豬病防疫最新技術

張文發

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Biosecurity 101
(生物安全101)

Pork Academy

World Pork Expo

June 3, 2009

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Iowa State University

Goals(目標)

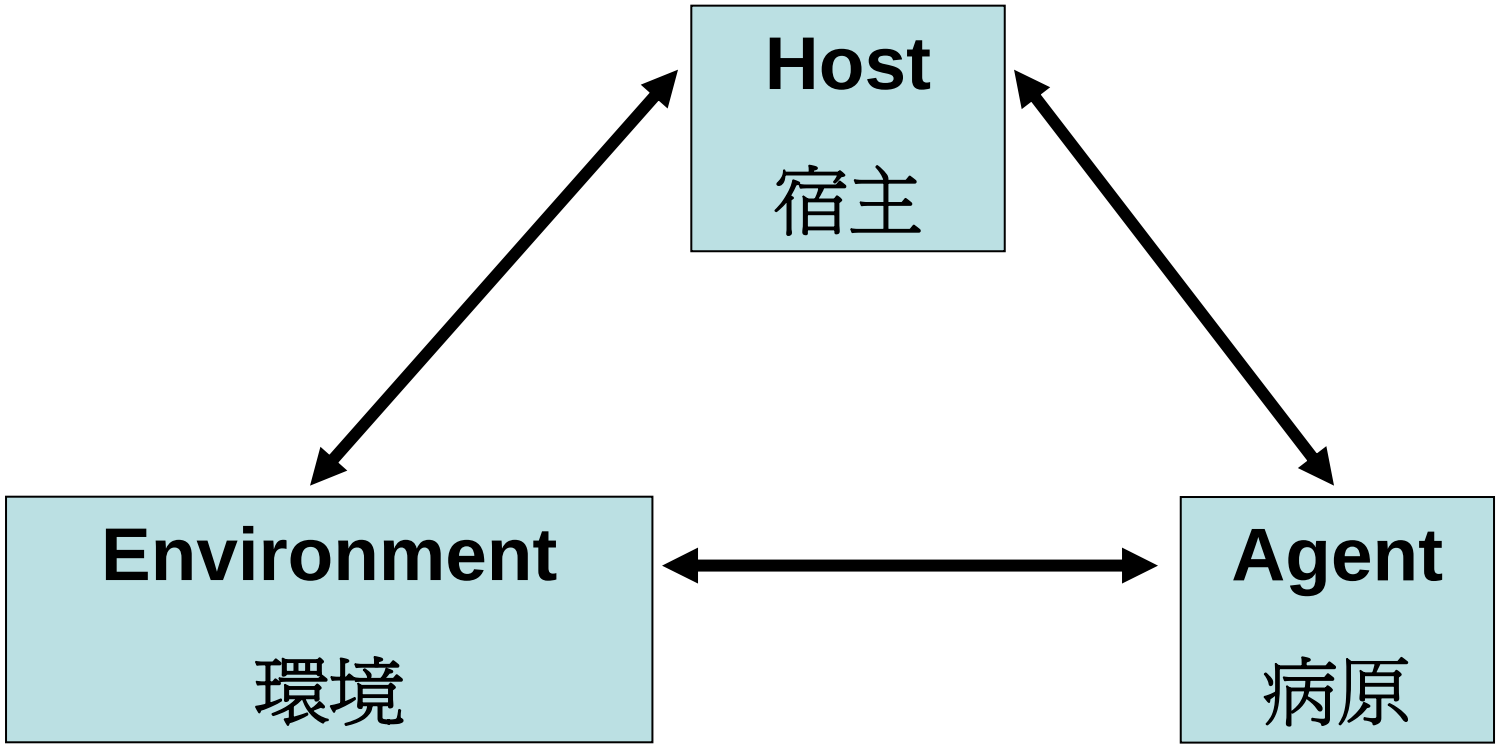
- Discuss the foundations for biosecurity
- 討論生物安全的基本原則
- Provide some science behind recommendations
- 提供建議背後的一些科學根據
- Provide some resources
- 提供資源

Biosecurity(生物安全)

- Definition: The steps or process for disease prevention.
- 定義:疾病預防的步驟或過程
  - External - New Introductions
  - Internal - Spread within an operation
  - 外源的-新引入
  - 內源的-在豬場內傳播
- Not all risk can be eliminated!
- 不是所有的危險因子都可以被排除
  - BRM – Biological Risk Management
  - BRM- 生物性危險管理
- Work to minimize the opportunities
- 將任何可能性最小化

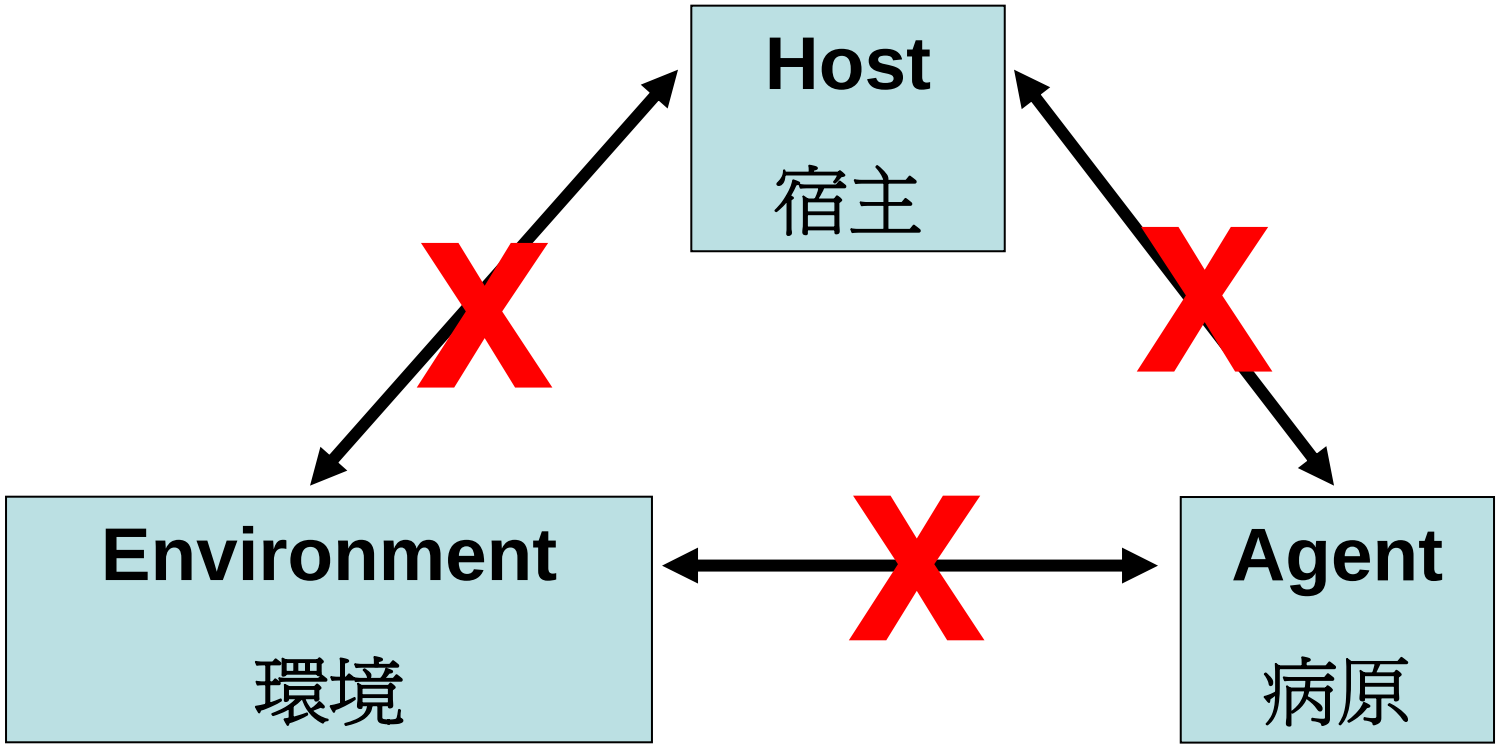
BRM – Foundation
BRM– 基本原則

- Disease triad(疾病三部曲)



BRM – Foundation
BRM– 基本原則

- Disease triad (疾病三部曲)



BRM – Foundation
BRM– 基本原則

- Three basic things to consider:
- 三個需要考慮的基本事情:

1) Need to have a disease agent present

   需要有病原的存在

   - Live(活病原)
   - Sufficient numbers(充足的數量)

2) Need to have a susceptible host

   需要具敏感性的宿主

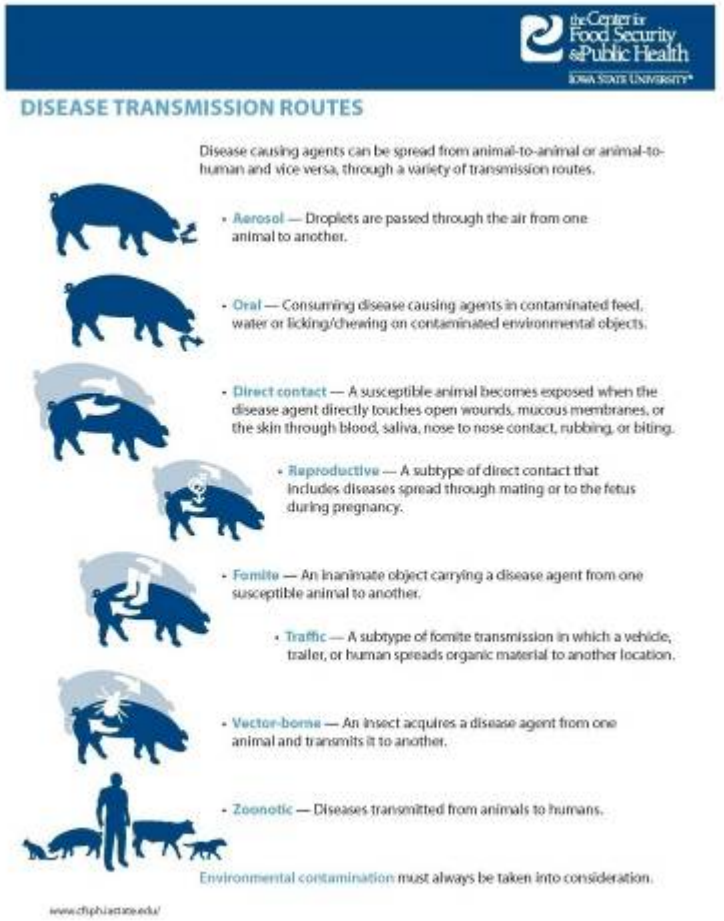
3) The host must become exposed to the agent in sufficient numbers so as to cause disease

   宿主必須曝露在足夠數量的病原下才能造成疾病

   - Routes of transmission
   - 傳播途徑

Routes of transmission
傳播途徑

- Aerosol空氣
- Fomite污染物質
- Oral經口
- Vector載體
- Direct contact
  直接接觸
- Zoonotic
  人畜共通

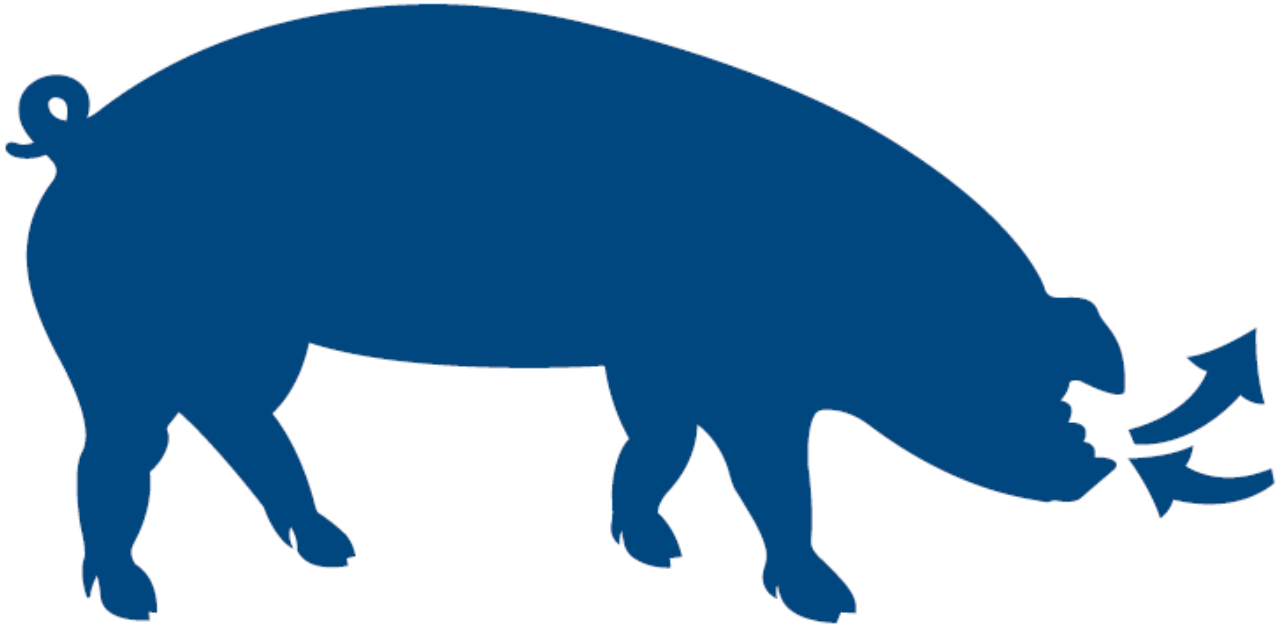


PRRS transmission
PRRS傳播

Route途徑	ID_{50}
SQ (parenteral)SQ(注射)	~10
Intranasal(鼻內)	~8,000
Artificial Insemination (人工授精)	~31,600
Oral(經口)	~158,500
Aerosol(空氣)	??

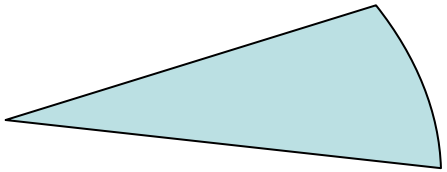
Zimmerman 2005

Aerosol Transmission
空氣傳播



Aerosol Requirements
空氣傳播需要條件

- Large numbers of pathogens大量的病原
  - Circle圓 → Area面積 = $\pi * r^2$
- Low temperature低溫
- High humidity高濕度
- Low sunlight少陽光
- Short travel distance短距離傳播
- Low wind speeds低風速
- Smooth topography 平整的地形



Gloster et al. 1981, Christensen et al 1990, Grant et al. 1994; Stärk 1999

Aerosol transmission
空氣傳播

- Agent specific特定病原
  - Yes是
    - Pseudorabies, Mycoplasma
    - 假性狂犬病，黴漿菌
  - **No**不是
    - APP
    - 放線桿菌胸膜肺炎
  - **Questionable**不確定的
    - PRRS – strain specific
    - 豬生殖與呼吸綜合症– 特定毒株

Aerosol transmission
空氣傳播

- Aerosol ≠ Area spread
- 空氣傳播≠地域傳播
- Aerosol = via the air
- 空氣傳播=藉由空氣
- Area spread = not specific to air, but more related to location
- 地域傳播=非特定藉由空氣，而是與所處地點相關

Aerosol – Biosecurity practices
空氣傳播–生物安全要項

- Location地點
  - Low pig density area低豬密度區域
  - Preferably at least 2 miles from other swine or manure spreading areas
  - 最好至少離其它豬群或排泄物散播區域2哩(3.2公里)
- Ventilation通風
  - Proper maintenance適當的維持
  - Use dust reduction protocols (1% fat in feed)
    使用降低塵土的方法(飼料中含1%脂肪)
  - Maintain relative humidity <60%
    維持相對溼度<60%
- Air filtration system?空氣過濾系統?

Aerosol空氣傳播

- Air filters空氣過濾

HEPA vs. MERV vs. Disposable

www.reliablefilter.com

Aerosol空氣過濾

Costs花費:

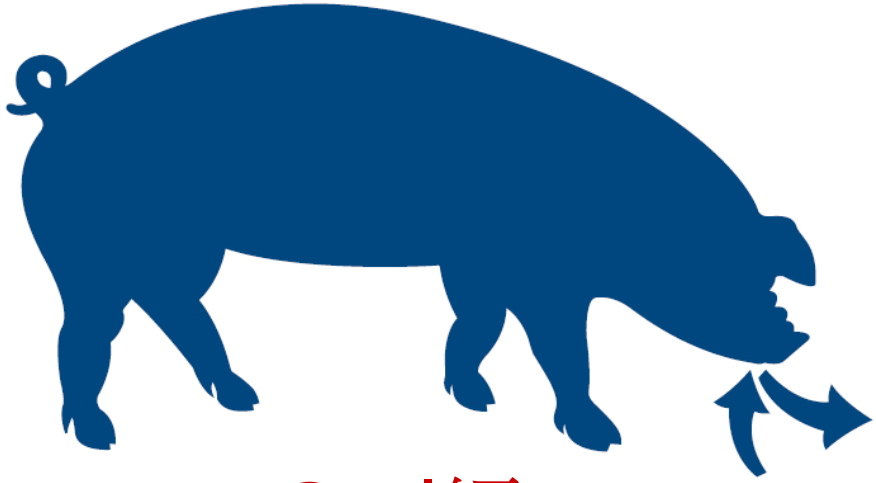
$250 per sow(每隻母豬)

$150 per boar(每隻公豬)

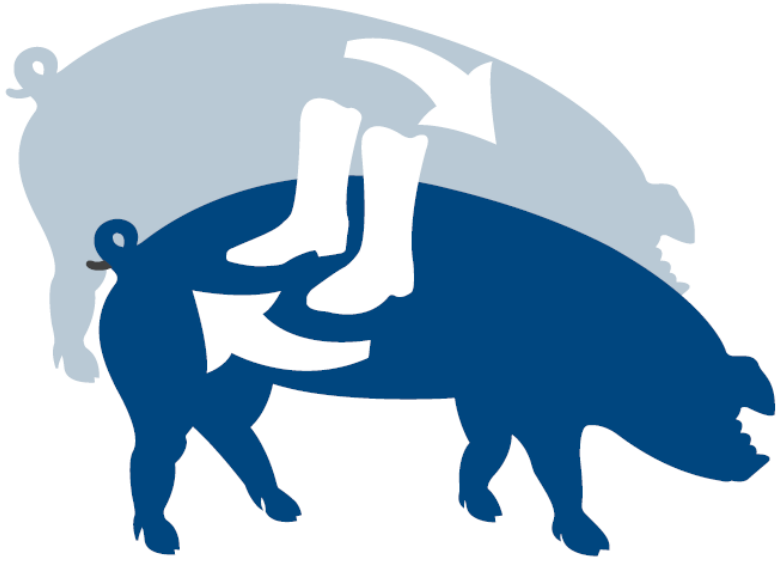
Maintenance(維持) $30 - 40/head/year /頭/年

www.reliablefilter.com

Fomites & Oral
污染物&經口



Oral經口



Fomites污染物

Fomites & Oral
污染物&經口

Fomites are inanimate objects (not alive) that can serve as a means to transport organisms from one animal to another

污染物可在動物間傳播病原

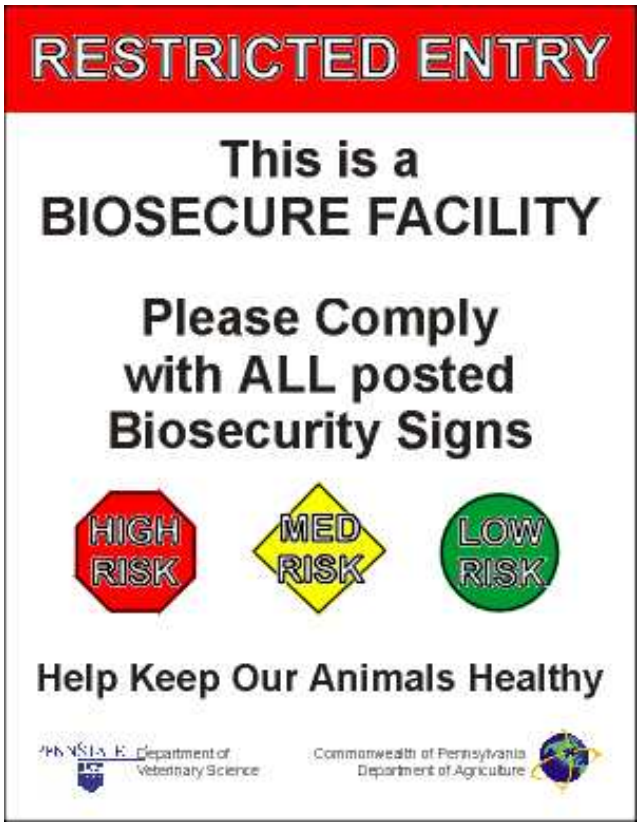
Fomites污染物

Fumigation of all objects entering the site

煙薰所有進入農場的器具

Photo: RB Baker

People人


RESTRICTED ENTRY
This is a
BIOSECURE FACILITY
Please Comply
with ALL posted
Biosecurity Signs
HIGH RISK
MED RISK
LOW RISK
Help Keep Our Animals Healthy
Department of Veterinary Science
Commonwealth of Pennsylvania
Department of Agriculture

People人

- How many people/vehicles enter your farm operation every month?每個月有多少人/交通工具進入你的牧場?
  - A study in 2001 reported that larger (>2,000 head) swine herds had contact with people and vehicles who had contact with other livestock facilities an average of 807 times each month. 2001年的研究報告指出，較大豬群(>2,000 頭)，平均一個月有807次會跟與其它家畜設備接觸過的人和交通工具接觸

Risk = Frequency X Consequence

風險因子=頻率X重要性

People人

- *E. coli* Amass et al 2003
- 大腸桿菌
- FMDV Amass et al 2003
- 口蹄疫病毒
- TGEV Alvarez et al. 2002
- 傳染性胃腸炎病毒
- Showering and putting on clean outerwear prevented transmission in **ALL** cases!
- 沖澡並換上乾淨工作衣可以預防所有可能的傳播情況

People人

- Risk is the same for **sow units** as well as **nursery** and **finishing** sites
- 母豬群的危險因子和保育及肥育豬場是一樣的
- Large systems implement showering at **all** phases
- 大規模的豬場在所有階段皆設有淋浴所

Boot Changing Stations
換鞋站

Boots & Coveralls
靴子與工作服

Boots & Coveralls
靴子與工作服

Hand Washing
洗手

- Hand washing decreases contamination
  洗手可以降低污染
- Availability可利用性
  - Location地點
  - Fully stocked充份貯存
- Gloves are not a substitute for hand washing
  手套並非好的洗手替代品
- Signage招牌

Exposure曝露

Variables	N	Titer ≥1:10 n (%)	Titer ≥1:20 n (%)	Swine H1N1* Bivariate OR (95% CI)	豬流感H1N1抗體 Multivariate OR (95% CI)
Swine exposure					
Swine workers who use gloves sometimes or never	34	12 (35.3)	7 (20.6)	**21 (4.4-100.8)†**	**30.3 (3.8-243.5)†**
Swine workers who use gloves most of the time or always	14	1 (7.1)	0 (0)	2.8 (0.2-34.2)	2.4 (0.1-40.9)
No swine exposed controls	79	2 (2.6)	1 (1.3)	reference	reference
Smoked in past year >5 packs?					
Yes	14	4 (28.6)	3 (21.4)	**4 (1.1-14.5)†**	**18.7 (2.5-141.3)†**
No	114	11 (9.7)	5 (4.4)	reference	reference

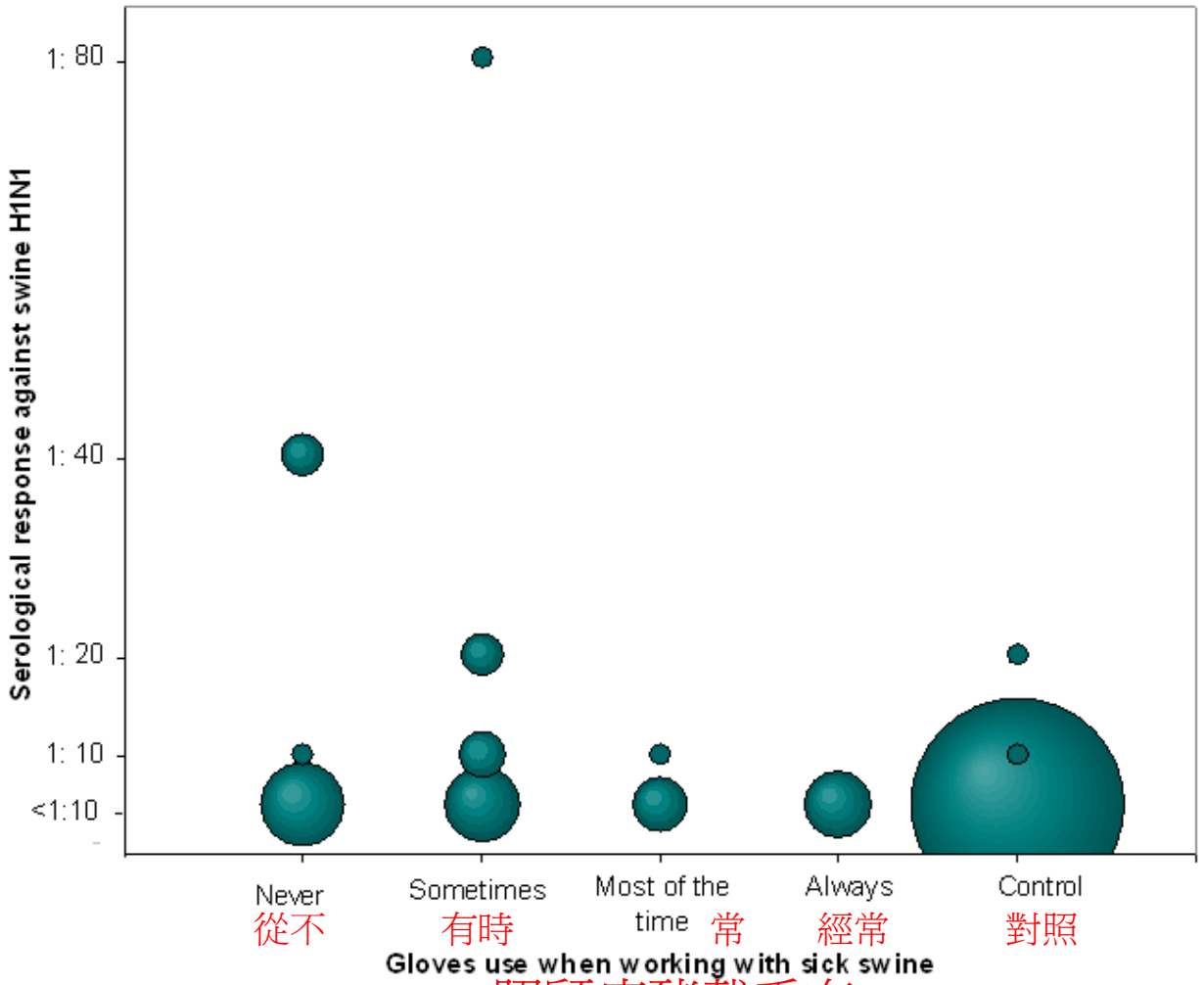
*Using proportional odds model, these titers were grouped: <1:10, 1:10; >1:10
† Significant odds for increased serological response, p-value<0.05

Ramirez *et al*, Emerg Inf Dis 2006

- 豬場人員有時或從不用手套
- 豬場人員常或經常用手套
- 對照(不曝露的豬)

Exposure曝露

豬流感之血清反應



Ramirez unpublished 2006

Downtime檢疫期

- 48hrs better than 36 than 24 …….?
  48小時比36比24……小時好?
- But …… no science behind it
  但是……背後沒有科學根據
- Very costly “tradition”
  代價非常昂貴的”傳統”
- Hard to move away from it
  很難從這個傳統脫離
- Under experimental conditions, decontamination methods were sufficient to prevent transmission without the need for down time
- 在實驗的狀態下，去污染(例：消毒)方法能有效預防傳播而不需要檢疫期
- Down time might be needed for zoonotic pathogens (**Influenza**, Salmonella)
- 人畜共通傳染病(流行性感冒、沙門氏菌)可能需要檢疫期

Vehicles運輸工具

- Clean vehicles only
  只允許用乾淨的運輸工具
- Designated parking
  指定的停車場
- Proper signage
  適當的招牌
- TQA program
  全面品保程序

Syntex industries

http://www.biosecuritycenter.org/truckwash.php

Photo: RB Baker

Hog Movements豬群移動

- **Offsite異地**
  - Load-out/transfer facility
  - 移出/轉移設備
  - Rendering化製
- **Chutes斜道**
  - Separate/Separated個別/分隔
  - Dirty vs. Clean髒vs.乾淨
  - Mark with a line用線標記
- Do not let pigs/driver run on and off truck

  不要讓豬/駕駛隋便進出貨車
- Know your driver!

  認識你的駕駛!

Truck wash/heat treatment
卡車沖洗/熱處理

Photo: RB Baker

Photo: RB Baker

Daily Biosecurity Priorities
每日生物安全優先順序

Photo: RB Baker

Do we know how to clean?
我們知道如何清潔嗎?

1. Removal of visible organic material
   移除可見的有機物質
   - Power washing強力清洗
     - Pressure vs. volume壓力vs.體積
     - Hot vs. cold 熱vs.冷
2. Disinfection消毒

3. Drying乾燥

Disinfect消毒

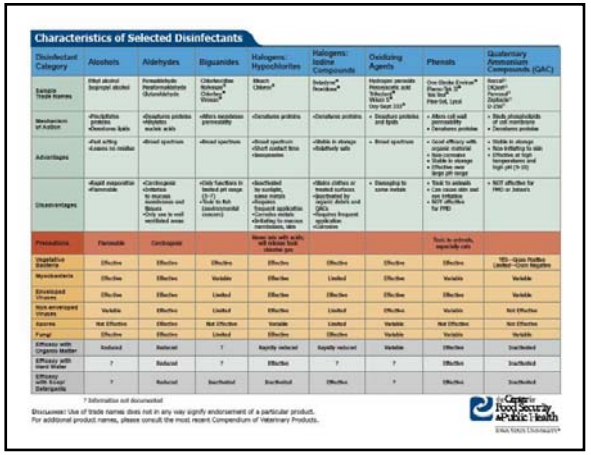
1. Read the product label閱讀產品標籤
   - Wear protective gear if needed
     如有需要，戴上防護工具
2. Disinfect消毒
   - Use label dilutions使用標籤上稀釋倍數
   - Allow label contact times (10 minutes)
     允許
3. Final rinse (if necessary)最後沖洗(如需要)
   - Low pressure to remove residue
     低壓來移除殘留物
4. Dry before allowing animals to return
   在動物移回前乾燥

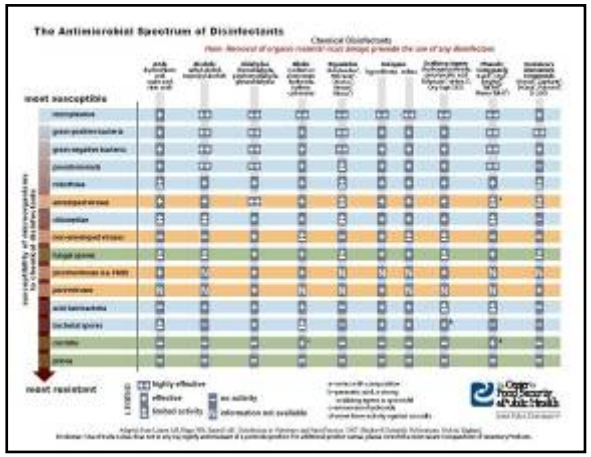
Which one?用哪一個品牌?

Disinfectant Information
消毒劑資訊

the Center for Food Security & Public Health
IOWA STATE UNIVERSITY®

- www.cfsph.iastate.edu/BRM/disinfectants.htm





Characteristics of Selected Disinfectants

Disinfectant Category	Alcohols	Aldehydes	Biguanides	Halogens: Hypochlorites	Halogens: Iodine Compounds	Oxidizing Agents	Phenols	Quaternary Ammonium Compounds (QAC)
Sample Trade Names	Ethyl alcohol Isopropyl alcohol	Formaldehyde Paraformaldehyde Glutaraldehyde	Chlorhexidine Nolvasan® Chlorhex® Virosan®	Bleach Chlorox®	Betadyne® Providone®	Hydrogen peroxide Peroxyacetic acid Trifectant® Virkon S® Oxy-Sept 333®	One-Stroke Environ® Pheno-Tek II® Tek-Trol® Pine-Sol, Lysol	Roccal® DiQuat® Parvosol® Zepharin® D-256®
Mechanism of Action	•Precipitates proteins •Denatures lipids	•Denatures proteins •Alkylates nucleic acids	•Alters membrane permeability	•Denatures proteins	•Denatures proteins	• Denature proteins and lipids	• Alters cell wall permeability • Denatures proteins	• Binds phospholipids of cell membrane • Denatures proteins
Advantages	•Fast acting •Leaves no residue	•Broad spectrum	•Broad spectrum	•Broad spectrum •Short contact time •Inexpensive	•Stable in storage •Relatively safe	• Broad spectrum	• Good efficacy with organic material • Non-corrosive • Stable in storage • Effective over large pH range	• Stable in storage • Non-irritating to skin • Effective at high temperatures and high pH (9-10)
Disadvantages	•Rapid evaporation •Flammable	•Carcinogenic •Irritation to mucous membranes and tissues •Only use in well ventilated areas	•Only functions in limited pH range (5–7) •Toxic to fish (environmental concern)	•Inactivated by sunlight, some metals •Requires frequent application •Corrodes metals •Irritating to mucous membranes, skin	•Stains clothes or treated surfaces •Inactivated by organic debris and QACs •Requires frequent application •Corrosive	• Damaging to some metals	• Toxic to animals • Can cause skin and eye irritation • NOT effective for FMD	• NOT effective for FMD or Johne's
Precautions	Flammable	Carcinogenic		Never mix with acids; will release toxic chlorine gas			Toxic to animals, especially cats	
Vegetative Bacteria	Effective	Effective	Effective	Effective	Effective	Effective	Effective	YES—Gram Positive Limited—Gram Negative
Mycobacteria	Effective	Effective	Variable	Effective	Limited	Effective	Variable	Variable
Enveloped Viruses	Effective	Effective	Limited	Effective	Effective	Effective	Effective	Variable
Non-enveloped Viruses	Variable	Effective	Limited	Effective	Limited	Effective	Variable	Not Effective
Spores	Not Effective	Effective	Not Effective	Variable	Limited	Variable	Not Effective	Not Effective
Fungi	Effective	Effective	Limited	Effective	Effective	Variable	Variable	Variable
Efficacy with Organic Matter	Reduced	Reduced	?	Rapidly reduced	Rapidly reduced	Variable	Effective	Inactivated
Efficacy with Hard Water	?	Reduced	?	Effective	?	?	Effective	Inactivated
Efficacy with Soap/ Detergents	?	Reduced	Inactivated	Inactivated	Effective	?	Effective	Inactivated

? Information not documented

DISCLAIMER: Use of trade names does not in any way signify endorsement of a particular product. For additional product names, please consult the most recent Compendium of Veterinary Products.

the Center for Food Security & Public Health
IOWA STATE UNIVERSITY

Cleaning and disinfecting
清潔和消毒

Clean before or after pigs?
在進豬群之前或之後清洗?

- Clean right **before** next group在下一批之前清洗
  - If it's dirty, it will stay dirty no matter how long you wait
    如果環境骯髒，不管等多久都會保持一樣的髒亂
  - Hard on equipment不利器械設備
  - Harder to clean不易清洗
  - Environment for insects and/or rodents昆蟲和/或嚙齒類的良好環境
- Clean right **after** this group在這一批之後清洗
  - If it's clean, it will eventually get dirty if you wait long enough
    如果環境乾淨，只要等的夠久，最後一定會變髒
  - Easier to "re-clean" if necessary如果需要，"再清洗"時更容易
  - Long drying time較長的乾燥時間
  - Have more time to do the job right!有更足夠的時間把事情做對!

Hot vs. Cold water
熱vs.冷水

- Cold冷水
  - Cheaper比較便宜
  - Easy to see (no fog)容易看見(沒有霧氣)
  - Less sweating出汗少
  - **Laundry study** showed 160 ºF was just as effective as 72 ºF in reducing bacterial counts (Blaser et al, 1984)
    洗衣研究證明在降低菌量方面，71.1˚C和22.2˚C一樣有效
- Hot熱水
  - Reduction of labor time!減少工作時間

Monitoring監控

- Regular veterinary herd health visits定期的獸醫豬群健康訪視
  - May include biosecurity audits可以包括在生物安全的稽核
  - Cleaning and disinfection checks清洗及消毒的檢查
- Cultures for specific bacterial organisms特定細菌的培養
- Testing for specific agents測試特定病原
  - Routine testing定期測試
  - Sentinel animals 哨兵動物

Vectors載體

www.pestvictoria.com

Pest control害蟲控制

- Sanitation衛生
  - Garbage垃圾
  - Feed spills飼料溢出
  - Manure spills排泄物溢出
- Insecticides殺蟲劑
- Rodent control嚙齒類控制
- Pets寵物
  - Cats & dogs貓&狗

Rodent Control嚙齒類控制

- http://rodent.swine.unl.edu/

- Gravel perimeter豬舍周圍鋪碎石
  - 2 – 3 feet wide
    寬2 – 3 英尺
  - 6 inches deep
    6 英吋深
  - ½ - 1 inch rock
    ½ - 1 英吋的石頭
- Bait stations 誘餌
  - Location地點
  - Maintenance維持
    - Professionals?專業?
    - Records紀錄?

Direct contact直接接觸

Pigs are #1豬是最主要的傳染原

- Know source知道來源
- Minimize sources

  來源最少化
  - Average vs. Lowest

    平均vs.最低
- Testing測試
- Herd health program

  豬群建康管理

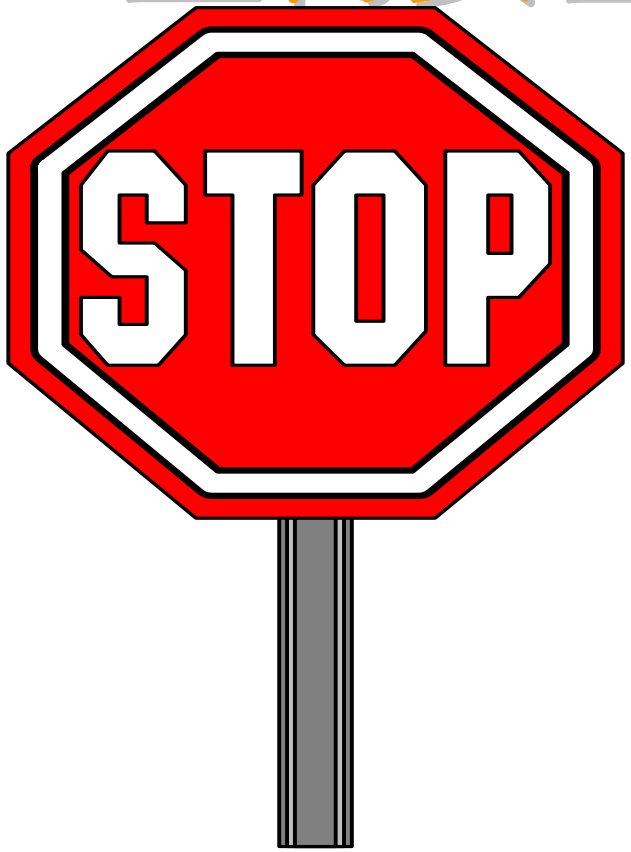
Summary
總結

Best Biosecurity
最佳的生物安全

- Look at pigs daily preferably 2x/day
  最好一天觀察豬隻兩次
- Maximize強化
  - Management管理
  - Nutrition營養
  - Environment環境
  - Health program (vaccination)
    健康(免疫)
- Routes of transmission傳播途徑

BIOSECURITY

生物安全



停

- **THINK!!** 想一想

Don’t Forget!别忘了!

Risk =

Frequency频率

X

Consequence

風險

重要性

Resources資源

- www.cfsph.iastate.edu/BRM/disinfectants.htm
- www.biosecuritycenter.org
- www.porkboard.org/securityBiosecurity.asp
- www.omafra.gov.on.ca/english/livestock/swine/health.html
- http://rodent.swine.unl.edu/


WASH
YOUR
HANDS
Wet hands and forearms with warm water
Add at least 3-5 mls of soap (the size of an olive)
Lather up and vigorously scrub each side of the hands beyond the wrist for 10-30 seconds, cleaning under rings and scrubbing dirty fingernails
Rinse under warm water until no soap residue remains
Turn off running water with a paper towel, not bare hands
Dry hands with paper towel or hot air dryer
the Center for Food Security & Public Health
IOWA STATE UNIVERSITY

Questions?問題?

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感謝您的聆聽

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