

# Containment and Security Challenges Associated with Plant Research in the Lab and Field

Jim Stack

Kansas State University

American Biological Safety Association

Alexandria, VA

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# Wheat Blast in South America



- 100s of thousands of hectares no longer planted to wheat due to wheat blast
- Brazilian farmers required to use wheat blast forecasting model to obtain loans for wheat seed

*Adapted from Man Mohan Kohli, "Pyricularia blast: a threat to wheat cultivation"*



# Wheat Blast in South America



- Head blast without leaf symptoms is common – unlike rice blast
- Source of inoculum unknown

*Slide from Andreas von Tiedemann & Etienne Duveiller*



# Wheat Blast in South America

Londrina, Paraná , August 2009

- Resistance wheat cultivars are not commercially available
- Chemical control is not effective
- Climate change predicted to favor spread

*Slide from Andreas von Tiedemann & Etienne Duveiller*

# Terminology

- Biosafety 

These terms are used to mean different things in the literature within and among areas of specialization.
- Biosecurity 

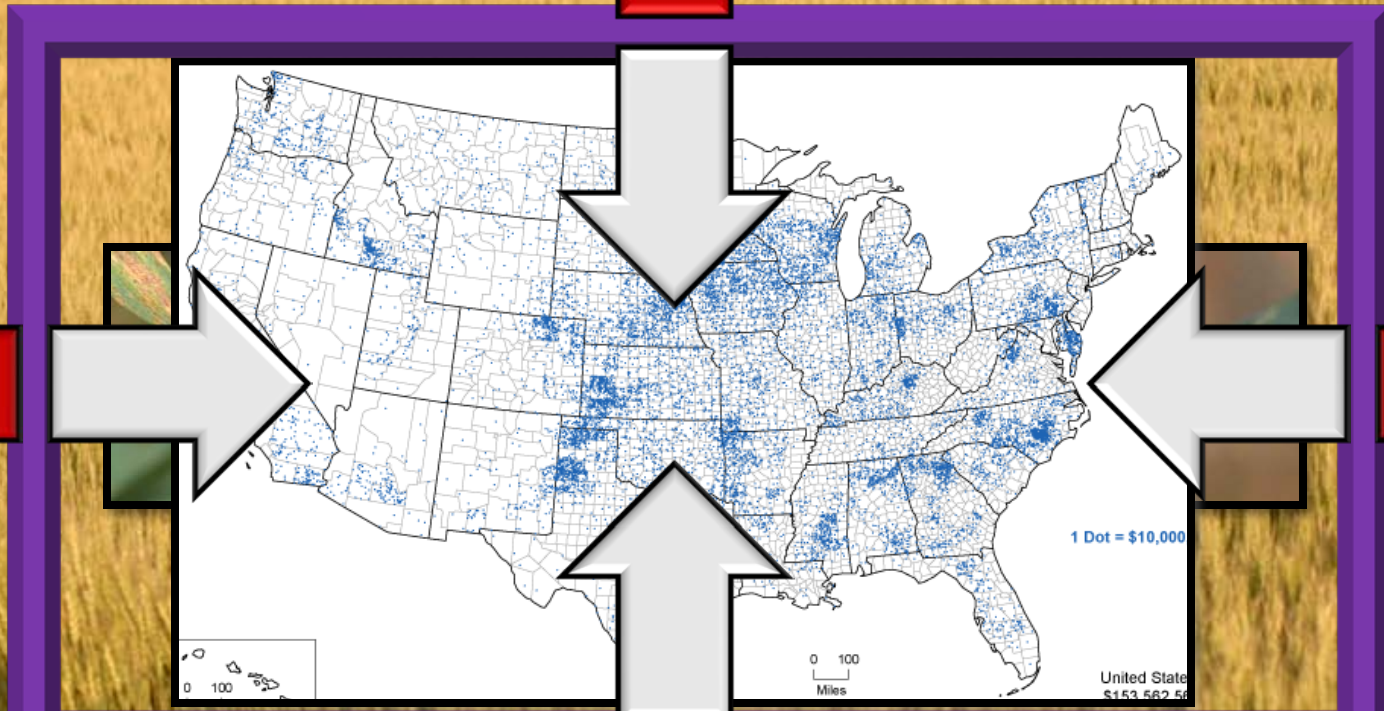
In plant systems, differences can be found among journals, regulatory and research communities, and between countries.
- Biocontainment





# Biosecurity is fundamentally about:

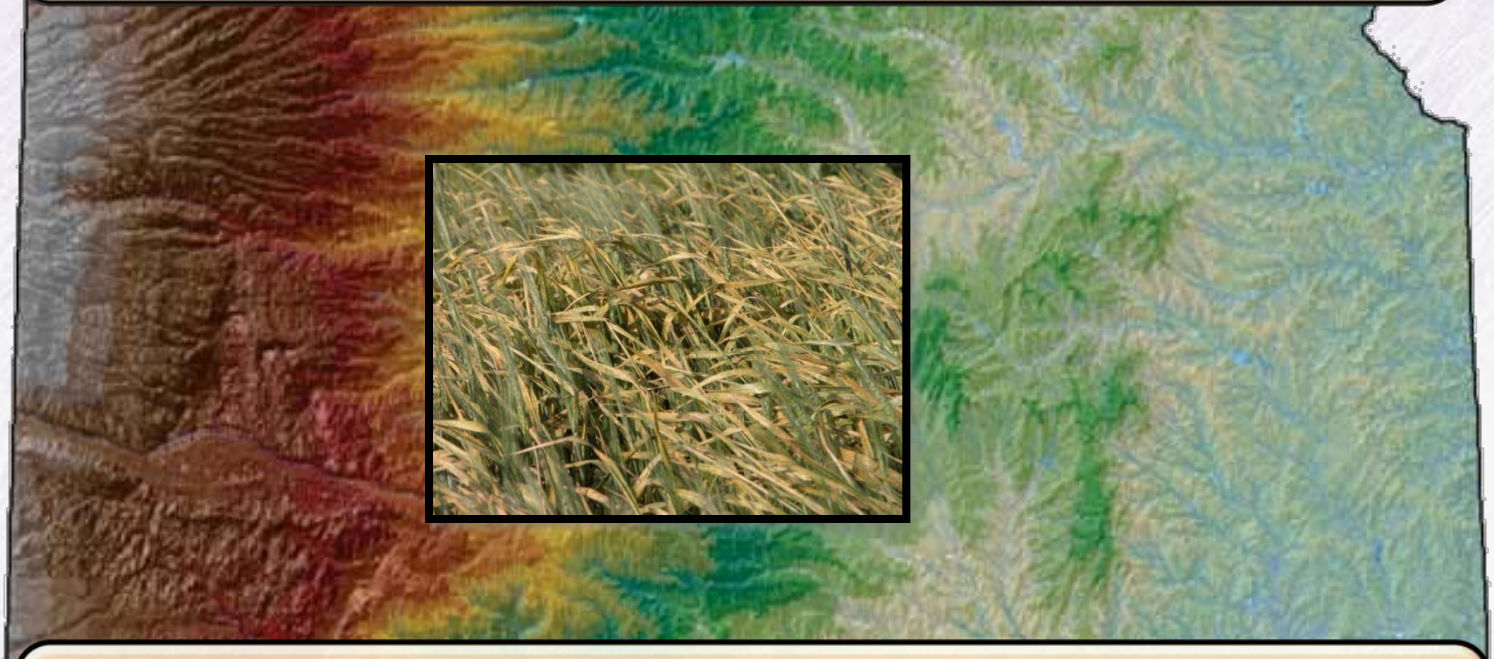
## Exclusion



### Concept applies across all scales

## Plant Biosecurity: ....

.... keeping specific organisms confined to certain areas



.... keeping certain areas free of specific organisms.



## Laboratory Biosecurity: ....



ensuring that organisms cannot escape from a laboratory.



# Terminology

- Confinement of a specific organism to a specific area/space or object
  - Lab, field, county, etc.
  - Controlled environment chamber, freezer, etc.
- Should temporal aspect be considered?
  - Confinement of a specific organism to a specific area or object for growing season
  - Confinement of a specific organism to a specific area or object for five years (e.g., Karnal Bunt)



# Terminology

- Attained through the application of:
  - Infrastructure
  - Technologies
  - Standardized Protocols
  - Human Behavior
- Biocontainment and risk
  - Zero risk (no zero risk scenario)
  - Possible risk (not practical)
  - Probable risk (pathway analysis analogy)





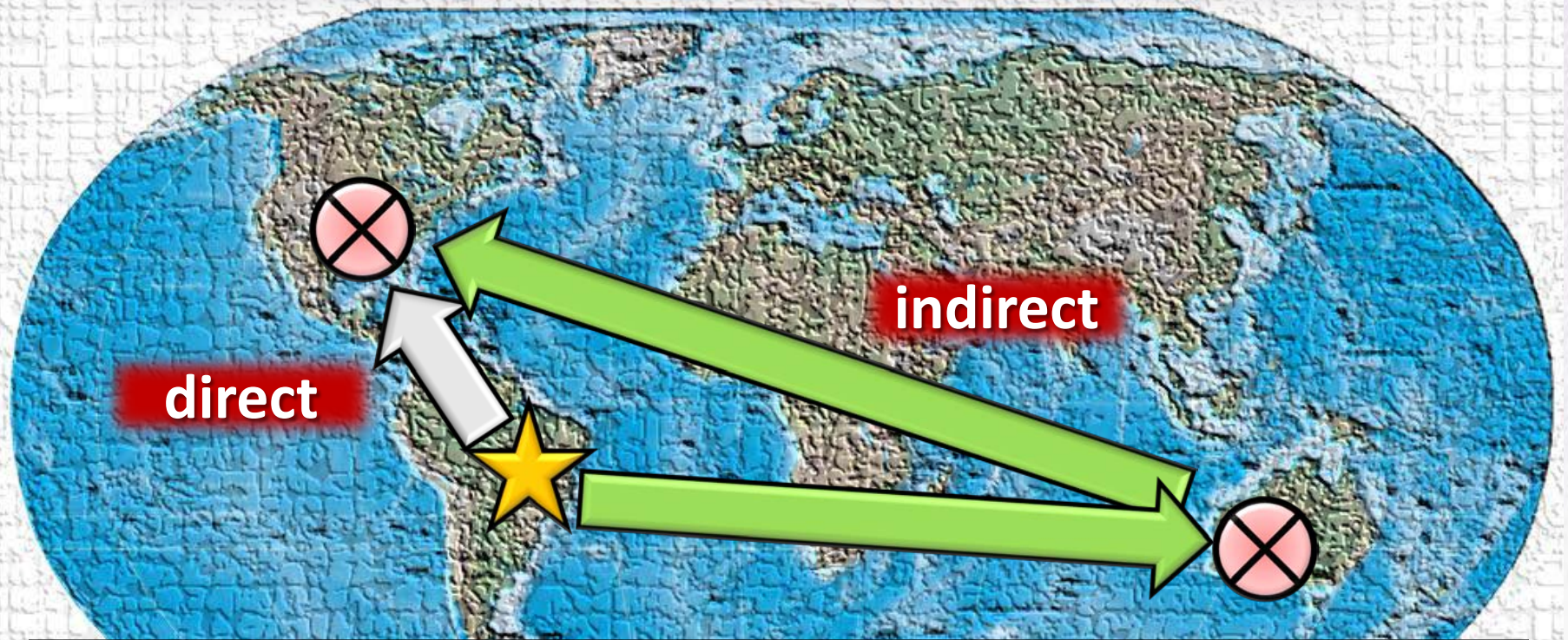
# Pathway Analysis Considerations

- Pathway Mechanisms:
  - Natural (weather events, vectors)
  - Accidental (trade, travel)
- Pathogen Attributes
  - Dispersal mechanisms
  - Survival mechanisms
  - Reproduction strategy and capacity (r vs k)





# Pathway Analysis



- Are there pathways for pathogen to get from source to target?





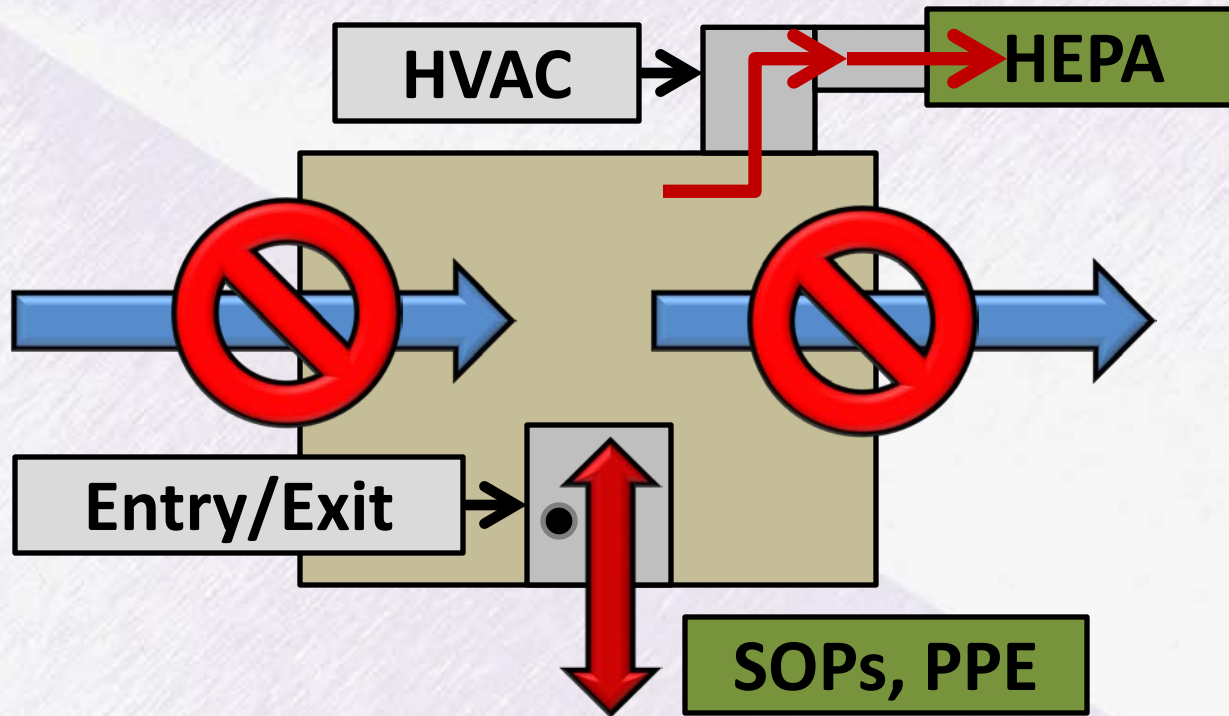
# Bio-Containment

- Confinement of a specific organism to a specific area/space or object
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- Should temporal aspect be considered?
  - Confinement of a specific organism to a specific area or object for growing season
  - Confinement of a specific organism to a specific area or object for five years (e.g., Karnal Bunt)
  - Is forever a reasonable goal?



# Bio-Containment - LAB

- Do pathways exist for entry or escape?



- Do mitigation measures exist to prevent entry/escape?

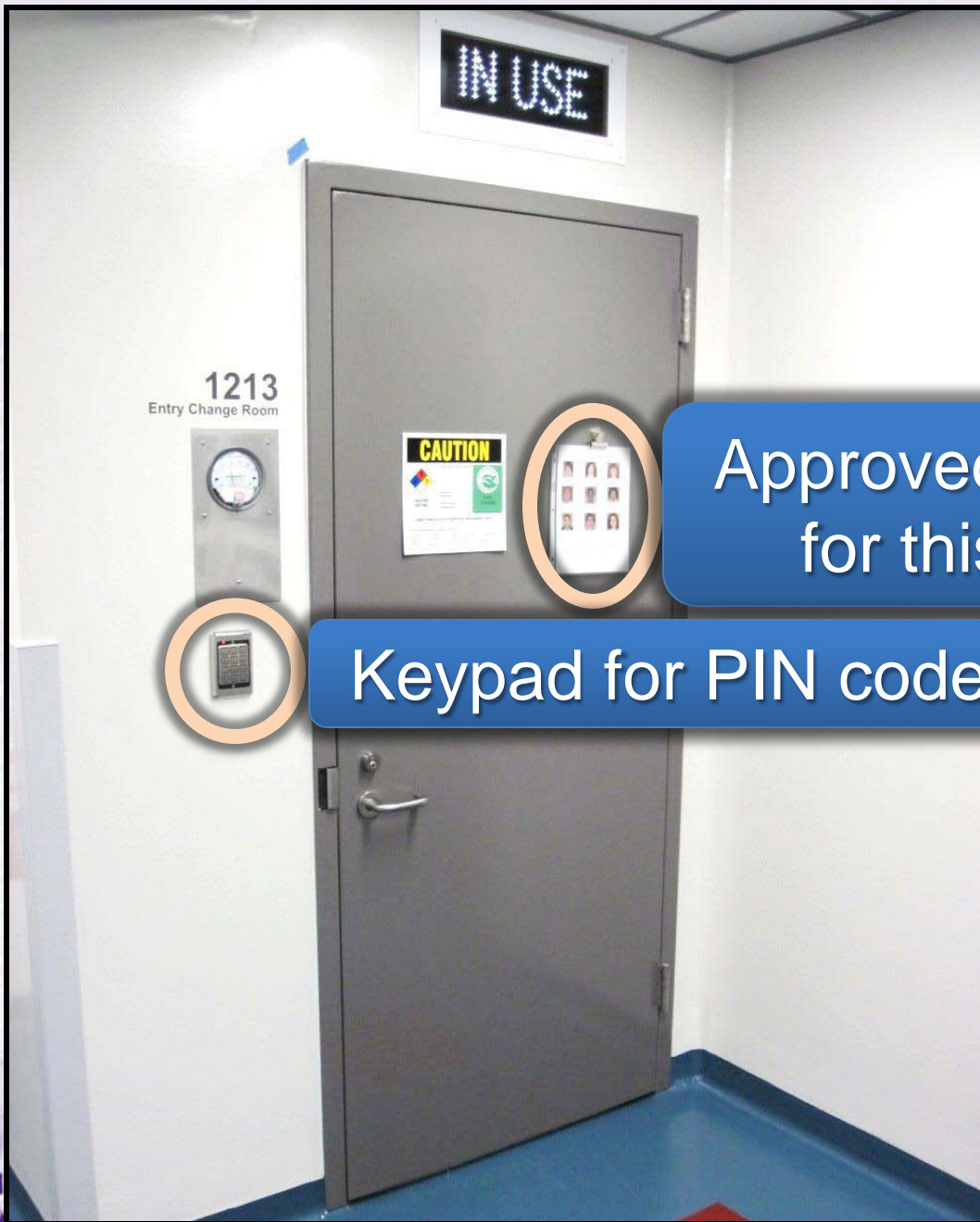




# K-State Biosecurity Research Institute



- Individual security PIN code access
- Hallway security cameras
- Centralized shower out
- HEPA filtration of exhaust air



Approved roster  
for this lab

Keypad for PIN code control



# CAUTION



**HAZARD  
RATING**

## PPE Required for Entry

- Standard Containment Clothing \_\_\_\_\_
- Lab Coat \_\_\_\_\_
- Gloves \_\_\_\_\_
- Eye Protection \_\_\_\_\_
- Respirator \_\_\_\_\_
- ~~Shoe Covers~~ Disposable Hood
- ~~Rubber Boots~~ TO COVER HAIR
- Face Protection \_\_\_\_\_
- ~~Blue Tyvek Suit~~ FACIAL HAIR
- ~~White Tyvek Suit~~ COVER
- Green Suits \_\_\_\_\_



**PLANT  
PATHOGEN**

# Personal Protective Equipment





# Plant Inoculations

Laboratory has HEPA air filtration and all lab staff exit lab through shower block

HEPA filter →

← air flow

spray  
inoculation

Minimize pathogen dispersal within lab



autoclave bag is sealed

The image shows a large, crumpled orange plastic bag. A white marker is visible on the surface of the bag. A blue arrow points from the text box to the neck of the bag where it is being sealed.

All soil, plant materials,  
and potting materials  
placed into autoclave b



bag is surface disinfested

The image shows a red plastic bag with a biohazard symbol and the text 'BIOHAZARD (INFECTIOUS)' printed on it. A yellow label is attached to the top of the bag. A blue arrow points from the text box to the yellow label. The bag is sitting on a white surface next to a white spray bottle.



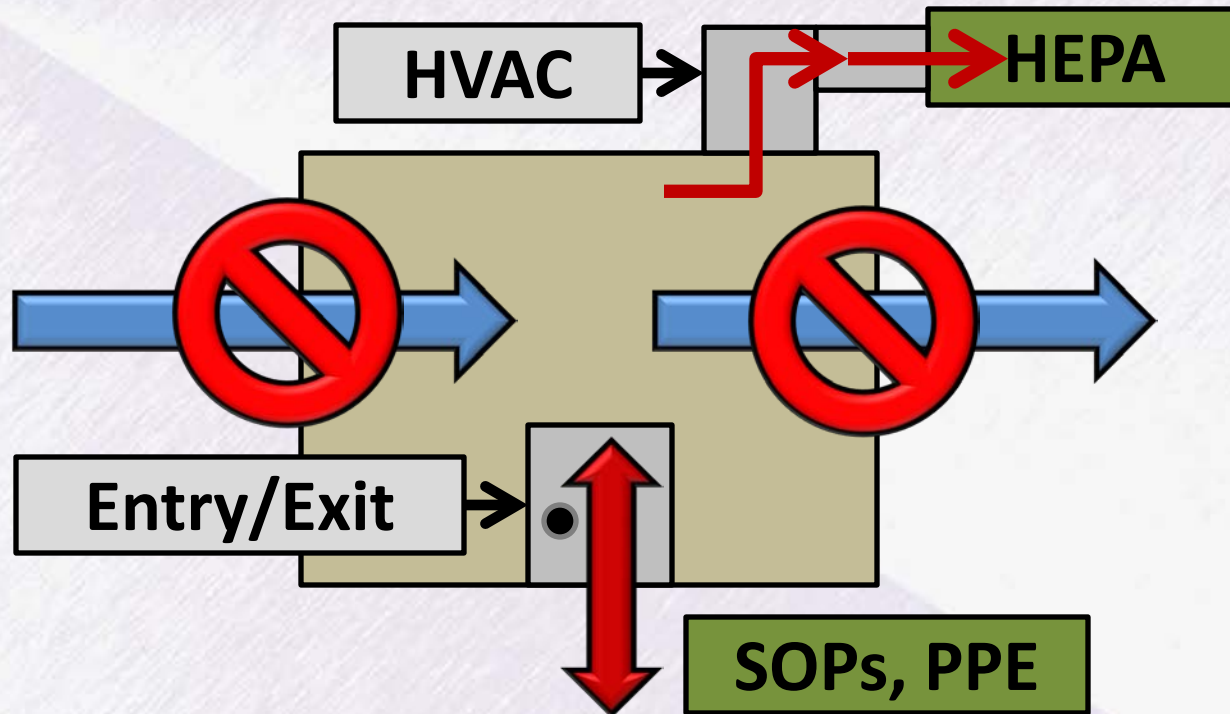
# Waste Sterilization



**All waste is autoclaved before leaving containment.**

# Bio-Containment - FIELD

- Do pathways exist for entry or escape?



- Do mitigation measures exist to prevent entry/escape?





# Quarantine Zones



# Farm Biosecurity





# Border Protection

**YOU MAY BE  
TRAFFICKING  
PESTS & DISEASES**

Do not travel into South Australia with fruit and vegetables.  
You may be carrying pests and diseases.

**FINES & PENALTIES APPLY**  
Call the Fruit Fly Hotline 1300 666 010  
[www.pir.sa.gov.au/fruitlefly](http://www.pir.sa.gov.au/fruitlefly)

 Government of South Australia  
Biosecurity SA

**NE HOLD QUARANTINE HOLD QUARANTINE H**

**EAT IT, BIN IT, OR DECLARE IT.**



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# Field Containment



**Disinfestation of shoes at exit.**

**Several documented cases of pathogen movement on shoes and clothing.**



# Field Test at Isolated Site



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# Field Test at Isolated Site

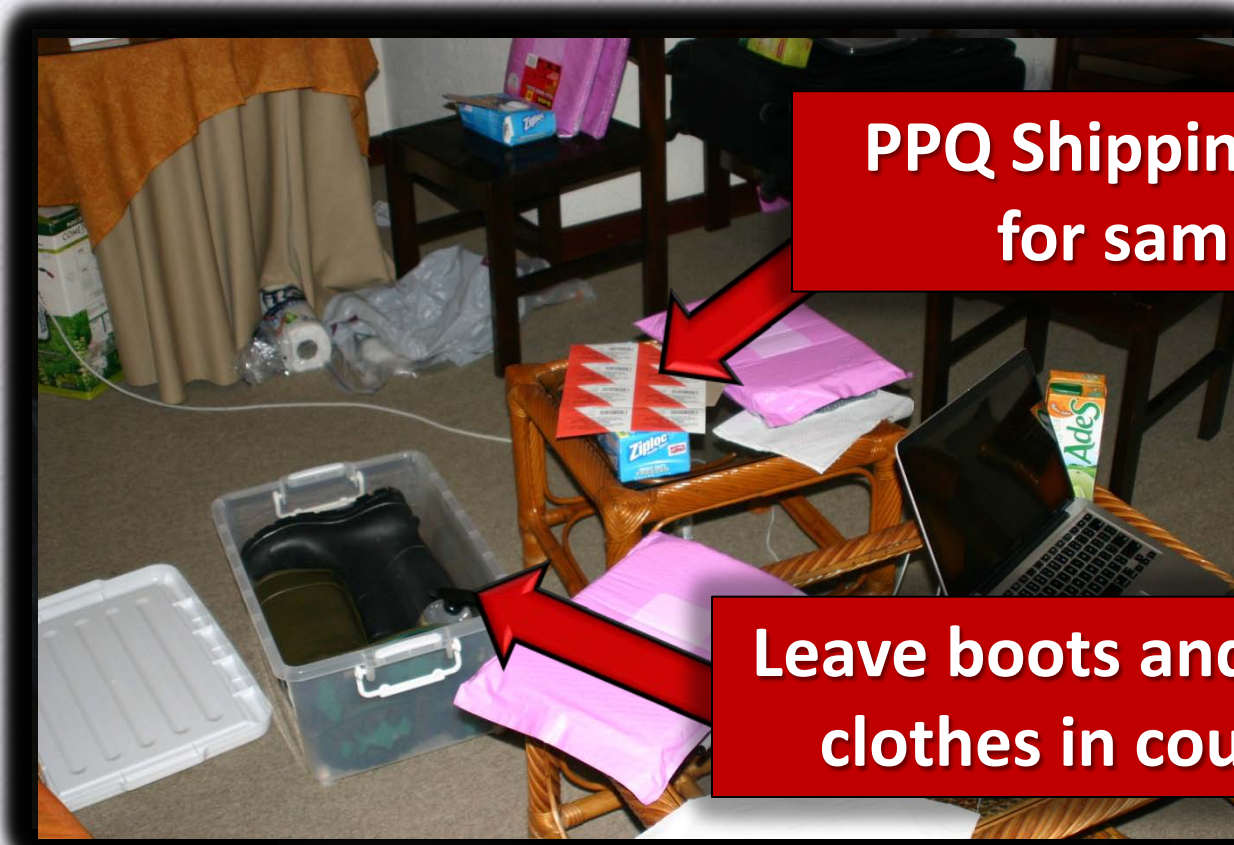




# Field Test at Isolated Site



# Field Test at Isolated Site - Samples



**PPQ Shipping Labels  
for samples**

**Leave boots and some  
clothes in country**





# Biosecurity Preparedness Plan

## Preparedness

### Before departure

#### Pack and carry:

- Field clothes
- Field shoes
- Latex gloves
- Autoclave bag
  - Tape
- Digital camera

#### Investigate:

- Carry forward concerns
- Carry back concerns

## Preparedness

### In country

#### Purchase:

- Disinfectant
- Trash bags
- Paper towels
  - Bleach
  - Ziplocks
- Backpack

#### Confirm:

- Carry forward concerns
- Carry back concerns

## Practice

### Field Test Site

#### Site inspection:

1. Don PPE
2. Inspect *unaffected* areas 1<sup>ST</sup>
3. Collect *unaffected* samples
4. Inspect *affected* areas 2<sup>ND</sup>
5. Collect *affected* samples
6. Disinfect all tools then bag
7. Bag clothes & shoes

#### Before departure:

1. Surface disinfect all tools (e.g., cameras, eye glasses)
2. Package samples according to permit conditions
3. Shower

# Conclusions

- BRI is a secure biocontainment laboratory to study high consequence plant pathogens.
- HEPA air filtration, waste decontamination infrastructure and protocols, use of PPE and strict operating protocols, and showering out of lab prevent the pathogen from escaping.





# Conclusions

- **Biosecurity principles for international travel and field research:**
  - don't bring any pathogens with you,
  - don't spread any pathogens around while there,
  - don't bring any pathogens back.



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## Questions or Comments?

*Thank you &  
Have a nice day!*

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