A Formal Biological Risk Assessment with Containment Matrix

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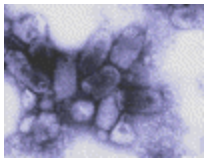
About Me

25 years experience in the animal health vaccine industry dealing with biological safety

Need for Formal Risk Assessment

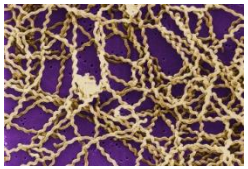
In the veterinary vaccine industry well-characterized Risk Group 2 and 3 agents are used, such as:

- **Viral agents, i.e., Rabies Virus**
- **Protozoal agents, such as *Leishmania***



New York State Department of Public Health

- **Bacteria such as *Leptospira spp.***



Centers for Disease Control/Rob Weyant

Need for Formal Risk Assessment

Work is also performed with less well characterized agents, such as:

- ***Chlamydophila felis*** **(feline chlamydia)**
- ***Bordatella bronchiseptica***
- **Feline leukemia virus**

CDC/Dr. William A. Clark

Need for Formal Risk Assessment

Those organisms whose zoonotic potential is not as well understood can be much more problematic to work with.

Need for Formal Risk Assessment

Lack of sufficient risk characterization leads to the following:

- **Use of inappropriate containment**
- **Erroneous information circulated**
- **Ongoing employee issues and concerns**

Need for Formal Risk Assessment

Nature Abhors a Vacuum !

A lack of information on an agent will be filled, but that information may end up being inaccurate.

Need for Formal Risk Assessment

Example:

An animal health facility handled a strain of bacteria which is generally considered to be non-infectious to healthy human adults.

Need for Formal Risk Assessment

However:

- **The facility misinterpreted the taxonomy of the agent.**
- **An employee became ill the day after working with the organism for the first time.**

Need for Formal Risk Assessment

The Result:

BSL 3 containment was used unnecessarily for work with the agent for many years.

Need for Formal Risk Assessment

It was determined that there was a need to formally assess and document the risk associated with organisms handled at the site.

Need for Formal Risk Assessment

3 OBJECTIVES:

- **Classification of the organism on the basis of risk**
- **Determination of the appropriate containment level**
- **Supporting documentation of RG and BSL**

Need for Formal Risk Assessment

Nothing was found that met the specific needs of the veterinary biologicals industry, however, so a risk assessment form was developed.

The Risk Assessment Document

PART ONE – RISK GROUP CLASSIFICATION

Part One – Risk Group Classification

STEP 1

Research the Organism to Obtain the Following Information:

Part One – Risk Group Classification

- **Proper name of organism, including serotype, strain, etc.**
- **Type of organism**
- **Origin**
- **Host species, including human pathogenicity**

Part One – Risk Group Classification

- **Any unique features of the organism, e.g., attenuation, unusual virulence**
- **Geographical range of the organism**
- **Pathogenicity**
- **Route of transmission**

Part One – Risk Group Classification

- **Stability in the environment**
- **Disinfectants that are effective against the organism**
- **Availability of effective treatments or prophylaxis**

Part One – Risk Group Classification

STEP 2

If the organism is genetically modified, refer to the, "*NIH Guidelines for Research Involving Recombinant DNA Molecules (NIH Guidelines)*"

Part One – Risk Group Classification

STEP 3

Search for Published Risk Group Classifications

- **CDC/NIH BMBL**
- **WHO Publication, *"Laboratory Biosafety Manual"***
- **ABSA website**

Part One – Risk Group Classification

STEP 4

Perform a literature search.

For Example:

American Journal of Veterinary Research

http://avmajournals.avma.org/loi/ajvr

Part One – Risk Group Classification

Assign risk group classification accordingly.

Biological Risk Assessment Worksheet

PART 2 – BIOSAFETY LEVEL DETERMINATION

CONTAINMENT MATRIX

Blank Containment Matrix

	BSL 1	BSL 2	BSL 3	BSL 4*	COMMENTS
Risk Group Classification	RG 1	RG 2	RG 3	RG 4	
Route of Transmission	NA – Not usually infectious to humans.	Parenteral injection, mucosal contact, or ingestion.	Same as BSL 2 plus inhalation of aerosols.	Same as BSL 3 includes human to human transmission.	
Host Species	Does not include humans.	Humans.	Humans.	Humans.	
Mortality in Humans	NA	Rarely fatal.	Sometimes fatal.	Almost always fatal.	
Stability of Organism in Environment	Fragile in environment	Consider BSL 2 for RG 1 organism if organism is highly stable under normal environmental conditions.	Same as BSL 2.	NA	The recommendations are intended to prevent contamination of other projects within the facility.
Resistance to Disinfectants	Susceptible to a wide variety of disinfectants.	Consider BSL 2 for RG 1 organisms if organism is highly resistant to chemical disinfectants.	Same as BSL 2.	NA	The recommendations are intended to prevent contamination of other projects within the facility.
Treatment or Prophylaxis for Humans Available?	NA	Yes	No	No	
Origin	Endemic	Endemic	Endemic or Exotic	Exotic	
Risk to Laboratorians	Low	Low to Moderate	Moderate to High	Extremely High	
Risk to Community	Low	Low	Moderate to High	Extremely High	
Risk to Agricultural Community	Low (endemic organism)	Moderate (endemic organism)	Moderate to High (may be exotic organism)	Extremely High (exotic, high consequence animal pathogen)	
Large Scale Replication – Closed Systems	If using closed systems for large scale manufacturing (e.g., fermentors, bioreactors, etc.), consider use of Large Scale Biosafety Guidelines, as found in the American Society of Microbiology website http://www.asm.org/Policy/index.asp?bid=13634 or Appendix K of the NIH GUIDELINES FOR RESEARCH INVOLVING RECOMBINANT DNA MOLECULES (NIH GUIDELINES) http://oba.od.nih.gov/oba/rac/guidelines_02/Appendix_K.htm				
Attenuation or Reversion to Virulence	Attenuation of organism (i.e., vaccine strain) may allow reduction of containment level, whereas a potential for return to virulence may require use of a higher biosafety containment level.				
Infection of Host Species with Organism	Infection of animals considered to be host species for the organism in question may require use of a higher biosafety level if the work is likely to result in viral amplification. For instance, infection of chick embryos with one of the encephalitides should be performed using BSL 3 containment due to amplification of the virus which, in turn, greatly increases the virulence of the organism and allows transmission via inhalation of aerosols.				
Influenza A Virus?	Consider BSL 2 containment at minimum for Influenza A viruses, particularly if they are administered to swine or avian species, due to their ability to mutate rapidly.				

Containment Matrix

Risk Group Classification	RG 1	RG 2	RG 3	RG 4
Route of Transmission	Not usually infectious to humans	Parenteral injection, mucosal contact, or ingestion	Same as BSL 2 plus inhalation of aerosols	Same as BSL 3
Host Species	Does not include humans	Humans	Humans	Humans

Containment Matrix

Mortality in Humans	NA	Rarely fatal	Sometimes fatal	Almost always fatal
Stability of Organism in Environment	Fragile	Consider BSL 2 for if organism is hardy	Same as BSL 2	NA

Containment Matrix

Resistance to Disinfectants	**Low**	**High**	**High**	**NA**
Treatment or Prophylaxis for Humans Available?	**NA**	**Yes**	**No**	**No**
Origin	**Endemic**	**Endemic**	**Endemic or Exotic**	**Exotic**

Containment Matrix

Risk to Laboratorians	Low	Low to Moderate	Moderate to High	Extremely High
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Containment Matrix

Large Scale Replication – Closed Systems	**If using closed systems for large scale manufacturing consider use of Large Scale Biosafety Guidelines.**
Attenuation or Reversion to Virulence	**Attenuation or increased virulence may change biosafety level.**

Containment Matrix

Infection of Host Species with Organism	Infection of a natural host species may require use of a higher biosafety level.
Influenza A Virus?	**Consider BSL 2 containment at minimum for Influenza A viruses, particularly if they are administered to swine or avian species.**

Completed Containment Matrix

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Questions?