dock.

Elevators:

Animal facilities should be confined to a single floor at grade level. If a multilevel design or location above or below ground is unavoidable, separate dedicated elevators for clean and soiled material located in a single bay are desirable in a dual corridor system. The elevator used for transporting clean materials should be located near the clean side of the cage wash area while the elevator used for transporting soiled material should be in close proximity to the soiled side.

Adjacencies:

Appropriate relationships and adjacencies are essential to permit a smooth flow of personnel, equipment, supplies, and animals and to provide a setting conducive to sound animal husbandry practices. Refer to Section 3, Room Relationship Diagrams for examples of suggested room relationships, recognizing however, that the needs of individual programs may dictate deviations from the diagrams.

Administrative offices are best located near the VMU entrance used by personnel (internal entrance if connected to the hospital). This places the VMU supervisor and veterinarian in a position to observe the movement of personnel and equipment into and out of the VMU. From this location, visitors may have access to the administrative area without entering the animal housing and service areas. The lounge used by the VMU staff should also be located in this vicinity. The lounge used by the VMU staff should also be located in this vicinity.

The surgical suite should be located away from high traffic corridors and potential sources of contamination such as the entrance to the cage sanitation area, necropsy and waste

storage. Animals should enter the surgical suite from a surgical preparation area while surgeons and surgical assistants should enter through a surgical scrub and gown room. A post-operative intensive care room should be near the operating room so that animals may be held there before they return to an animal room.

Unless separate lockers are provided for the surgical suite, the lockers, lounge, toilets and showers for the VMU staff should be located in the vicinity of the surgical suite. The radiographic suite should also be located convenient to the surgical suite. Clustering the administrative offices, personnel space (lockers, lounge, toilets, and showers), surgical suite and radiographic suite provides the opportunity for oversight by the VMU staff and administration, convenience for users, and isolation from areas of potential contamination.

Large animal rooms may be noisy, therefore they should be distant from quieter areas such as small animal rooms, administrative offices and the lounge. Procedural laboratories should be placed near rooms used for housing small animals and in some instances procedural space may be located within cubicle rooms. The dry feed and bedding storage space should be near the receiving dock and preferably close to the animal rooms as well. The cage sanitation area should be convenient to the animal rooms but distant from administrative offices and personnel space.

If the facility includes a barrier suite and/or biohazard areas (chemical/radioisotope suite and/or infectious disease suite), these should be distant from high traffic corridors.

Areas in which contaminated material such as soiled bedding and animal carcasses are received or stored should be located near the soiled dock area. Such areas include necropsy, the dirty side of the cage wash room, carcass and waste storage, and the incinerator room.

Safety, Security, and Environmental Monitoring

The need for careful attention to physical security of VMUs is a recognized reality. In the past, access to an animal facility was achieved primarily by means of keys. However, other technologies such as electronic, keyless and newer technologies for biological identification (e.g. voice identifying, fingerprint ID) are clearly superior. The number of doors opening into an animal facility should be the minimum necessary for proper function and safety. Elevators should be equipped with lockout systems to control access. Ground level windows opening into the animal facility should be avoided or if provided, designed in a manner to prevent forcible entry. Apart from security concerns, outside windows in animal rooms are to be avoided due to interference in controlling lighting cycles and temperature. Intrusion alarms, television surveillance, and exterior lighting add to the level of physical security. In addition to perimeter security, provisions should be made for restriction of access to rooms. Interior access should be limited to authorized personnel via keypads or other devices. Communication within the facility may take the form of an intercom system and use of walkie-talkies. Telephones should be located at intervals in the corridor. Means of notifying VMU personnel when animals and supplies arrive at the dock should be provided. Physical security requirements and options are described in VA Handbook H-08-3.

Environmental monitoring is essential in contemporary animal research settings. Consideration should be given to combining the security system and the environmental monitoring system. Ideally, temperature, humidity, air flow, light cycles, and water leakage from automatic watering devices are monitored and recorded continuously. An alarm should be activated when the temperature rises above or falls below a predetermined point. The alarms should be connected to a central control such as the Security Office or Engineering Control Center of the VAMC in order that malfunctions will be detected during off-duty hours of animal facility personnel.

The sound of conventional fire alarms, even when confined to corridors, may be stressful to animals and should be avoided. Use of alarms that produce a pure tone alternating between 430 and 470 Hz, so as to be easily heard by humans with no adverse

effect on animals is recommended. The VA requires fire sprinklers in all areas including animal rooms.

ENGINEERING CONSIDERATIONS:

HVAC

An adequate heating, ventilating and air conditioning (HVAC) system is a critical element in VMU design and requires careful evaluation. The mechanical engineer should coordinate with the architect and equipment designers to accommodate laboratory equipment specified for the project. Any request for deviation from HVAC design criteria must be approved by VA and occur no later than the design development stage. The following represents the highlights of the mechanical systems design for the animal research facilities. Refer to the VA HVAC Design Manual for further design requirements.

HVAC System:

A dedicated air handling unit should be provided to serve the following areas; however, consolidation of the areas/units for small facilities may be allowed subject to VA approval:

a. Animal Housing Areas
b. Animal Procedural and Administration Areas
c. Animal Surgical Area

Each air handling unit will operate 24 hours a day and should use 100% outside air. Exhaust grilles for animal housing areas should be located 7 inches above the floor level.

Each room should have an individual room temperature control. **All animal room reheat coil hot water or steam valves MUST be of the FAIL OFF variety, rather than the FAIL ON type.**

Utilities:

Steam for heating and humidification is are typically provided from the central boiler plant. Cooling is accomplished by providing a dedicated chiller to serve the VMU. If the facility is equipped with a central chilled water plant, the dedicated chiller is cross-connected with the central plant to allow the central plant to serve as the back-up.

Emergency Power:

The complete mechanical system, including the dedicated chiller, should be connected to the emergency electrical power system to ensure a continuous electrical supply in the event of a power failure. Emergency power is required to operate the mechanical system and thus maintain acceptable temperature and adequate ventilation in the animal rooms during power failures.

Noise Levels:

Animals and research equipment are sensitive to excessive noise and vibrations. The noise level of NC 40 is recommended as the maximum permissible limit in the occupied spaces. Sound attenuation and vibration isolators for the mechanical system should be provided where required. The masonry cavity of interior walls may be filled with fiberglass inserts where sound deadening is needed.

Design Requirements:

Design should consider future requirements. Animal facility HVAC systems should be independent of all other mechanical systems in the building. Mechanical design in animal rooms shall accommodate ventilated rack systems, individually ventilated caging units, or site built or prefab cubicle units; depending on the system specified. The mechanical equipment should be located outside the VMU to avoid disturbances from noise and vibration and to permit servicing the system without entering the facility. The information listed on the Design Standards of this document's Sections 4, 5, 6, and 7 must be verified for each project.

Electrical

Lighting in animal rooms should be uniform using "enclosed waterproofed" surface mounted fluorescent fixtures. The light-dark cycles of the animal rooms should be individually and automatically controlled to assure consistency. Lighting should be provided with at least two (2) levels, one for the employees and a reduced level for the animals.

Power outlets in animal rooms, cage wash, and other areas where water is used in cleaning should be ground fault interrupter type with waterproof covers. Emergency power should be provided to meet the Life Safety requirements in addition to power the HVAC system and selected lighting and equipment.

Conduits should be installed in operating rooms and procedural lab areas for future use of computers. Refer to the Electrical Design Manual and H-08-04, Vol. 4, for additional information.

Floor Drains

Large animal rooms require special floor drains. Floor drains for these rooms should have a minimum 4 inch diameter outlet and be covered by a 12 inch diameter grid or strainer. A drain trough may be positioned along the wall at the rear or behind pens or cages. Floors should slope toward the drain troughs, and the drain troughs slope toward the drains, at a rate of no less than 1/8 inch per foot and no more than 1/4 inch per foot. Manual flush rim drains shall be included in large animal rooms to provide for periodic flushing of waste into the drain. While rooms housing rodents, rabbits, and other small animals do not require drains, drains in these rooms may add flexibility and be useful if large quantities of water are to be used in cleaning. If drains are installed in small animal rooms or cubicles, then they must be equipped with sealable drain covers. Flushing racks can use open floor drains.

CONCERNS SPECIFIC TO VETERINARY MEDICAL UNITS:

Equipment

All casework in procedural rooms should be installed so as to leave the floors unobstructed. Modular cabinet systems offering flexibility are a suggested alternative to fixed casework in procedural rooms.

Fixed equipment may be purchased and installed by the contractor (CC), purchased by the user and installed by VA or the contractor (CF), or purchased and installed by the user (VV). If purchased by the contractor, specifications must be clearly described in the plans. Certain items are obtained as "initial portable equipment" or "activation equipment".

A veterinarian who is a laboratory animal specialist (Veterinary Medical Officer or Veterinary Medical Consultant) and knowledgeable about equipment styles and types that best meet the needs of the facility should guide the selection of equipment. In purchasing equipment not listed in GSA catalogs, specifications must be sufficiently detailed to assure acquisition of the quality intended.

The selection of equipment should proceed along with facility design in order that utility and space requirements are considered during design development. Careful attention must be given to ensure that the location and capacity of electric outlets, water and steam supply, drains, vacuum, anesthetic gas outlets, exhaust ducts and other utilities are compatible with equipment to be installed.

Refer to H-08-5, VA Equipment Guide List and H-08-6, VA Equipment Symbol List.

CONSTRUCTION NOTE: *It is imperative that the equipment selected and installed by the user conforms to the voltage and phase supplied during construction. Thus, the A/E should note on the construction documents the voltage and phase at each special outlet to insure compatibility with the equipment to be used by the VMU.*

Sanitation Equipment

Frequent and thorough cleaning of cages and room surfaces is essential to prevent noxious odors and avoid dissemination of microbial agents.

Animal room walls and ceilings are typically scrubbed manually with detergent/disinfectant compounds or sprayed with water using either line pressure or high pressure sprayers. If vacuum cleaners are used, they must be equipped with HEPA filters to avoid spreading infectious material throughout the facility. Floors may be damp mopped or cleaned by means of an electric floor scrubber or high pressure sprayer. Hose bibbs are needed if running water is to be used in cleaning room surfaces or fixed equipment.

Fixed equipment such as pens and large cages are routinely cleaned in place using sanitizing chemicals. The animals must be removed from the primary enclosure (cage) before cleaning. Large cages may be cleaned in place on a daily basis, then transported to a mechanical cage washer periodically for more thorough sanitizing. A dry system may be employed for some species such as domestic farm animals. With a dry system, the pen floor is covered with absorbent bedding materials. Periodically, animals and all bedding are removed and pen surfaces are thoroughly sanitized. Use of a dry system imposes additional spatial requirements for bedding storage and disposal.

Portable cages are transported to a mechanical cage washer for cleaning as needed. Soiled cages are taken to the cage wash room after transferring animals to a clean cage. The soiled bedding is dumped into a soiled bedding receptacle in the cage wash room. Heavy soil is rinsed from the cages in a prewash area before placing them in the cage washer.

Occasionally special flushing racks are used for rodents and rabbits. When flush racks are used, special plumbing will be required. If flushing rack systems are **planned**, provisions for preventing excess humidity in the animal rooms are essential.

An autoclave is necessary for all VMUs; however the chamber size needed will depend to some extent on characteristics of the research program. If survival surgery is contemplated, an autoclave is required to sterilize surgical instruments. Use of the steam autoclave in the operating suite should be confined to instruments and other surgical items. In addition to an autoclave in the surgical suite, a separate autoclave with a chamber size adequate to accommodate large rodent cages is usually needed. The additional autoclave is essential when immunodeficient animals are present, or when design includes a barrier suite. In these instances, feed, bedding, water, and cages, will ordinarily be autoclaved. An autoclave is also essential when infectious agents are used in animal studies. Steam autoclaves are suitable for most applications.

Mechanical Cage Washers

A mechanical cage washer is virtually the "heart" of a VMU and the washer type(s) and location require careful consideration. Mechanical cage washers are of three styles: cabinet type, cage and rack type, and tunnel type. Cabinet style washers are essentially oversized glassware washers and are not recommended in VA animal facilities unless substituted for a bottle washer.

A cage and rack style washer features a chamber of sufficient size to accommodate one or more cage racks or large cages. Cage rack washers should be mounted in a pit to prevent the need for ramps with the danger of attendant falls, back injuries and scalding water. Tunnel style washers transport items on a continuously moving conveyer through a pre-rinse, detergent wash, rinse, final freshwater rinse, and drying. These

units are suited for sanitizing water bottles, small cages, and a variety of other small equipment items. In those cases where a tunnel washer is selected, a pass through bottle washer is usually not needed.

The cage and rack style washer is provided in facilities up to 14,000 NSF. Facilities exceeding 14,000 NSF are equipped with both a cage and rack washer and a tunnel style washer. Regardless of the washer style, cages should move in a single direction, entering through the soiled side of the cage wash room and exiting through the clean side.

Cubicles

Cubicles are essentially rooms within a room. Typically, supply air delivered through ceiling diffusers located in the center of the room passes to the floor and under the cubicle door and is then exhausted through registers in the ceiling of the cubicle. The direction of air flow may be reversed in some systems. A higher level of protection is attained through the provision of individual supply and exhaust in each cubicle. The air may pass through a HEPA (High Efficiency Particle Arrester) filter at the supply end, the exhaust end, or both. Cubicles offer the advantage of isolating small segments of the animal population within a room permitting the housing of multiple species in a single room, thereby providing more efficient use of space. They are particularly useful for quarantine of incoming animals. Cubicles may preclude the need for a separate quarantine room for small animals. Cubicles may also promote the containment of hazardous substances used in animal studies, provide an added degree of security against mix-ups for the user, and reduce odors and allergens. Cubicle installation can be of the prefabricated type that precludes masonry structures and can be readily disassembled to convert the room to other uses.

Barriers and Containment Areas

Specialized areas may be required to keep infectious agents away from animals (Barrier Suite) or for preventing hazardous materials such as infectious agents, radioisotopes, toxins or carcinogens from escaping to the outside (Biohazard Suite). Species housed in such areas are typically rodents.

Barrier Suites are used for protection of specific pathogen free (SPF) or viral antibody free (VAF) rodents, immunodeficient animals, or for particularly valuable animals such as transgenics. These suites require restricted personnel access, dress codes and means of decontaminating (autoclaving) supplies entering the area. Air pressure within a Barrier Suite should be positive relative to the corridor and separated from the corridor by an air lock.

Prevention of contamination by radioisotopes and hazardous chemicals and infectious agents of low pathogenicity may be attained by controlled access, protective clothing, and performance of procedures under a properly designed biological safety cabinet or fume hood. Work with microbial agents classified by the Center for Disease Control (CDC) as Biosafety Level 3 (BSL 3) or higher requires special engineering features that protect the laboratory worker, the community, and the environment. The unique features that distinguish the BSL 3 facility or Infectious Disease Suite from a basic laboratory are the provisions for access control and a specialized ventilation system. The CDC handbook Biosafety in Microbiological and Biomedical Laboratories should be consulted in planning a BSL 3 facility. Air pressure in an Infectious Disease Suite should be negative relative to the corridor. Requirements for a maximum containment laboratory (Biosafety Level 4) are extremely unlikely at a VA medical center. Means of containment using cubicles, ventilated cages or cage racks and microisolator units are described below.

With conventional housing, animals are maintained in primary enclosures (cages, pens) that do not provide protection from contaminants that may be present in the room environment. Some racks and caging systems are designed to reduce airborne contaminants in the animals' environment. Systems used for this purpose include microisolator cages, ventilated racks, individually

ventilated cages, laminar flow units, and racks enclosed in heavy plastic sheeting. Some barrier systems require special ventilation and other engineering features.

Large Animal Housing

Dogs, cats, primates and domestic farm animals are considered "large animals" in a biomedical research setting. Dogs are not routinely housed in traditional cages, but rather in most cases are kept in runs or pens that are large enough to permit exercise. If properly designed, these pens are also suitable for housing most domestic farm species used in biomedical research laboratories.

Primates must be maintained under conditions conducive to their "psychological well being". These animals are sometimes housed in compatible pairs or groups as a means of promoting psychological well-being. Pair or group housing requires cages of a larger size than used for individually housed animals and this must be taken into consideration when planning door sizes, animal room configuration, and cage wash areas.

Rooms housing dogs or primates are typically noisy, therefore, if possible they should be separated by a sound barrier from administrative offices and rooms in which rodents and rabbits are housed.

Interior Doors and Hardware

Hospital type door jambs should be used throughout interior spaces with door stops located 8 inches from the floor to facilitate mopping. Doors in corridors to offices and in heavy traffic areas should have windows of shatter proof glass. They should fit the frames tightly, be mounted without a sill and be equipped with self sealing, externally mounted sweep strips if the space between the closed door and floor exceeds 3/16 inch. Doors to animal rooms should not be less than 84 inches high by 42 inches wide, and preferably 48 inches wide, to facilitate moving of cages and other equipment. Animal room doors throughout the VMU should be metal or metal clad, with small viewing windows. Interior doors should have full width kick plates and bumper guards at a height that protects them against moveable equipment. Doors should be lockable, self closing and master keyed to the station or computer controlled. Most should have closers with hold open devices. The door handles should be flush mounted or recessed. Handicapped type door handles instead of knobs are useful in animal room areas to facilitate easy opening. Automatic openers on doors to the cage wash room facilitate the movement of equipment.

Interior Finishes

Interior finishes of animal facilities must be smooth, impermeable to moisture, and capable of withstanding the impact of animal cage racks and other equipment. Concrete Masonry Unit walls should have flush joints with a 1/8-inch thick portland cement plaster skim coat finish and sealed with epoxy paint. Bumper rails or curbing are needed to prevent wall damage in animal housing rooms and corridors. Bases of corridors and animal rooms should be coved to allow for ease of cleaning. Walls of animal rooms and the cage wash area must withstand periodic washing with detergents, disinfectants and water under high pressure. Rooms housing dogs, swine, and primates are subject to particularly harsh treatment that may include high pressure washing and at times steam cleaning. The soiled side of the cage wash room must tolerate the most extreme conditions of steam, heat, large amounts of water, strong detergents, disinfectants, acids and heavy traffic.

Places for harborage or entry of insects and vermin must be eliminated by sealing all junctions and penetrations with a caulking material to which paint will bond. All pipes and ducts should be furred or placed above the ceiling. Ceilings in animal areas should be smooth, moisture-proof, and free of imperfect junctions. Ceilings of portland cement plaster should be sealed and finished with epoxy or comparable paint. Ceilings constructed of absorbent material are unacceptable. Light fixtures should be waterproof, surface mounted, and vermin

proof. Dust and moisture resistant fixtures must be used where humid conditions are present such as cage wash and autoclave areas. Air conditioning diffusers should also be tight-fitting with joints sealed. Walls should be concrete masonry units finished flush with cementitious block filler.

All ceilings and walls should be painted with epoxy paint. Walls and ceilings should be off-white. Floors should be darker than walls but still relatively light in color. Fixed equipment, such as sinks, counters and shelves should either be sealed tight to walls and floors or moved out a minimum of 2 inches to facilitate cleaning. Floors and bases of animal areas should be non-skid epoxy resin types with thicknesses and mixes varying with traffic conditions. Metal surfaces in the cage wash area should be stainless steel. A vapor barrier on the unexposed side of portland cement plaster (PCP) ceiling may be beneficial. A PCP ceiling with access panels is required to cover exposed pipes and ducts. Interior materials must be easily maintained and cleaned in order that contaminants are readily removed. Refer to H-08-14, Room Finish, Door, and Hardware Schedule.

COMMUNICATION:

The single most frequent source of user dissatisfaction during both the design and construction phases is failure of communication and interaction among parties with an interest in and responsibility for the project. The Office of Construction Management selects the Architectural Engineer (A/E) with VA medical center representation on the Selection Board. The A/E bases design on VA criteria. Costs are fixed at the end of design development, therefore, extensive changes must be avoided beyond this point. Plans should be reviewed by the local Veterinary Medical Officer or Veterinary Medical Consultant, Administrative Officer, Veterinary Medical Unit Supervisor and Associate Chief of Staff for Research and Development and the Chief Veterinary Medical Officer, VA Central Office during the design phases. In each instance, the reviewers must thoroughly examine the plans. Planning changes and design errors must be addressed as early as possible to avoid costly change orders during construction.

The Office of Construction Management at the VA Central Office assigns a Resident Engineer (RE) to a project prior to beginning construction. The RE has responsibility for assuring that construction proceeds on schedule, stays within the budgeted cost and follows plans and specifications bid on by the contractor. Interaction between the RE and representatives of the users is critical. The Project Coordinator (PC), who may be either the Chief of the VA Medical Center Engineering Service or another individual designated by the VA Medical Center Director will have frequent contact with the RE. During construction, the Veterinary Medical Officer or Consultant, the Administrative Officer, and the Veterinary Medical Unit Supervisor should be afforded the opportunity of touring the construction site at approximately monthly intervals.