

*Animal Handling in Containment*  
*Safety, Security, Sensitivity*

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**National Centre for Foreign Animal Disease**

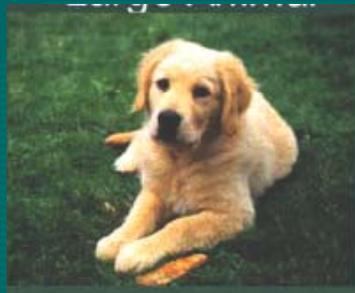
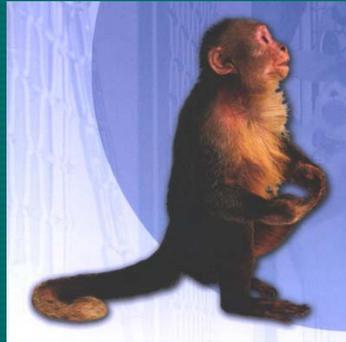
**Winnipeg, Manitoba, Canada**

# Animals In Containment

## Whitetail Deer



# Animal Species Usage In Laboratories Vary Greatly With “Purpose” Intended



# Animals In Laboratories

All Shapes -- All sizes -- All Species



# Wildlife Species In Laboratories

## Avian – Mammalian – Reptilian - Aquatic



# Animal Use In Laboratories

## The Public Perception

- The “Question” that always comes to mind is: WHY ??
- Why -- do we use animals in laboratories ???
- Why -- can the same results not be achieved by using other methods ???
- Why -- is there a “public outcry” surrounding animal use in laboratories ???
- Why -- are abattoirs viewed as “acceptable” by the general public ???

# Animal Use in Laboratories

## “The General Public Perception”

- These are long-standing rhetorical questions

There are many formidable “moral”, “ethical” and “philosophical” issues surrounding the use of any animal in a laboratory setting

The Answer is :

“That there is -- NO -- quick and simple answer”

Explanations to the public and the media **MUST** :

- Stress the “safety”, “security” & “sensitivity” of any animal use
- Be forthright, open, completely transparent, and sincere
- Stress the “positives” – vaccine development, monoclonal abs, etc

# Working With Animals in a Laboratory Setting

A “Controlled “ Process -- In A “Controlled” Environment

1. Regulations -- cover the use of animals in laboratories

Note: regulations are NOT universally equal -- (Int'l)

- 2 Lab Animals – the species used - can vary GREATLY

The critical first step -- Assess the Risk ???

– (for handlers, and animals, or both )

3. Functions of a Animal Holding Facility

Facility design and equipment design

-- can, and do, -- affect both “function” and “safety”

5. Purpose of Animal usage:

diagnostics, research, teaching / training

# Animal Use Regulations

## Variations Across the Globe

- **Canada**

- Animal use is governed locally by the facility's -- Animal Care and Use Committee.
- ( CSCHAH Committee – researchers, veterinarians, technicians, lay members )
- Review every animal use project – purpose, humane treatment, animal welfare,
- -- reduction of number possibilities, -- question any alternatives available

- **Other Countries**

- Scientist may be licensed to perform only specific procedures
- A complete outline of the experiment must be submitted for review.
- **Research “individuals ” – have a varied educational background**
- **Int'l requirements differ greatly:**
  - -- what is permitted
  - -- how specific animal related procedures are carried out.
  - -- animal procurement policies
  - -- end points and euthanasia methods

# Animal Regulations

## Jurisdictional Variations

**Federal laws** -- applies nationwide – **Criminal Code of Canada**

**Provincial Law** – province specific “**Animal Care Act**” (Manitoba)

Outlines the requirements for “a person who has ownership, possession or control of an animal”

**Municipal Laws:** can set local standards, and can enforce by-laws within the boundaries of the Municipality ( or city )

### **Note:**

**Federal Institutions:** -- are exempt from Provincial and Municipal animal related laws and by-laws

**Federal facilities try to comply with existing local laws.**

# Animal Containment Facilities

## Design Constraints

### 1. The existing regulations affect:

- Design -- of the animal holding facility
- Animal related procedures -- how, where, and what
- Bio-safety concerns – how these are to be addressed
- ( safety first – for handlers and animals alike )

### 2. Animal containment facilities are governed by: laws, regulations, guidelines and local rules

- Examples:**
1. Guidelines for Laboratory Animal Care Facilities
  2. Containment Standards for Veterinary Facilities
  3. Laboratory Biosafety Guidelines
  4. Guide To The Care And Use Of Experimental Animals

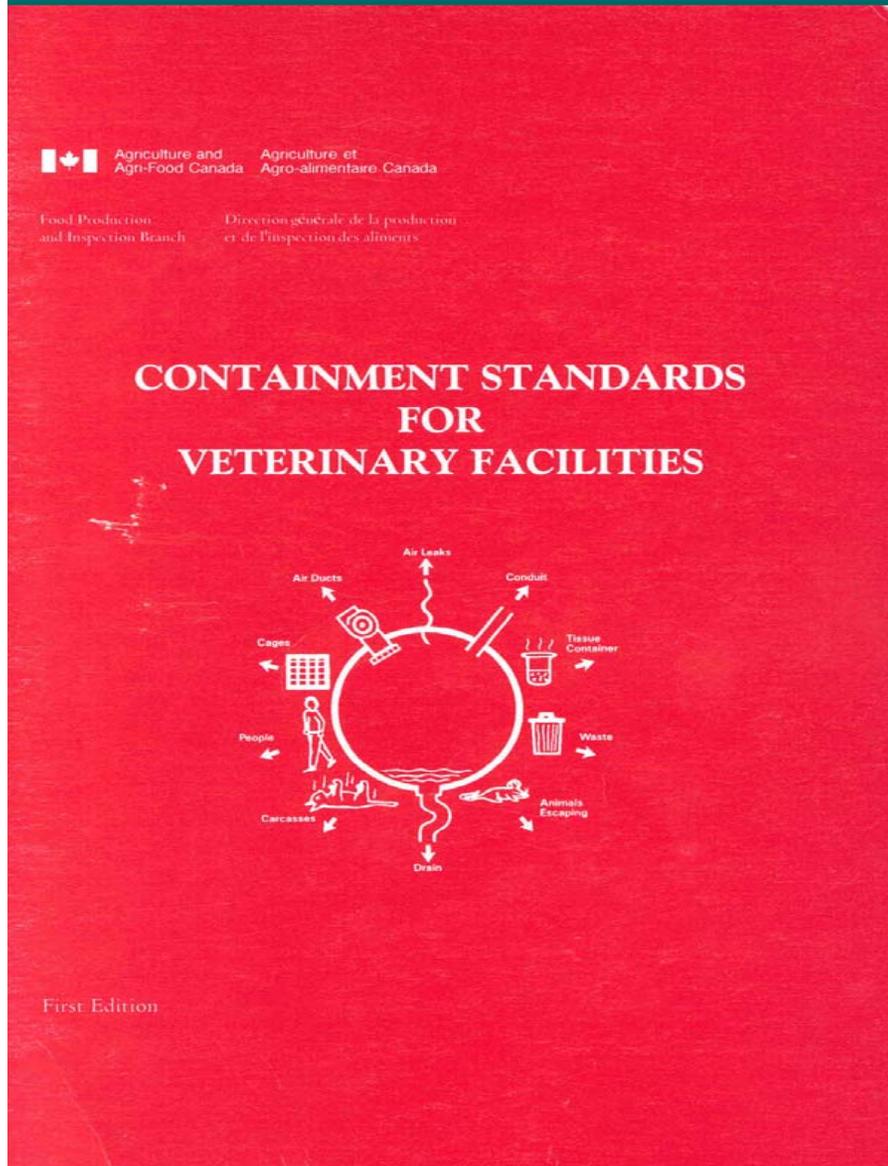
# Animal Containment Facilities

## Design Dictates Function

- Containment -- inclusion - exclusion -- or both.
- Facility design -- to a large extent dictates function.
- -- how animals are housed, handled, sampled, medicated, and waste decontamination and finally disposal of all materials
- -- which species, and size of animal, can be safely -
- housed, handled, sampled, treated, etc

# Examples of Regulatory Materials

## Federal – Provincial – Municipal



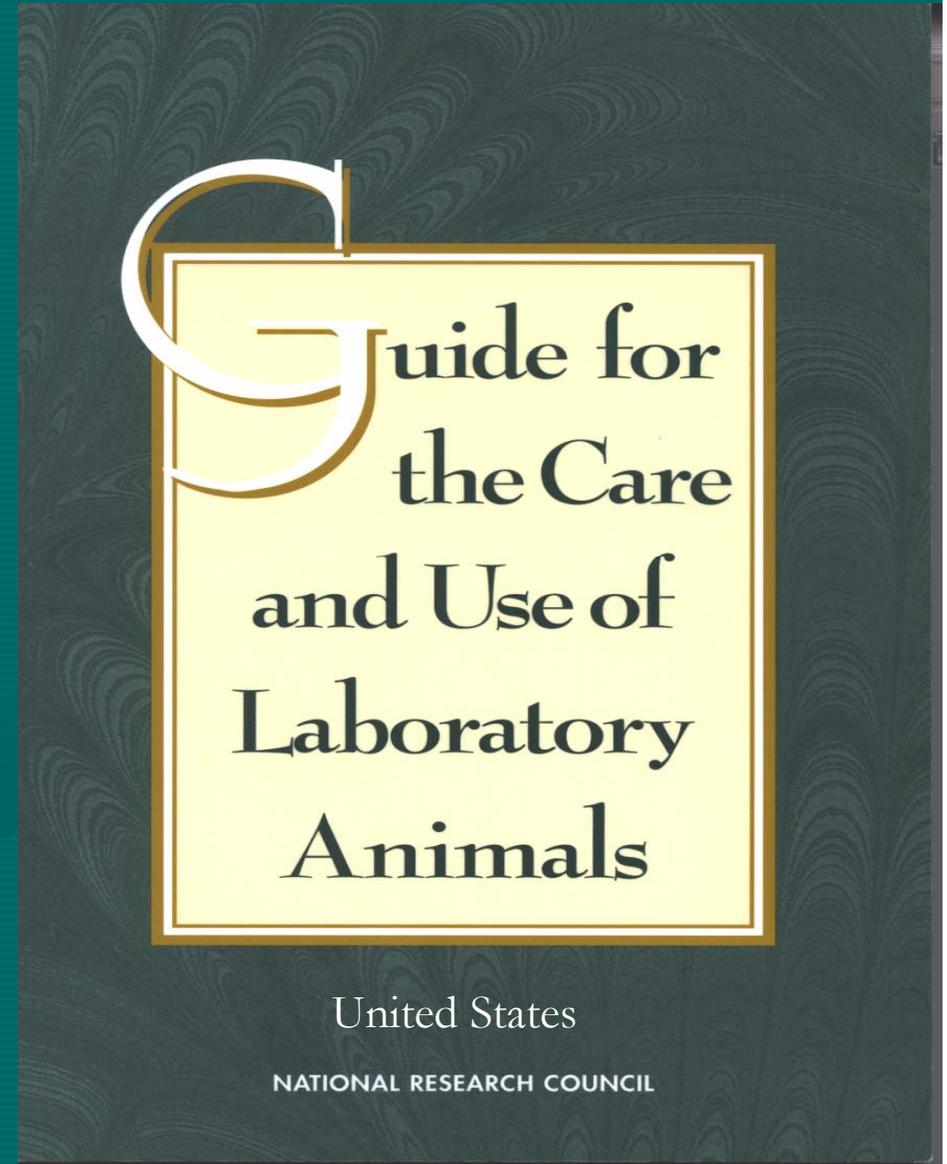
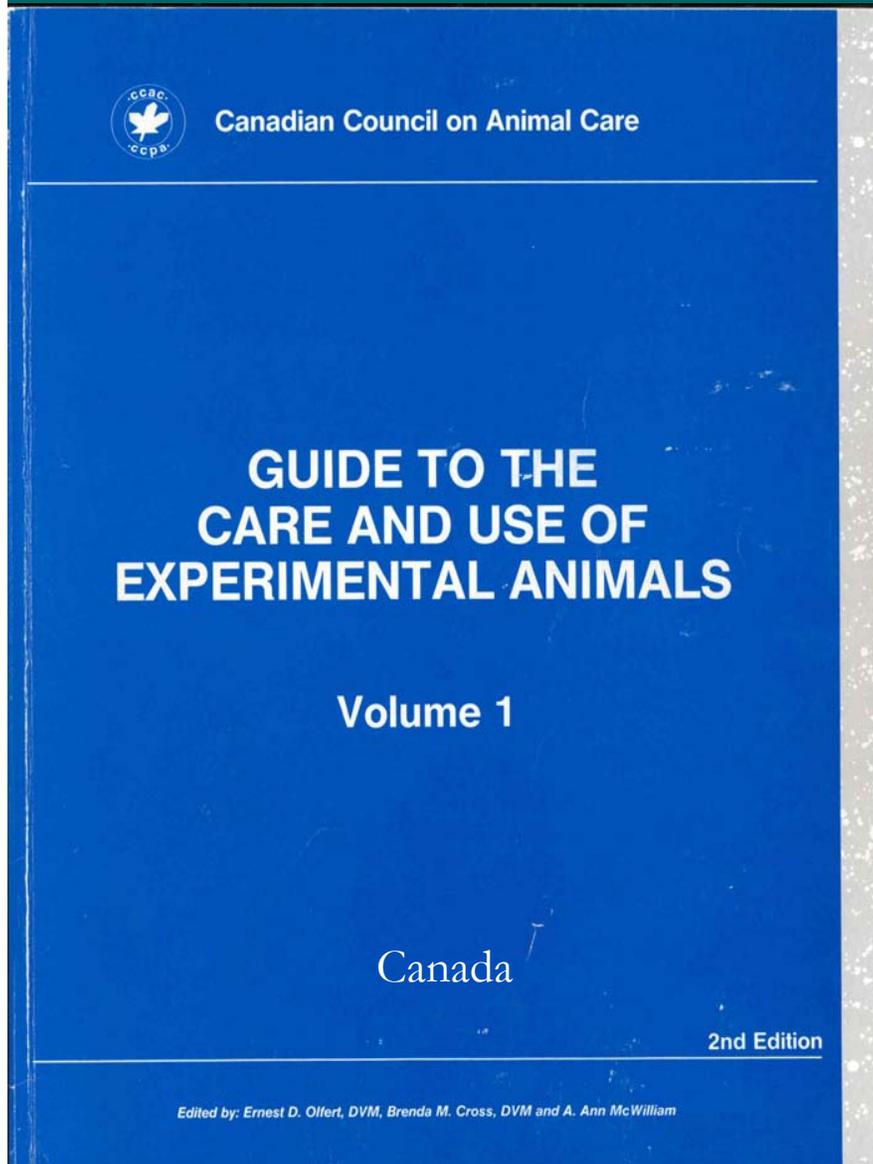
Canadian Council on Animal Care



***guidelines on:***  
***laboratory animal***  
***facilities —***  
***characteristics,***  
***design and***  
***development***

# Examples of Regulatory Materials

## International Requirements Vary Greatly



# Animal Facility Function

## Environment of an Animal Cubicles

- **Wall Finish – Seamless – all penetrations sealed & tested**
- **Temperature – should be controlled within  $\pm 1$  degree C ( species specific )**
- **Humidity – 40 to 60% controlled to  $\pm 5\%$**
- **Lighting 12/12 325 lux 1 meter off the floor in the centre of the room**

# Animal Facility Function

## Environment of an Animal Cubicles

- 100% fresh air
- Filtered air must operate continuously 24/7 – 15-20 air exchanges per hour
- Appropriate differential pressure (directional air flow)
- 75/25 lux intensity lighting
- Each room controlled separately
- Sound dampening may be necessary -- animal sensitivities

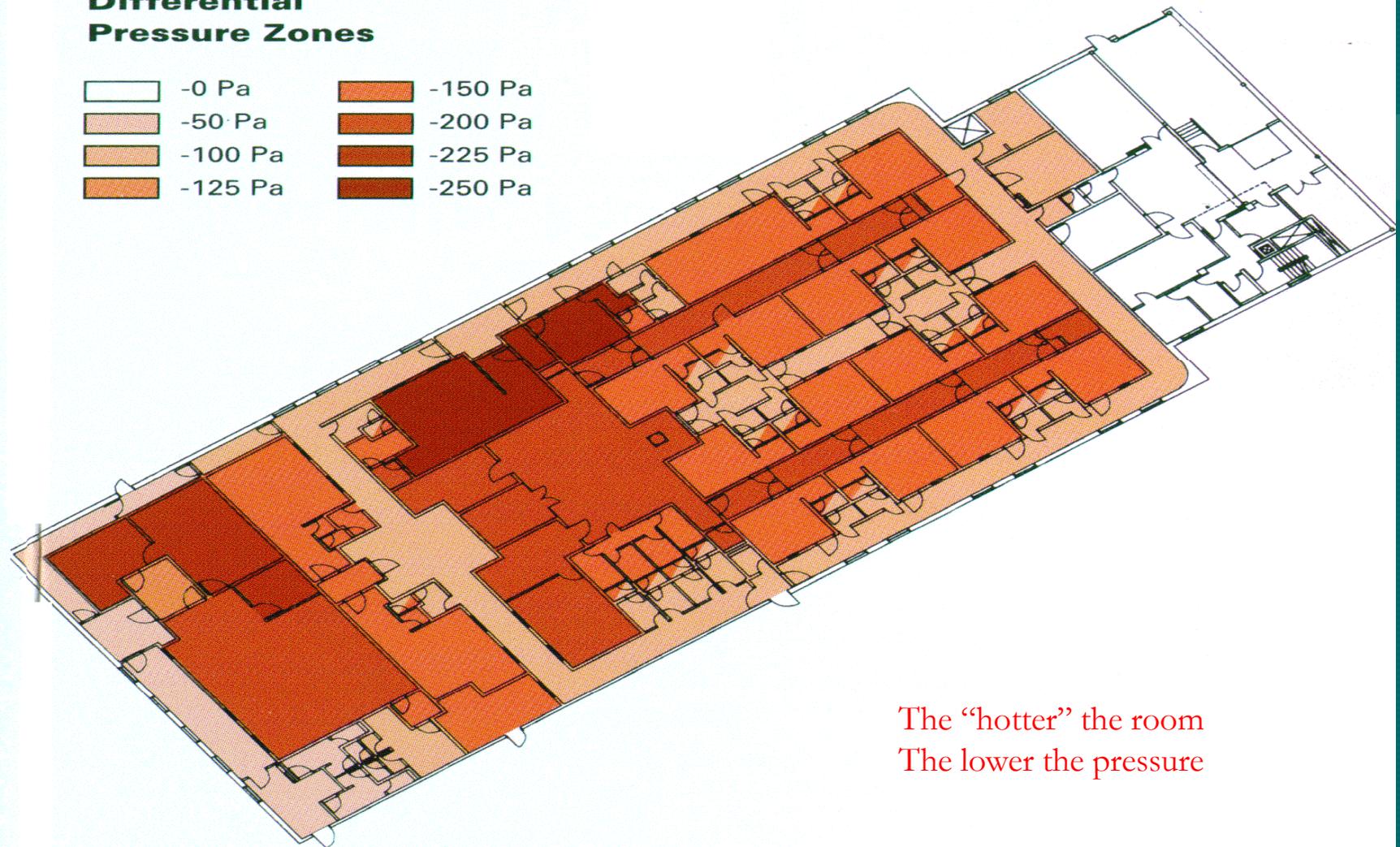
# Animal Containment Facility

## Design Dictates Function -- Typical CL-3

### Pressure Gradients

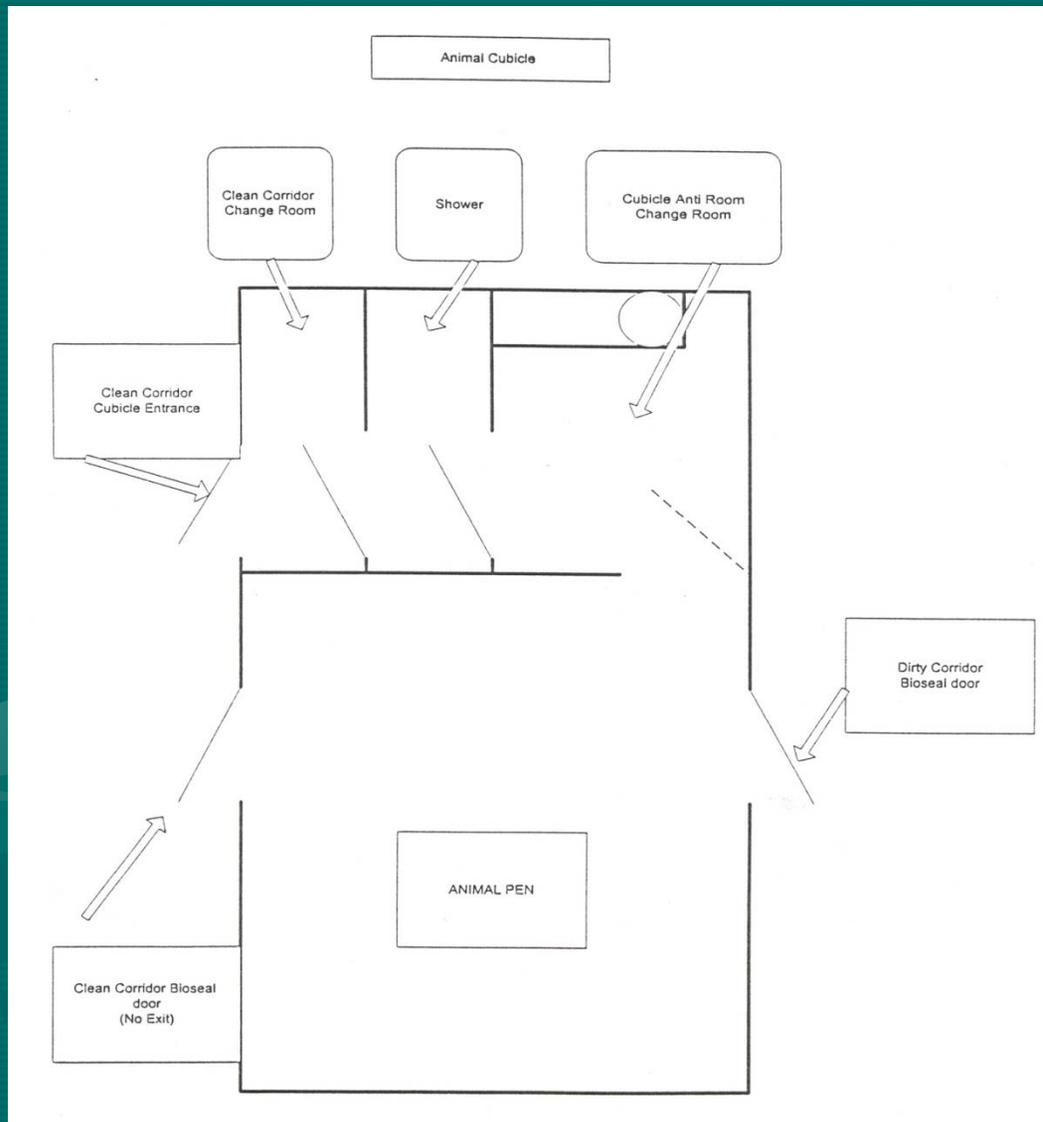
#### Differential Pressure Zones

	-0 Pa		-150 Pa
	-50 Pa		-200 Pa
	-100 Pa		-225 Pa
	-125 Pa		-250 Pa



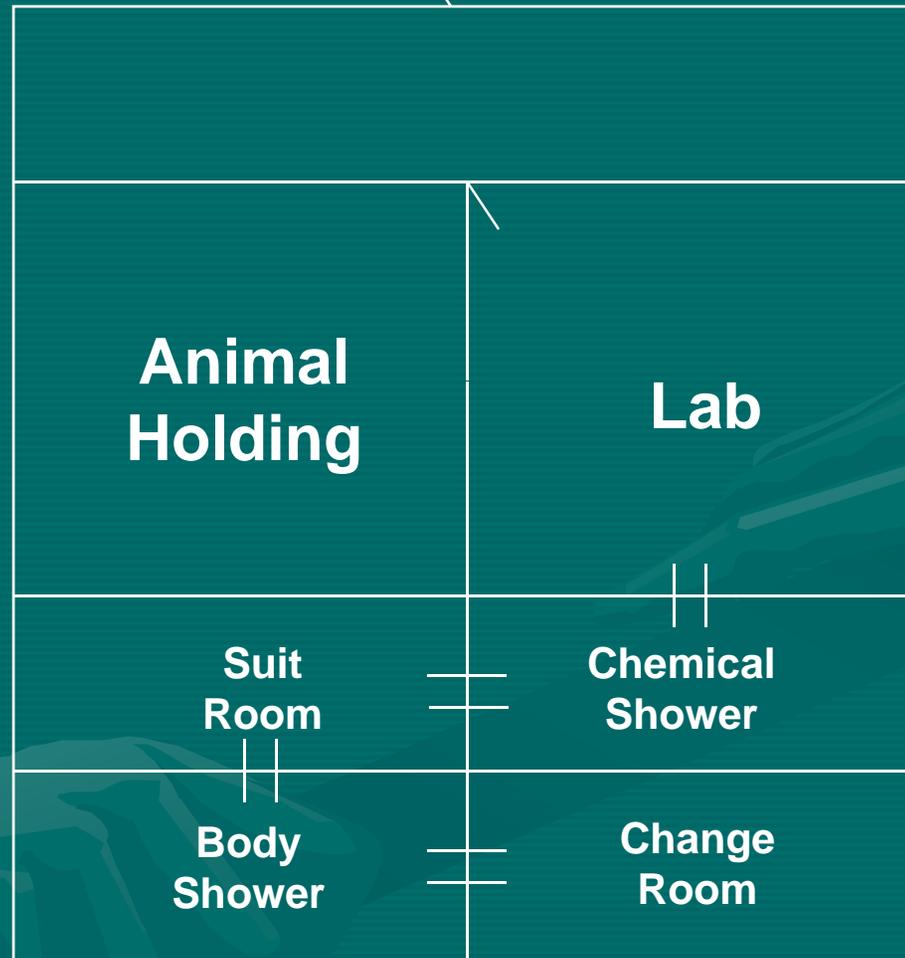
The "hotter" the room  
The lower the pressure

# Animals In Containment A Typical Animal Holding Cubicle



# Containment Level 4

Protective suits, chemical showers and personal showers



# Animal Containment Cubicles

## Similarities & Differences

- **Large Animal**
  - Entry / Exit doors
  - Feed storage
  - Water supply
  - Waste removal
  - Flooring – NON-slip
  - Wall finishes
  - Lighting – timers, lux
  - Air exchanges
  - Noise levels
- **Small Animal**
  - Cage banks entry / exit
  - Feed – special considerations – g. pigs
  - Water – chlorination level
  - Waste removal – aerosols
  - Cage banks – drawers
  - Wall finish – decontamination
  - Lighting – critical levels / time
  - Air – banks direct link to filters
  - Noise levels -- equipment

# Animal Containment

## Examples of Mixed Species Single Room Considerations

### Heat Generated by Laboratory Animals

		Heat Generation, Normally Active Btu/h per Animal		
Species	Weight, lb	Sensible	Latent	Total
Mouse	0.046	1.11	0.54	1.65
Hamster	0.260	4.02	1.98	6.00
Rat	0.620	7.77	3.83	11.60
Guinea pig	0.900	10.22	5.03	15.25
Rabbit	5.410	39.22	19.31	58.53
Cat	6.610	45.57	22.45	68.02
Nonhuman primate	12.000	71.27	35.10	106.38
Dog	22.700	104.80	56.40	161.20
Dog	50.000	230.70	124.20	354.90

# Laboratory Animal Sourcing ???



# Laboratory Animal Sourcing

## “Public Perception”

- Absolutely Essential – be open and transparent
- (Animal Care and Use Committees – composite membership)
- Laboratories Do NOT :
  - “steal pets from neighbourhoods” – dogs & cats
  - “rustle livestock at night” -- calves, pigs, ponies, etc
  - “trap wildlife “ -- rabbits, birds, horses, deer, ferrets, etc
  - “Force “ Humane Societies to give up unclaimed or un-adopted pets – dogs, cats, gerbils, guinea pigs, rabbits, birds, fish, etc,

# Laboratory Animal

## “Actual Sources”

- 1. Specialized laboratory animal suppliers
- ( ie Charles Rivers Laboratories, etc -- small mammals)
- 2. Primates – National Research Council ( NRC ) - primate colony
- 3. Avian – CFIA - specific pathogen free ( SPF ) flocks
- (chicks and fertilized egg source )
- 4. Large mammals – specialized laboratory animal suppliers
- ( sheep, goats, swine, ferrets, etc -- limited )
- 5. Farm supply – avian, mammalian, aquatic
- (health status must be established – serology, agent isolation)
- (parasite infestation – internal / external )
- (treat specifically and / or treat empirically, -- or tolerate “agent” in containment )

*During emergencies : – fertilized eggs -- for virus isolation, animals ( ie chicks ) for diagnostic purposes  
may have to be obtained from local sources*

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# Laboratory Animal Sourcing Controls

## Animal Use Document “AUD”

- 1. Title of Project
- 2. Principle Investigator
- 3. Animals:– anticipated requirement – species, strain, age/weight, sex, number per group, total for project
- 4. Class of animal, use, -- invasive category anticipated
- 5. Duration of project, -- specific time
- 6. Project status – new – ongoing
- 7. Alternate investigators involved in project -- names
- 8. Persons manipulating live animals – live animal work duties -- animal care staff, researchers, veterinarian
- 9. Nature of work – genetic research , product production, testing, test development,
- 10. Ongoing, pilot study, contracted project

## Animal Use Document cont'd

- 11. Principle of “replacement”, “reduction”, “refinement”
- 12. Biohazards – toxins, carcinogens, biologics
- 13. Lay summary – history, purpose, intent,
- 14. Scientific rationale for project – details of project
- 15. Justification of animal use and numbers
- 16. Environmental enrichment – species specific toys
- 17. Animal housing and site experiments – cubicle locations
- 18. Special requirements – housing, care, transport,
- 19. Anaesthesia – dosage, local, general, inhalation,
- 20. Pain / discomfort from manipulations – inoculations etc
- 21. Post-operative care – monitoring, treatment,
- 22. Humane endpoint – scoring chart – species specific
- 23. Euthanasia – species specific
- 24. Declaration – investigator & project supervisor – agree to abide by CCAC Guidelines
- 25 Approval – a) approved, b) minor revision, c) major revision, d) outright rejection

# Project Approval Documents

## SES

## AUD

PROTECTED

C-04-002



Safety &  
Environmental  
Services

RECU/RECEIVED  
04-06-2004  
P. Blusson

To: Federal Laboratories Animal Care Committee  
Winnipeg, Manitoba

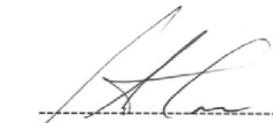
From: Safety and Environmental Services  
Federal Laboratories  
Winnipeg, Manitoba

April 20<sup>th</sup> 2004

Regarding: FLACC submission "Production of serum and tissue from sheep goats and cattle to evaluate existing ELISA, EM, PCR, RT-PCR, and IHC tests for Capripox in large animals." # 004-002

We, the undersigned, certify that the biological safety concerns with reference to the above animal care committee submission have been addressed. The protocols, use of protective clothing and training as outlined in this submission adhere to Health Canada's Laboratory Biosafety Guidelines and the Canadian Food Inspection Agency's Containment Standards for Veterinary Facilities. Only those people who have signed off on the training are able to take part in the above experiment.

  
-----  
Chief Safety and Environmental Services

  
-----  
CFIA Biosafety Officer

PROTECTED

CSCHAH - ACC 2-2003

APPLICATION FOR USE OF LIVE ANIMALS IN RESEARCH  
- ANIMAL USE DOCUMENT -

PLEASE SUBMIT TO: ANIMAL CARE COMMITTEE  
c/o Secretary

Electronic Submission Permitted by Principal Investigator: Yes/No

RECU/RECEIVED  
15-04-2004  
P. Blusson

FOR ACC USE ONLY AUD ID #: C-04-002 Rev.1 START: END:

Animal Species: Approved number of animals: Max invasiveness:

### SECTION I: GENERAL INFORMATION

1. TITLE OF PROJECT: (maximum of 2 lines)

Production of Serum and Tissues from Sheep, Goats and Cattle to Evaluate Existing ELISA, Electron Microscopy, PCR, RT-PCR and Immunohistochemistry Tests for Capripox - Large Animals

2. 2 - 6 KEYWORDS: (Use CCAC Keywords on M:Drive)

diagnostic, regulatory, antibody production, injections (IV, ID, SQ, IM), blood removal, infectious agent (poxviruses)

3. PRINCIPAL INVESTIGATOR (full name, title and association, phone number)  
**Must be prepared to take on all the responsibilities of the project.**

Dr. John Copps  
BscAg, DVM, DVSc  
Animal Care Veterinarian, CFIA  
789-2037  
jcopps@inspection.gc.ca

4. ALTERNATE INVESTIGATOR (full name, title, association, phone number)  
**Must be available and prepared to replace PI if required.**

Dr. Paul Kitching  
DVM, PhD  
Director, CFIA  
789- 2102  
kitchingp@inspection.gc.ca  
(temporary - a new Research Scientist will be hired)

# Containment Levels

## (Safety Considerations )

- Containment levels are selected to provide the end user with a description of the minimum containment required for handling the organism safely in a laboratory/animal setting
- The containment system includes the engineering, operational, technical, and physical requirements for manipulating a particular pathogen
- There are “4” containment levels

# Safety and Bio-Safety

## Risk Levels – Reduce The Risks

- **Biological Safety Assessment**
  - Review all procedures and appropriate manuals
  - Material Safety Data Sheets ( MSDS) for ALL materials used
  - Biosecurity aspects of BSL 3 & 4 -- entry & exit procedures
  - Emergency situations -- contacts, procedures, exit sites,
  - Decontamination procedures – cubicles, materials, staff
  
- **Animal Use Documents (AUD) and Protocols**
  - Staff – animal care, researchers, veterinarians
  - Species – care, feeding, cleaning, socializing, problems
  - Animal Care – policies and procedures ( SOPs )

# Risk Levels & Safety Concerns

## Critical Factors

- -- when working in containment
- !!!!! Know ALL aspects of agent being worked with !!!!!
- - aerosol spread – concentration in cubicle
- - contact spread – direct, fomites, excretions
- - secretions / excretions -- contact or exposure
- - blood borne agents and tissue contact risks -- post mortem
- - Zoonotic disease risks --- any form of contact
  
- *Risk considerations:* -- during All routine activities
- Feeding, cleaning, sample collections, post mortems

( Applies to ALL levels of containment -- CL2, CL3, CL4 )

# Containment Level 1 (CL-1)

- Requires no special design features beyond those suitable for a well-designed and functional laboratory
- Biological Safety Cabinets are not required
- Work can be done on an open bench top
- Containment is achieved through the use of practices normally employed in a basic microbiology lab



Laboratory Biosafety Guidelines 3<sup>rd</sup> Edition 2004

# Containment Level 2 (CL-2)

- Exposure hazards associated with organisms requiring CL-2 are through ingestion, inoculation, and mucous membrane penetration
- Agents are not generally transmitted by airborne route
- Primary containment devices used are:
  - Biological Safety Cabinets (BSCs),
  - centrifuges,
  - personal protective equipment (gloves, lab coats, safety glasses)
- Environmental contamination is minimized by the use of hand washing sinks, and decontamination facilities (autoclaves)

# Containment Level 2 (CL-2)

## (Examples of General Serology Diagnostics)

- Monoclonal Antibody Production
- *Campylobacter spp.*
- *Escherichia coli*
- *Helicobacter pylori.*
- *Listeria monocitogenes*
- *Neisseria meningitidis*
- *Salmonella spp.*
- *Shigella spp.*
- *Vibrio spp.*
- Herpesviridae
- Hepatitis C
- Scrapie
- Orthomyxoviridae Genus Influenzavirus
- CWD (Chronic Wasting Disease)

# Animal in Containment

## Ante Room and Animal Cubicles

- Usually the large animal holding room is also the procedure room.
- The animals generally will not fit into a BSC nor lend themselves to be confined in small spaces without chutes or pens.
- The staff must have a safe place to put on and take off the PPE
- -- not in the animal housing areas.
- The chance for contamination is far greater while working in the cage with the infected animals.
- Procedures with large animals can be dangerous -- only personnel experienced with that animal species should enter the pen.
- Animal restraint devices typically include snares for pigs, head gates for cattle; however some species require gentle persuasion or tranquilization for optimal safety.
- Excessive sampling can lead to dangerous situations when animals become afraid of the person sampling. Acclimation and understanding the animals behaviour are critical to success.

# Animal Facility Function

## Animal Holding Cubicles

- Varies with zoonotic potential – air pressure gradient differentials
- Some species are versatile and can be housed either on the floor or in cages.
- Large domesticated animals require a restraining chute / squeeze and holding pens.
- Treatment of animal waste – volume and nature of material – disposal difficulties – wash into drain – very moist environment for animals.
- Traditional bedding is replaced with soft mats or inlaid flooring.
- Staff safety is critical -- staff must work in pairs.
- Miniature animals or very young animals are used to ensure ease of handling

# Containment Level 2 (CL-2)

## Routine Animal Related Activities

- Daily husbandry
- Monitoring animals for clinical signs
- Inoculations
- Injections (SQ, IV, IM, IC, tracheal lavage)
- Sample collections (blood, fluid)
- Necropsies ( sample collections – including tissues )
- Develop and maintain specific Animal Records
- Develop “Standard Operating Procedures” ( SOPs)
- Sterile Technique -- usage and development
- Animal and area cleaning and disinfection

# Animals in Containment

## Levels of Risk to the Animal

- Risk to animals in the study -- ( controls & infected ).
- Risk to the animals on different studies – contamination
- Level of risk dictates the requirements for:
  - 1. Personal Protective equipment ( PPE ) use,
  - 2. Housing – group, single cages, individual cubicles
  - 3. Ventilation – air exchange – humidity, temperature
  - 4. Handling procedures,
  - 5. Floor finishes – footing – large animal handling
  - 6. Wall finishes / sealed units --- agent escape

# Containment Level 2 (CL-2)

## Common Laboratory Animal Species

- Rabbits

- Guinea Pigs

- Hamsters

- Mice

Chickens / Turkeys

Ferrets

Non-human Primates

Rats

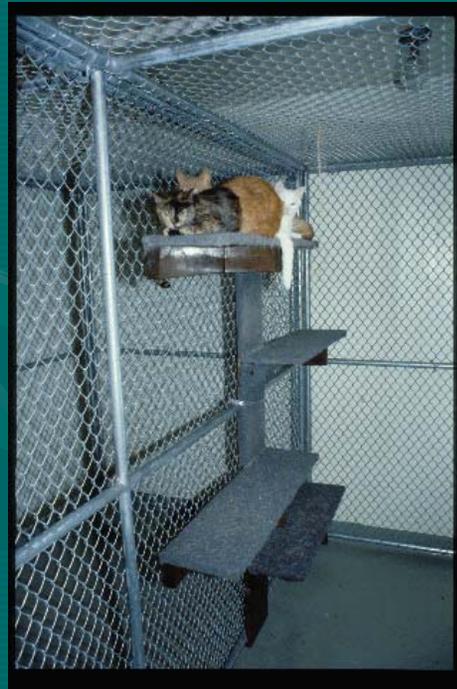
# Animal Containment Levels 2, 3, & 4

## Small Mammal Animal “Bank”



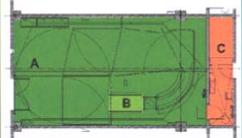
Can be used in any containment level area

# Animals In Containment Confinement and Restraint



**Planning - Holding Areas** 

Penning / Livestock Design



*Frost & Associates ASI*

# Containment Level 2 (CL-2)

- Rabbit



Caging system



Cardiac Bleeding



Restraint



Ear artery bleed

# Animal Containment Level 2 – (CL-2)

- Hamsters



Restraint



Intra-peritoneal injection  
In Bio-security hood

## Animal Containment Level 2 (CL-2)



Fresh fruit & “toys”  
Ferrets tend to be very active

# Animal Containment Level 2(CL-2)

## Animal Containment & Handling

- Mice



Cage changes



Anesthesia



Saphenous  
bleed



Intra-cranial injection

# Animal Containment Level 3 (CL-3)

- Agents may be transmitted by the airborne route
- Have a low infectious dose to produce effects and can cause serious or life threatening disease
- Additional primary and secondary barriers are used to minimize the release of infectious organisms into the immediate laboratory and environment.
- These include:

- directional air flow – important to maintain level 3
- pressure differentials
  - Magnehelic gauges are used to measure the differentials
- HEPA filtration of exhausted air
- Controlled lab access – security clearances required



# Animal Containment Level 3 (CL-3)

## Foreign Animal Disease Agents:

- Pose serious national and international Animal Health risks
- (ie. . Foot and Mouth Disease)
- Some agents pose both a major Public Health risk and an Animal Health risk
- ( ie. Avian Influenza, Bovine Tuberculosis, Q-Fever )

## Zoonotic Agents:

Although some agents can cause clinical symptoms in humans  
– the agent may still be classed as a CL 3 agent

- (eg. Avian Influenza and New Castle Disease, Glanders, Q-Fever )
- Proper personal protective equipment is always worn when working with these pathogens

# Animal Cubicles

## Animal Containment CL-3

- Example of animal containment cubicle (CL-3):
- Each cubicle can have its own temperature and humidity settings for different species
- Each cubicle has
  - A clean change room – strip down pass through shower
  - Shower -- depending on project, -- usually shower out only
  - Anteroom – feed storage, clean up materials, staff clothing etc,
  - Animal containment holing area
- Animal pens are approximately 12 foot square
- Animal pen floors have inlaid rubber matting

# Animal Containment Level 3 (CL-3)

Species Usage Depends On Intended Project / Function

- **Animal Variety Used In Containment**

- Chickens and Turkeys
- Pigs
- Calves
- Sheep
- Goats
- White Tailed Deer
- Miniature Horses
- Canadian Geese
- Mallard Ducks
- Peking Ducks
- Blue Jays and Crows
- Ostriches
- Rabbits, Guinea Pigs, Rats, and Mice



# Animal Containment Level 3 (CL-3)

## • Examples of Some CL 3 Agents Handled at CSCHAH:

- *Burkholderia mallei* (Glanders)
- Capripox (Sheep/Goat Pox, Lumpy Skin Disease)
- Avian Influenza
- Classical Swine Fever
- African Swine Fever
- Pseudo-rabies
- Blue Tongue
- Vesicular Stomatitis
- Foot and Mouth Disease
- West Nile Virus
- Swine Vesicular Disease
- Eastern Equine Encephalitis
- New Castle Disease
- Vesicular Exanthema of Swine
- Rinderpest
- Turkey Rhino-tracheitis
- Swine Influenza
- Epizootic Hemorrhagic Disease
- Prions (Scrapie, Chronic Wasting Disease, BSE)
- Rabbit Hemorrhagic Disease
- Orf
- Seneca Virus
- Rift Valley Fever
- Borna Disease



# Levels of Risk in Containment

## Clinical Assessment of Animals

**Nothing** – no special precautions

- **Seizures** – problem with large species handling, may require sedation
- **Diarrhea / Discharge** – contamination of the cubicle with agent, and increase risk of contamination of the staff and other animals by direct contact and aerosol contact
- **Coughing** – aerosol dispersion of agent
- **Behavior change** – aggression, mobility problems, recumbancy



# Risk of Disease Exposure In Containment

## Primary Methods of Disease Agent Spread

- Animal to Human
- Human to Animal
- Animal to Animal



# Containment Level 3 (CL-3)

## Large Animal Restraint



In animal cubicles, space is a “premium” – staff safety is a major concern

# Animal Containment Level 3 (CL-3)

## Animals in Containment

### Chickens & Turkeys

Floor housed

Single sex in larger birds

Can be “flighty” – slow methodical movements are required



# Animal Containment Level 3 (CL-3)

## Small Animal Containment “Banks”

- Small mammals, birds, reptiles can housed in HEPA filtered isolator cage units



Heat Lamps

H  
e



Supplemental heat is provided to avian species via external heat lamps

# Containment Level 3 (CL-3)

## Animals In Containment

- Pigs
- Good footing material is essential

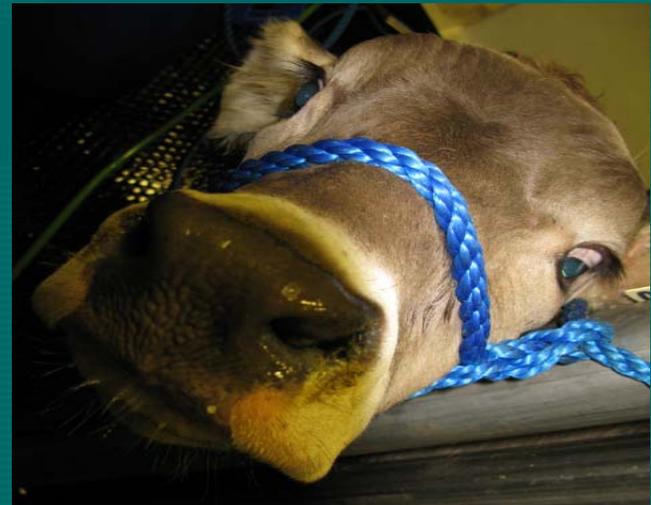


Group socializing – pen-mates - best source  
Critical if from various pen sources  
(fighting injuries )

# Containment Level 3 (CL-3)

## Animals In Containment

- Calves
  - Maximum 500 Kg
  - Docile temperment – critical
  - NO horns & No testicles



# Containment Level 3 (L-3)

## Species Differences – Specific Handling Techniques

- Miniature Horses



Docile demeanour  
NO stallions

# Containment Level 3 (CL-3)

## “Special” Animals In Containment

### Ostrich ( young)

Unique considerations

Kick / Strike

Eat foreign materials

Cover head - handling



# Containment Level 3 (CL-3)

## “Special “ Animals in Containment

- Canadian Geese

Socialize & slow movement – KEY elements



# Containment Level 3 (CL-3) “Special” Animals In Containment

West Nile Virus Studies



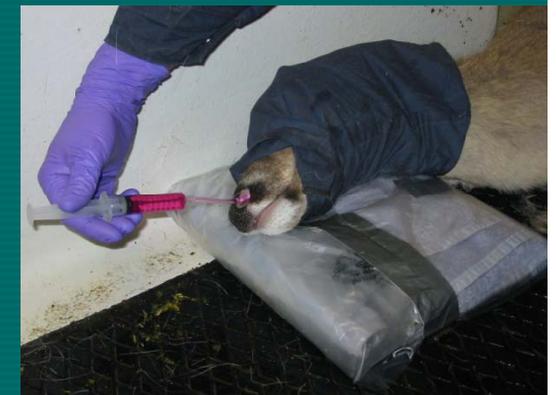
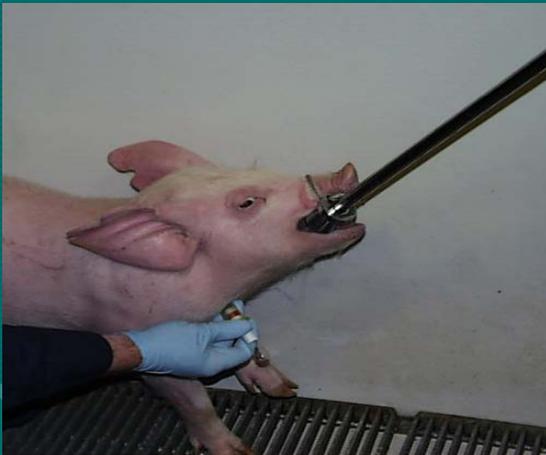
Crows



Blue Jays

# Animal Restraint and Manipulations

## Varies Markedly With Species and Required Function



# Animals in Containment

## Normal Animal Requirements



### Monitoring of Animals

- Attitude
- Temperature
- Appetite
- Thirst
- Urine Output / Appearance
- Fecal Output / Appearance
- Clinical signs of disease



# Animals In Containment (Prevent Aggression and Boredom)

## Environmental Enrichment



“Toys”



# Animal Containment

## Animal Care Staff – A Key Element

Animal Socialization – An Essential Element For Project Success



# Animal Containment CL-3

## Animal Socialization – Handling & Manipulations



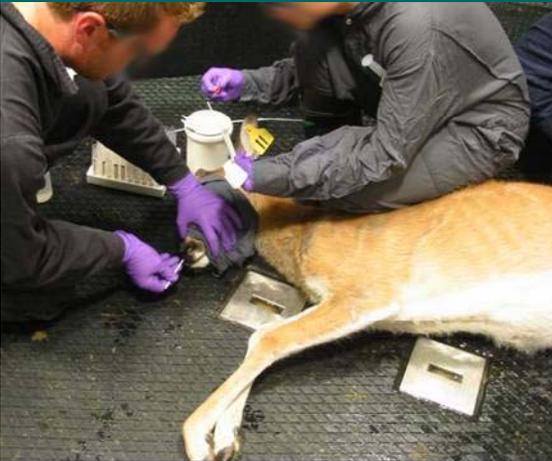
### Socialization

A psychological  
Effect on staff



# Animal Containment CL-3

## Restraint and Anaesthesia



Injectable Anaesthesia



Hog snare – replaced by cotton rope



Inhalation Anaesthesia

# Animals in Containment CL- 3 & CL- 4 Treatment Regimes

## Routes of Treatment

- For administering antibiotics, pain relief medication, or inoculate viruses
- These include
  - Intramuscular
  - Subcutaneous
  - Intravenous
  - Intraperitoneal
  - Intradermal
  - Intracranial
  - Intracardiac
  - Extra-ocular
  - Intranasal
  - Oral
  - Topical



# Animal Facility Risk Control

## Risk and Protecting Yourself

- Various forms of PPE can be worn in the animal facility depending on personal suitability, requirements, and ease of use.
- Small animal facilities – surgical scrubs, followed by a gown with a moisture barrier, gloves X 2 or 3, and a HEPA face mask or Rocal HEPA filtration.
- Large animal clothing often requires steel toed boots, coveralls, boots, gloves and a Rocal HEPA filtration.
- Secondary layers of PPE may require disposable coveralls and a layer of washable PPE.
- All PPE must be able to be worn in the animal pen with minimal risk of tear or “hooked” on animals or equipment etc.
- “Gowning up & down” is -- time consuming and reduces actual work time in the cubicles
- Extensive time wearing PPE can lead to dehydration, exhaustion,
- -- frequent rest periods may be required.

# Risk Mitigation In Containment Personal Protective Equipment



Kevlar gloves

Chain-mail glove

Double or triple glove

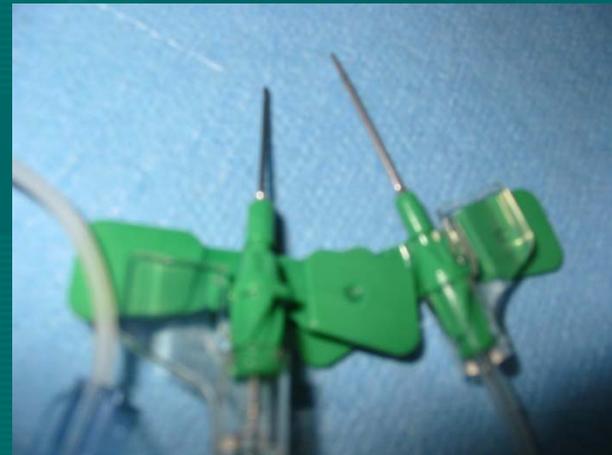


Fine manipulations are encumbered – animal anaesthesia required

# Animals In Containment

## Staff Related Ergonomic Issues

- Repetitive Stress Syndrome
- Zoonotic Infections
- Sharps Problems
- Trauma
- Fatigue
- Inability to exercise bodily functions
- Bunker Mentality
- Welfare Stress



# Example Of Risk Assessment

## Mild Abrasion – Consequences If Not Treated



**Wear PPE, and do NOT ignore injuries  
– no matter how small**

# Risk and Safety Factors

## Signage – A Critical Safety Element

- Hazard Warning

Simplicity & Clarity



Ensure Visibility

# Animals in Containment

## Safety Equipment and Procedures



# Risk and Safety Concerns

## Various Risk Levels In CL- 3



West Nile Virus Post mortem preparation



Newcastle Disease  
Health Check



Highly Zoonotic post moretm  
Q- Fever

# Risk & Safety Decontamination Procedures



# Biosecurity Threats

- One of the greatest “biosecurity “ threats to a laboratory facility is:
- “Staff Complacency”

# Containment Level 4 (CL-4)

## A Unique Area

- CL-4 agents have the potential for aerosol transmission, often have a low infectious dose and produce very serious and often fatal disease
- There is generally no treatment or vaccine available
- Emphasizes maximum containment of the infectious agent by complete sealing of the facility perimeter
- The service area and corridors are fitted with air supply, exhaust fans, and controls such that zones of negative pressure are maintained at all times
- The pressure is progressively more negative from the clean corridor and entry room (-100 kPa) to the suit room (-150 kPa) to the chemical shower (-200 kPa) and finally the laboratory and animal cubicle area (-250 kPa)
- Personnel wear positive pressure suits

# Containment Level 4

CL-4 agents some of the AHT's work with include:

- Nipah virus
- Hendra Virus
- Ebola Virus
- SARS (Severe Acute Respiratory Syndrome)
- Avian Influenza H5N1
- Swine Influenza 1918
- Crimean-Congo Hemorrhagic Fever



# Containment Level 4

## Biosecurity – Safety and Restrictive

- **CL-4** can house a variety of animals including:
  - Pigs (must be under 50 lbs)
  - Sheep (must be under 70 lbs)
  - Chickens
  - Ferrets
  - Mallard Ducks
  - Rabbits
  - Guinea Pigs
  - Mice



# Animal Facility

## Necropsy Area

- For small animals, necropsy are typically completed in a biological safety cabinet.
- Working within a BSC requires dexterity if small pigs or birds are necropsied.
- Alternatively, down draft necropsy tables are used to prevent contamination and when greater access to the animal is required.
- Large animal species can be raised up onto a table where they can be autopsied easily.
- The floor becomes an adequate surface if extensive PM is required or very large animals must be necropsied within the cubicle.
- The higher the level of containment, the slower the procedure will be. ( PPE equipment and biosecurity procedures )

# Animals In Containment Necropsy



# At Times The Impossible Can Be Accomplished



# Animal Containment

## Animal Waste Controls

- Waste streams must be in place before the project starts.
- The treatment of the waste from animals must be according to SOP's and strictly followed.
- Initial waste treatment for small animals usually starts with the BSC when the cage is dumped.
- Disinfectant is sprayed on the cage and allowed sufficient contact time to kill the organism of test.
- Secondary treatment of waste occurs with a combination of autoclaving and cage washing.
- Treatment of large animal waste depends on the level of containment; level 2 containment water can be treated with the use of lagoons and time.
- Level 3 and 4 material require an initial treatment within the drainage system and a secondary treatment using various forms of heat and pressure.
- Waste streams for carcasses depends on the facility and agent to be decontaminated – ideally -- incineration

# Animal Containment Challenges

## Waste and Bio-waste Control



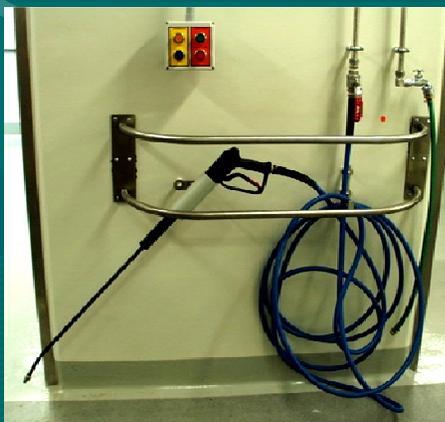
Bio-hazard materials



Autoclave material



Pressure wash  
Virkon



Pressure Washers



Tissue disposal



Disinfectants & Soap

# Animal Containment Post Mortem Room



- When the cooler is full, a rendering run occurs
- The waste is lowered into a large (bio-cooker)
- It is cooked for several hours at 121 – 145 degrees Celsius and up to 40 psi

# Animal Containment

## Waste Control & Disposal



Autoclave



“Cooker” tissue & waste water



Alkaline Digester

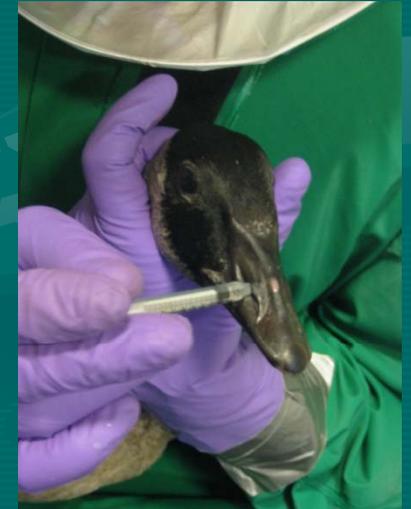
# Animal Containment

## Decontamination

### The Final Step

- Upon project completion the animal cubicle is completely cleaned of all organic material
- Chemical decontamination is completed using
  - Virkon
  - Bleach
  - Germ Kill
  - Quatricide PV-15
  - Paraformaldehyde
- In most cases, decontamination of the cubicle is completed with the use of paraformaldehyde as a final treatment





# Animals In containment From Start – To – Finish

## FMD Project





New Horizons \_\_\_\_ New Opportunities

# Acknowledgements

- Always keep in mind that the animals in containment give the “ultimate sacrifice” in order for us to achieve our research, diagnostic or teaching / training goals.

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