

# Biosafety at MUSC

## ■ *Unit 3*

- ◆ **How to determine the relative biosafety risk associated with a planned experiment**



# *Laboratory Containment Levels for Biological Research Involving Potential Biohazards*

## ■ Questions to Ask ?

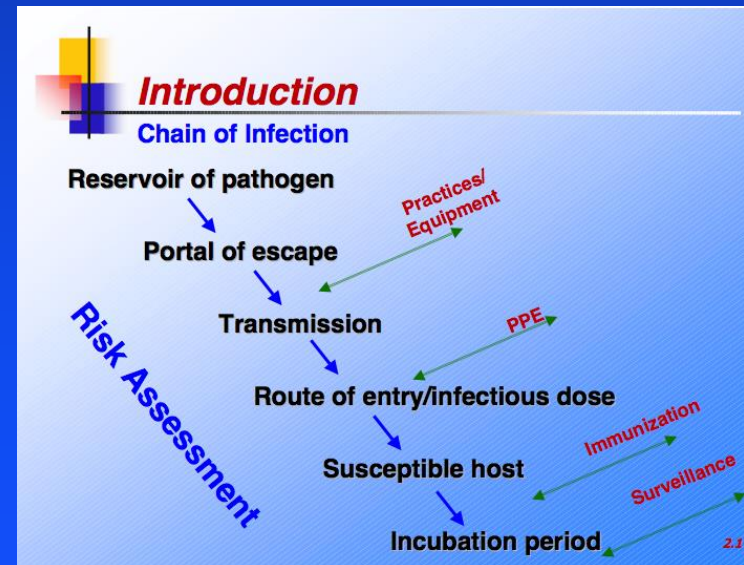
### ◆ Hazard Levels

☞ MSDS for Microbes

### ◆ Standard Microbiological Practices

### ◆ Special Practices

### ◆ Containment Equipment

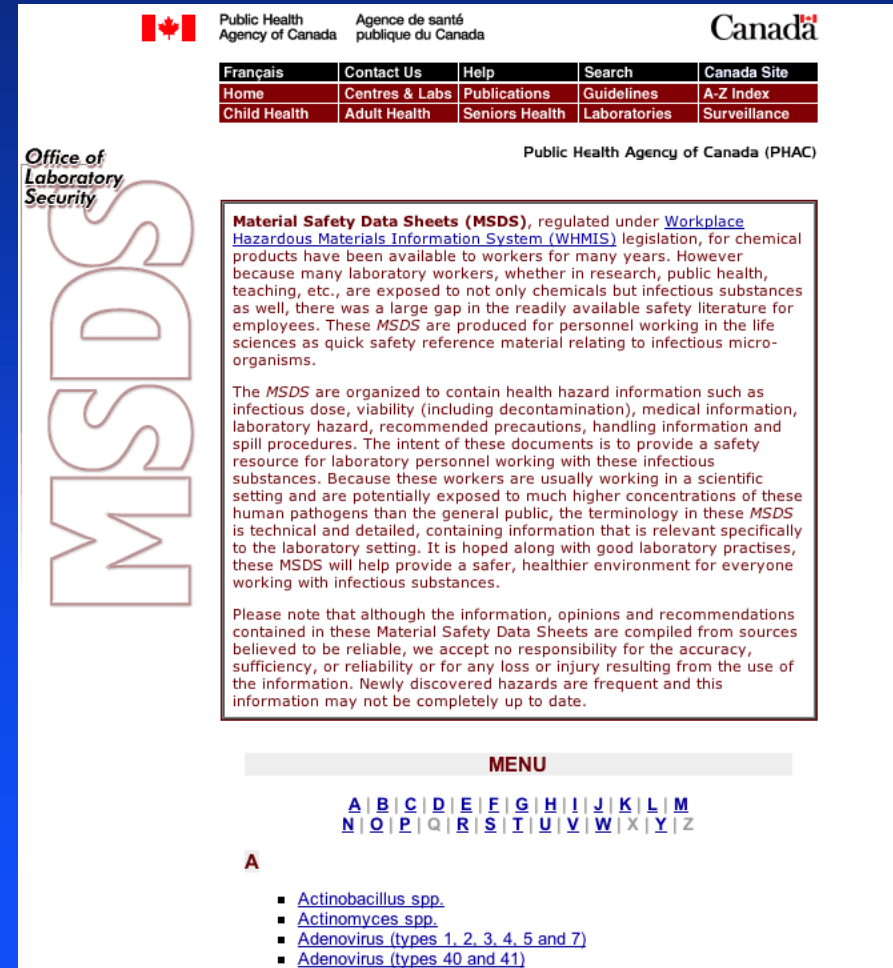


# Laboratory Containment Levels for Biological Research Involving Potential Biohazards

## ■ Questions to Ask ?

### ◆ Hazard Levels

#### ☞ MSDS for Microbes



The screenshot shows the 'Office of Laboratory Security' page for MSDS. It includes the Canadian flag, the Public Health Agency of Canada logo, and a navigation menu. The main content area is titled 'MSDS' and contains text explaining that MSDS are regulated under WHMIS legislation. It states that MSDS are produced for personnel working in the life sciences as quick safety reference material relating to infectious microorganisms. The text further explains that MSDS are organized to contain health hazard information such as infectious dose, viability, medical information, laboratory hazard, recommended precautions, handling information, and spill procedures. It notes that the terminology in these MSDS is technical and detailed, containing information relevant specifically to the laboratory setting. A disclaimer at the bottom states that the information, opinions, and recommendations are compiled from sources believed to be reliable, but the agency accepts no responsibility for the accuracy, sufficiency, or reliability of the information, especially for newly discovered hazards.

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Public Health Agency of Canada (PHAC)

## MSDS

**Material Safety Data Sheets (MSDS)**, regulated under [Workplace Hazardous Materials Information System \(WHMIS\)](#) legislation, for chemical products have been available to workers for many years. However because many laboratory workers, whether in research, public health, teaching, etc., are exposed to not only chemicals but infectious substances as well, there was a large gap in the readily available safety literature for employees. These *MSDS* are produced for personnel working in the life sciences as quick safety reference material relating to infectious microorganisms.

The *MSDS* are organized to contain health hazard information such as infectious dose, viability (including decontamination), medical information, laboratory hazard, recommended precautions, handling information and spill procedures. The intent of these documents is to provide a safety resource for laboratory personnel working with these infectious substances. Because these workers are usually working in a scientific setting and are potentially exposed to much higher concentrations of these human pathogens than the general public, the terminology in these *MSDS* is technical and detailed, containing information that is relevant specifically to the laboratory setting. It is hoped along with good laboratory practises, these *MSDS* will help provide a safer, healthier environment for everyone working with infectious substances.

Please note that although the information, opinions and recommendations contained in these Material Safety Data Sheets are compiled from sources believed to be reliable, we accept no responsibility for the accuracy, sufficiency, or reliability or for any loss or injury resulting from the use of the information. Newly discovered hazards are frequent and this information may not be completely up to date.

**MENU**

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**A**

- [Actinobacillus spp.](#)
- [Actinomyces spp.](#)
- [Adenovirus \(types 1, 2, 3, 4, 5 and 7\)](#)
- [Adenovirus \(types 40 and 41\)](#)

# Laboratory Containment Levels for Biological Research Involving Potential Biohazards

## ■ Questions to Ask ?

### ◆ Hazard Levels

#### ☞ MSDS for Microbes

- Issue Aerosol
  - 150 pfu is infectious intranasally
- Incubation
  - 1-10 days
- Communicability
  - Yes

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Office of Laboratory Security

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### MATERIAL SAFETY DATA SHEET - INFECTIOUS SUBSTANCES

#### SECTION I - INFECTIOUS AGENT

**NAME:** Adenovirus types 1, 2, 3, 4, 5 and 7

**SYNONYM OR CROSS REFERENCE:** ARD, acute respiratory disease, pharyngoconjunctival fever

**CHARACTERISTICS:** *Adenoviridae*; non-enveloped, icosahedral virions, 70-90 nm diameter, doubled-stranded, linear DNA genome.

#### SECTION II - HEALTH HAZARD

**PATHOGENICITY:** Varies in clinical manifestation and severity; symptoms include fever, rhinitis, pharyngitis, tonsillitis, cough and conjunctivitis; common cause of nonstreptococcal exudative pharyngitis among children under 3 years; more severe diseases include laryngitis, croup, bronchiolitis, or severe pneumonia; a syndrome of pharyngitis and conjunctivitis (pharyngoconjunctival fever) is associated with adenovirus infection

**EPIDEMIOLOGY:** Worldwide; seasonal in temperate regions, with highest incidences in the fall, winter and early spring; in tropical areas, infections are common in the wet and colder weather; annual incidence is particularly high in children; adenovirus types 4 and 7 are common among military recruits (ARD)

**HOST RANGE:** Humans

**INFECTIOUS DOSE:** >150 plaque forming units when given intranasally

**MODE OF TRANSMISSION:** Directly by oral contact and droplet spread; indirectly by handkerchiefs, eating utensils and other articles freshly soiled with respiratory discharge of an infected person; outbreaks have been related to swimming pools; possible spread through the fecal-oral route

**INCUBATION PERIOD:** From 1-10 days

**COMMUNICABILITY:** Shortly prior to and for the duration of the active disease

#### SECTION III - DISSEMINATION

**RESERVOIR:** Humans



# Laboratory Containment Levels for Biological Research Involving Potential Biohazards

## ■ Questions to Ask ?

### ◆ Hazard Levels

#### ☞ Disinfectants

- Bleach

#### ☞ Physical Inactivation

#### ☞ Survival outside host

- Type 3 survival 10 days on paper
- Type 2 survived 3-8 weeks on environmental surfaces at room temperature.

#### SECTION III - DISSEMINATION

**RESERVOIR:** Humans

**ZOONOSIS:** None

**VECTORS:** None

#### SECTION IV - VIABILITY

**DRUG SUSCEPTIBILITY:** No specific antiviral available; cidofovir has shown promise in the treatment of adenoviral ocular infections.

**SUSCEPTIBILITY TO DISINFECTANTS:** Susceptible to 1% sodium hypochlorite, 2% glutaraldehyde, 0.25% sodium dodecyl sulfate

**PHYSICAL INACTIVATION:** Sensitive to heat >56°C; unusually stable to chemical or physical agents and adverse pH conditions

**SURVIVAL OUTSIDE HOST:** Resistance to chemical and physical agents allows for prolonged survival outside of the body. Adenovirus type 3 survived up to 10 days on paper under ambient conditions; adenovirus type 2 survived from 3-8 weeks on environmental surfaces at room temperature

#### SECTION V - MEDICAL

**SURVEILLANCE:** Monitor for symptoms; confirm by serological analysis

**FIRST AID/TREATMENT:** Mainly supportive therapy

**IMMUNIZATION:** Vaccine available for adenovirus types 4 and 7 (used for military recruits)

**PROPHYLAXIS:** None available

#### SECTION VI - LABORATORY HAZARDS

**LABORATORY-ACQUIRED INFECTIONS:** Ten cases documented up to 1988

**SOURCES/SPECIMENS:** Respiratory secretions

**PRIMARY HAZARDS:** Ingestion; droplet exposure of the mucous membrane

**SPECIAL HAZARDS:** Contact with feces from infected animals

#### SECTION VII - RECOMMENDED PRECAUTIONS

**CONTAINMENT REQUIREMENTS:** Biosafety level 2 practices and containment facilities for all activities involving the virus and potentially infectious body fluids or tissues

**PROTECTIVE CLOTHING:** Laboratory coat; gloves when skin contact with infectious materials is unavoidable

**OTHER PRECAUTIONS:** None

# Laboratory Containment Levels for Biological Research Involving Potential Biohazards

## ■ Questions to Ask ?

### ◆ Hazard Levels

☞ 10 case of lab infections

### ◆ Special Hazards

☞ Contact with feces from infected animals

### ◆ Spills

### ◆ Disposal

#### SECTION VI - LABORATORY HAZARDS

**LABORATORY-ACQUIRED INFECTIONS:** Ten cases documented up to 1988

**SOURCES/SPECIMENS:** Respiratory secretions

**PRIMARY HAZARDS:** Ingestion; droplet exposure of the mucous membrane

**SPECIAL HAZARDS:** Contact with feces from infected animals

#### SECTION VII - RECOMMENDED PRECAUTIONS

**CONTAINMENT REQUIREMENTS:** Biosafety level 2 practices and containment facilities for all activities involving the virus and potentially infectious body fluids or tissues

**PROTECTIVE CLOTHING:** Laboratory coat; gloves when skin contact with infectious materials is unavoidable

**OTHER PRECAUTIONS:** None

#### SECTION VIII - HANDLING INFORMATION

**SPILLS:** Allow aerosols to settle; wearing protective clothing gently cover the spill with absorbent paper towel and apply 1% sodium hypochlorite starting at the perimeter and working towards the centre; allow sufficient contact time (30 min) before clean up

**DISPOSAL:** Decontaminate all wastes before disposal; steam sterilization, incineration, chemical disinfection

**STORAGE:** In sealed containers that are appropriately labelled

#### SECTION IX - MISCELLANEOUS INFORMATION

**Date prepared:** November 1999

**Prepared by:** Office of Laboratory Security, PHAC

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[Material Safety Data Sheets - Index]

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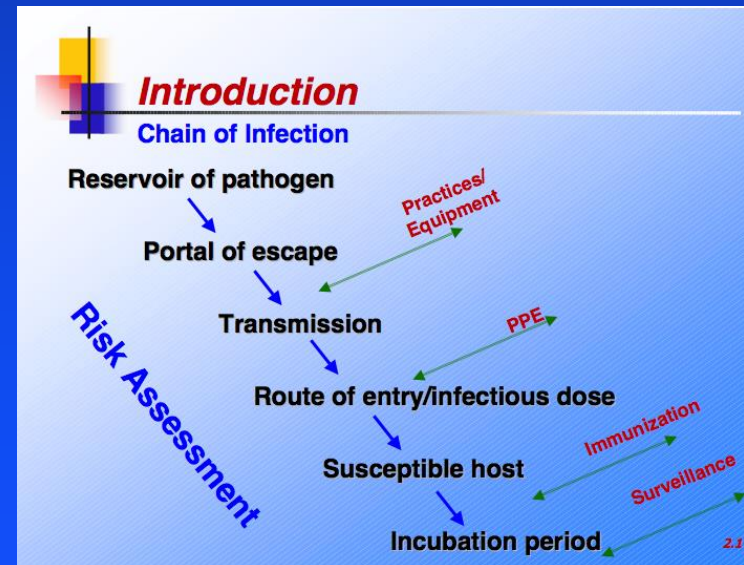
### ◆ Hazard Levels

☞ MSDS for Microbes

### ◆ Standard Microbiological Practices

### ◆ Special Practices

### ◆ Containment Equipment



# *Laboratory Containment Levels for Biological Research Involving Potential Biohazards*

## ■ *Infectious Agents*

- ◆ *Work may only be conducted with prior approval of the IBC regardless of the safety classification of the agent*
- ◆ *You must follow the requirements as specified in the CDC/NIH [Biosafety in Microbiological and Biomedical Laboratories Manual](#)*
- ◆ *Containment requirements may be subject to modification by the IBC*



# *Laboratory Containment Levels for Biological Research Involving Potential Biohazards*

## ■ Define the risk

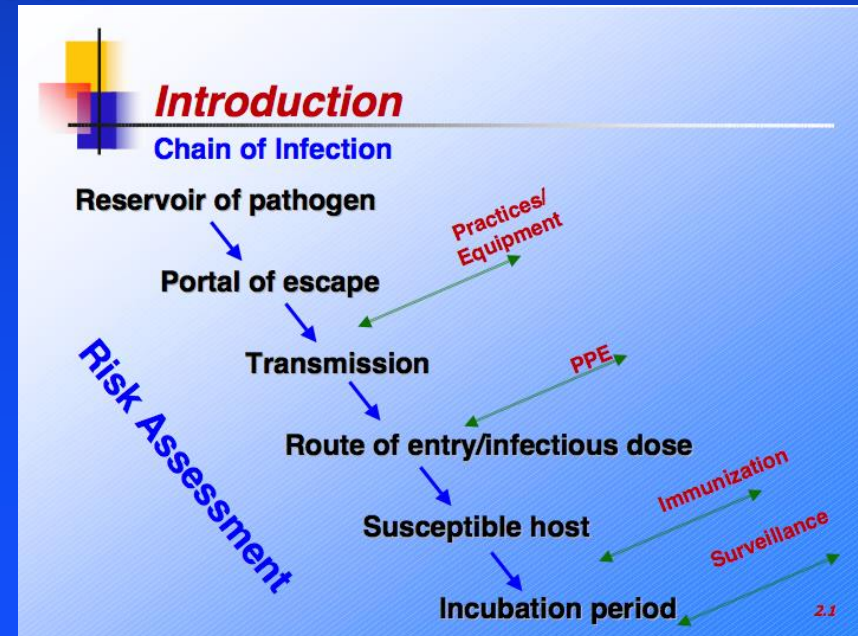
### ◆ Infectious Agents List

### ◆ Experimental Protocol

☞ How big ?

☞ Aerosols ?

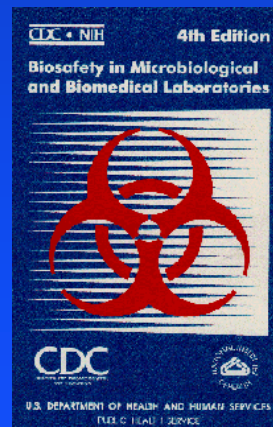
☞ Animals ?



# Laboratory Containment Levels for Biological Research Involving Potential Biohazards

## ■ SECTION II - Principles of Biosafety

- ◆ Recommended Biosafety Levels for Infectious Agents in the Laboratory
- ◆ Summary of Recommended Biosafety Levels for Activities in Which Experimentally or Naturally Infected Vertebrate Animals Are Used



<http://www.cdc.gov/od/ohs/biosfty/bmb14/bmb14toc.htm>

[PDF](#)

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Public Health Agency of Canada (PHAC)  
Material Safety Data Sheet - Infectious Substances  
SECTION I - INFECTIOUS AGENT  
NAME: Adenovirus types 1, 2, 3, 4, 5 and 7  
SYNONYM OR CROSS REFERENCE: ARD, acute respiratory disease, pharyngoconjunctival fever  
CHARACTERISTICS: Adenoviridae; non-enveloped, icosahedral virions, 70-90 nm diameter, double-stranded, linear DNA genome.  
SECTION II - HEALTH HAZARD  
PATHOGENICITY: Varies in clinical manifestation and severity; symptoms include fever, rhinitis, pharyngitis, tonsillitis, cough and conjunctivitis; common cause of nonbacterial exudative pharyngitis among children under 3 years; more severe diseases include laryngitis, croup, bronchitis, or severe pneumonia; a syndrome of pharyngitis and conjunctivitis (pharyngoconjunctival fever) is associated with adenovirus infection.  
EPIDEMIOLOGY: Worldwide; seasonal in temperate regions, with highest incidences in the fall, winter and early spring; in tropical areas, infections are common in the wet and colder weather; annual incidence is particularly high in children; adenovirus types 4 and 7 are common among military recruits (ARD).  
HOST RANGE: Humans  
INFECTIOUS DOSE: >150 plaque forming units, when given intranasally  
MODE OF TRANSMISSION: Directly by oral contact and droplet spread; indirectly by handkerchiefs, using utensils and other articles freshly soiled with respiratory discharge of an infected person; outbreaks have been related to swimming pools; possible spread through the fecal-oral route  
INCUBATION PERIOD: From 1-10 days  
COMMUNICABILITY: Shortly prior to and for the duration of the active disease  
SECTION III - DISSEMINATION  
RESERVOR: Humans

# *Laboratory Containment Levels for Biological Research Involving Potential Biohazards*

- Section III Laboratory- Biosafety Level Criteria
  - ◆ BSL 1, BSL 2, BSL 3, BSL 4
  - ◆ Comparison of Biological Safety Cabinets
- Section IV-Vertebrate Animal Biosafety Level Criteria
  - ☞ ABSL 1,
  - ☞ ABSL 2,
  - ☞ ABSL 3,
  - ☞ ABSL 4

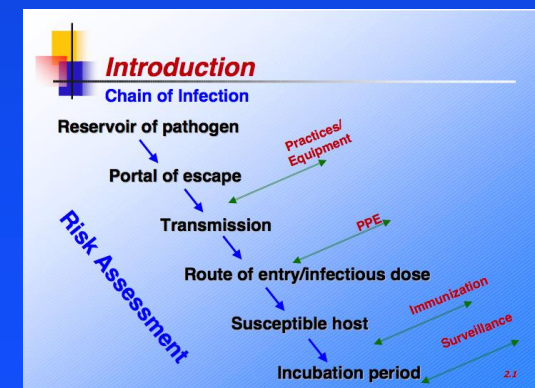
# *Laboratory Containment Levels for Biological Research Involving Potential Biohazards*

- **SECTION V** - Risk Assessment
- **SECTION VI**- Recommended Biosafety Levels For Infectious Agents and Infected Animals
- **Section VII**- Agent Summary Statements

<http://www.cdc.gov/od/ohs/biosfty/bmb14/bmb14s5.htm>

<http://www.cdc.gov/od/ohs/biosfty/bmb14/bmb14s6.htm>

<http://www.cdc.gov/od/ohs/biosfty/bmb14/bmb14s7.htm>





# Recombinant DNA, Gene Therapy and Transgenics

## Guidelines for Research Involving Recombinant DNA Molecules

Or in PDF at this site

- *Scope*
- *Safety*
- *Experiments Governed*
- *Roles and Responsibilities*

Effective June 24, 1994. Published in Federal Register, July 5, 1994 (59 FR 34496)  
Amendment Effective July 28, 1994. Federal Register, August 5, 1994 (59 FR 40170)  
Amendment Effective April 17, 1995. Federal Register, April 27, 1995 (60 FR 20729)  
Amendment Effective December 14, 1995. Federal Register, January 19, 1996 (61 FR 1482)  
Amendment Effective March 1, 1996. Federal Register, March 12, 1996 (61 FR 10004)  
Amendment Effective January 23, 1997. Federal Register, January 31, 1997 (62 FR 4782)  
Amendment Effective September 30, 1997. Federal Register, October 14, 1997 (62 FR 53335)  
Amendment Effective October 20, 1997. Federal Register, October 29, 1997 (62 FR 56196)  
Amendment Effective October 22, 1997. Federal Register, October 31, 1997 (62 FR 59032)  
Amendment Effective February 4, 1998. Federal Register, February 17, 1998 (63 FR 8052)  
Amendment Effective April 30, 1998. Federal Register, May 11, 1998 (63 FR 20018)  
Amendment Effective April 29, 1999. Federal Register, May 11, 1999 (64 FR 25361)  
Amendment Effective October 2, 2000. Federal Register, October 10, 2000 (65 FR 60328)  
Amendment Effective December 28, 2000. Federal Register, January 5, 2001 (66 FR 1146)  
Amendment Effective December 11, 2001. Federal Register, December 11, 2001 (66 FR 64051)  
Amendment Effective December 19, 2001. Federal Register, November 19, 2001 (66 FR 57970)  
Amendment Effective January 10, 2002. Federal Register, December 11, 2001 (66 FR 64052)  
Amendment Effective January 24, 2002. Federal Register, November 19, 2001 (66 FR 57970)

### NIH GUIDELINES FOR RESEARCH INVOLVING RECOMBINANT DNA MOLECULES (NIH GUIDELINES)

April 2002

Visit the OBA Web site at:

<http://www4.od.nih.gov/oba>

For current information on Guidelines, Protocols, Principal Investigators, Meetings, and information about upcoming Gene Therapy Policy Conferences

DEPARTMENT OF HEALTH AND HUMAN SERVICES  
National Institutes of Health  
Guidelines for Research Involving Recombinant DNA Molecules (NIH Guidelines)

These NIH Guidelines supersede all earlier versions and shall be in effect until further notice.

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# Recombinant DNA, Gene Therapy and Transgenics

## Guidelines for Research Involving Recombinant DNA Molecules

- *Classification of Human Etiologic Agents on the Basis of Hazard*
  - ◆ Appendix B-I. Risk Group 1 (RG1) Agents
  - ◆ Appendix B-II. Risk Group 2 (RG2) Agents
  - ◆ Appendix B-III. Risk Group 3 (RG3) Agents
  - ◆ Appendix B-IV. Risk Group 4 (RG4) Agents

Effective June 24, 1994. Published in Federal Register, July 5, 1994 (59 FR 34496)  
Amendment Effective July 28, 1994. Federal Register, August 5, 1994 (59 FR 40170)  
Amendment Effective April 17, 1995. Federal Register, April 27, 1995 (60 FR 20730)  
Amendment Effective December 14, 1995. Federal Register, January 10, 1996 (61 FR 1482)  
Amendment Effective March 1, 1996. Federal Register, March 12, 1996 (61 FR 60024)  
Amendment Effective January 23, 1997. Federal Register, January 31, 1997 (62 FR 4762)  
Amendment Effective September 30, 1997. Federal Register, October 14, 1997 (62 FR 53395)  
Amendment Effective October 29, 1997. Federal Register, October 29, 1997 (62 FR 56196)  
Amendment Effective October 22, 1997. Federal Register, October 31, 1997 (62 FR 50022)  
Amendment Effective February 26, 1998. Federal Register, February 17, 1998 (63 FR 60521)  
Amendment Effective April 30, 1998. Federal Register, May 11, 1998 (63 FR 26018)  
Amendment Effective April 28, 1999. Federal Register, May 11, 1999 (64 FR 25261)  
Amendment Effective October 2, 2000. Federal Register, October 10, 2000 (65 FR 60328)  
Amendment Effective December 28, 2000. Federal Register, January 5, 2001 (66 FR 11465)  
Amendment Effective December 11, 2001. Federal Register, December 11, 2001 (66 FR 64051)  
Amendment Effective December 10, 2001. Federal Register, November 19, 2001 (66 FR 57670)  
Amendment Effective January 10, 2002. Federal Register, December 11, 2001 (66 FR 64052)  
Amendment Effective January 24, 2002. Federal Register, November 19, 2001 (66 FR 57670)

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# Recombinant DNA, Gene Therapy and Transgenics

## Guidelines for Research Involving Recombinant DNA Molecules

### ■ Physical and Biological Containment for Recombinant DNA Research Involving Animals

#### ◆ Appendix Q-I. General Considerations

##### ☞ Appendix Q-I-A. Containment Levels

##### ☞ Appendix Q-I-B. Disposal of Animals (BL1-N through BL4-N)

##### ☞ Appendix Q-II. Physical and Biological Containment Levels

##### ☞ Appendix Q-II-A. Biosafety Level 1 - Animals (BL1-N)

##### ☞ Appendix Q-II-B. Biosafety Level 2 - Animals (BL2-N)

##### ☞ Appendix Q-II-C. Biosafety Level 3 - Animals (BL3-N)

##### ☞ Appendix Q-II-D. Biosafety Level 4 - Animals (BL4-N)

##### ☞ Appendix Q-III. Footnotes and References for Appendix Q

Effective June 24, 1994. Published in Federal Register, July 5, 1994 (59 FR 34496)  
Amendment Effective July 29, 1994. Federal Register, August 5, 1994 (59 FR 40170)  
Amendment Effective April 17, 1995. Federal Register, April 27, 1995 (60 FR 20726)  
Amendment Effective December 14, 1995. Federal Register, January 19, 1996 (61 FR 1482)  
Amendment Effective March 1, 1996. Federal Register, March 12, 1996 (61 FR 10024)  
Amendment Effective January 23, 1997. Federal Register, January 31, 1997 (62 FR 4762)  
Amendment Effective September 30, 1997. Federal Register, October 14, 1997 (62 FR 6135)  
Amendment Effective October 20, 1997. Federal Register, October 29, 1997 (62 FR 6181)  
Amendment Effective October 22, 1997. Federal Register, October 30, 1997 (62 FR 5652)  
Amendment Effective February 4, 1998. Federal Register, February 17, 1998 (63 FR 652)  
Amendment Effective April 30, 1998. Federal Register, May 11, 1998 (63 FR 20218)  
Amendment Effective April 29, 1999. Federal Register, May 11, 1999 (64 FR 22017)  
Amendment Effective October 2, 2000. Federal Register, October 10, 2000 (65 FR 63328)  
Amendment Effective December 28, 2000. Federal Register, January 5, 2001 (66 FR 1184)  
Amendment Effective December 11, 2001. Federal Register, December 11, 2001 (66 FR 64051)  
Amendment Effective December 19, 2001. Federal Register, November 19, 2002 (67 FR 57670)  
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# Recombinant DNA, Gene Therapy and Transgenics

## Guidelines for Research Involving Recombinant DNA Molecules

### ■ What's Exempt?

#### ◆ See section III F (page 20 NIH Guide (April 02))

- ☞ Those that are not in organisms or viruses
- ☞ Those that consist entirely of DNA segments from a single non-chromosomal or viral DNA source, though one or more of the segments may be synthetic
- ☞ Those that consist entirely of DNA from a prokaryotic host including its indigenous plasmids or viruses when propagated in that host (or a closely related strain of the same species), or when transferred to another host by well established physiological means.
- ☞ Those that consist entirely of DNA from a eukaryotic host including its indigenous chloroplasts, mitochondria or plasmids (excluding viruses) when propagated in that host.

Effective June 24, 1994. Published in Federal Register, July 5, 1994 (59 FR 34198)  
Amendment Effective July 28, 1994. Federal Register, August 5, 1994 (59 FR 49173)  
Amendment Effective April 17, 1995. Federal Register, April 27, 1995 (60 FR 20726)  
Amendment Effective December 14, 1995. Federal Register, January 19, 1996 (61 FR 1482)  
Amendment Effective March 1, 1996. Federal Register, March 12, 1996 (61 FR 10004)  
Amendment Effective January 23, 1997. Federal Register, January 31, 1997 (62 FR 4782)  
Amendment Effective September 30, 1997. Federal Register, October 14, 1997 (62 FR 5335)  
Amendment Effective October 20, 1997. Federal Register, October 29, 1997 (62 FR 56196)  
Amendment Effective October 22, 1997. Federal Register, October 31, 1997 (62 FR 59532)  
Amendment Effective February 4, 1998. Federal Register, February 17, 1998 (63 FR 8052)  
Amendment Effective April 30, 1998. Federal Register, May 11, 1998 (63 FR 20018)  
Amendment Effective April 23, 1999. Federal Register, May 11, 1999 (64 FR 23361)  
Amendment Effective October 2, 2000. Federal Register, October 10, 2000 (65 FR 60228)  
Amendment Effective December 28, 2000. Federal Register, January 5, 2001 (66 FR 1148)  
Amendment Effective December 11, 2001. Federal Register, December 11, 2001 (66 FR 64051)  
Amendment Effective December 15, 2001. Federal Register, November 19, 2001 (66 FR 57570)  
Amendment Effective January 10, 2002. Federal Register, December 11, 2001 (66 FR 64052)  
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#### ◆ Bottom line... PCR and gel running..



# Biosafety at MUSC

## ■ *Questions Unit 3*

- ◆ How to determine the relative biosafety risk associated with a planned experiment

