

About Pathogens

- Can cause disease
- Include a wide variety of organisms, bacteria, viruses, nematodes, fungus, spirochetes, amoeba, and other parasitic organisms.
- Pathogens exist where life exists,
- they need a pathway to a plant or animal, to cause infection.
- The amount of exposure of infectious, combined with the susceptibility of the individual, can result in illness.



****Common and Uncommon Feedstock****

Crop residual, Food processing residual, *Orange, carrot, banana and apple pulp*, Livestock manure, Dog manure, Zoo doo, Biosolids-human manure, Coir, Chipped Christmas trees, *Mixed leaf and Yard residual*, Eggs/egg shell, *Mixed food waste (residential, grocery, school, restaurant, etc.)* Out dated soda and alcohol, glucose solutions, Brewery & Distillery waste, Fruit leather residual, Currency (from the US Mint), *Burnt grain from elevator fire*, Cherry/stone fruit pits, Garlic/ onion processing residual, *Paper from document destruction*, Bread dough/bakery excess, Seized and legal cannabis, *Floral and cut flower production waste*, Coffee/tea grounds, Cocoa, coffee, rice hull, Off-spec. pet food, Dog and cat treat dust, Off-spec. human food & wasted food, residual from fish canneries and slaughterhouses, Fruit & Vegetable peelings-Acai, Grape, Apple, Olive pressings, Poultry feathers, Livestock wool, *Butcher residuals*, *Blood: liquid, semi-solid or dried*, Whole whales & marine mammals, Fish from fish kills, *Sea weed/ lake weed*, Seafood shell, Fish and fish guts, Vanilla bean residual, Sunflower seed shell, biochar, whey- all different compositions, Milk/ice cream, Liquid manure, FOG: fats-oils-greases, Gummy vitamin residual, Gel caps from drug manufacturers, Coir, Bagasse, *Drywall/ untreated size reduced wood*, Livestock/deadstock, feed, water, eggs, milk and bedding/litter from disease outbreaks, etal.



Disaster Response

HPAI outbreak- 2015

*HPAI Response Mortality Composting Protocol
for Avian Influenza Infected Flocks
https://www.aphis.usda.gov/animal_health/emergency_management/downloads/hpai/mortalitycompostingprotocol.pdf

Brucella suis Outbreak-zoonotic 2017

Fowl Cholera in Pheasants-2019

Hurricane Florence –NC-2018



Responding to a Poultry Disease Outbreak

8-minute password protected video. 2019.

file:///Users/jb29/Desktop/final-
Responding%20to%20a%20Poultry%20Disease%
20Outbreak%20on%20Vimeo.html



Response to Highly Pathogenic Avian Influenza Outbreak 2015



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Roadkill Pathogen Research

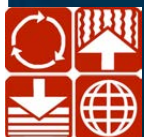
- 24" wood chips
 - 2 deer
 - 12" wood chips
 - 2 deer
 - 24" wood chips
- Temps recorded every ½ hour



Wood Chip Analysis – Day 0

Pile	Fecal Coliforms (MPN/g solids)	<i>E. Coli</i> (MPN/g solids)	<i>Salmonella</i> spp. (MPN/4 g solids)	Fecal Strep (MPN/g solids)	Fecal Enterococci (MPN/g solids)
Watertown	1.9×10^5	2800	0.71	6.9×10^6	3.2×10^6
Cortland	1.2×10^4	2000	0.47	5.0×10^8	1.5×10^5
Highland	1.4×10^5	140000	0.49	1.3×10^7	9.2×10^4

Analysis done by Woods End Research Laboratory, Mount Vernon, ME
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	Hardiness Rating		
Pathogen	1	2	3
<i>Salmonella</i> spp.	*		
<i>E. coli</i> and <i>E. coli</i> O157:H7	*		
<i>Campylobacter</i> spp.	*		
<i>Yersinia</i> spp.	*		
<i>Listeria</i> spp.	*		
<i>Leptospira</i> spp		*	
<i>Streptococcus</i> (enterococci)		*	
<i>Clostridium perfringens</i>			*
<i>Mycobacterium</i>			*



Pathogens/Indicators Selection

Fecal coliforms (EPA 503)	Ferment lactose and survive/grow at 44.5°C
<i>E. coli</i>	Present in high numbers in feces of birds & mammals; some members are very toxigenic
<i>Salmonella</i> (EPA 503)	Most are pathogens; survive outside body



Pathogens and Indicators ...

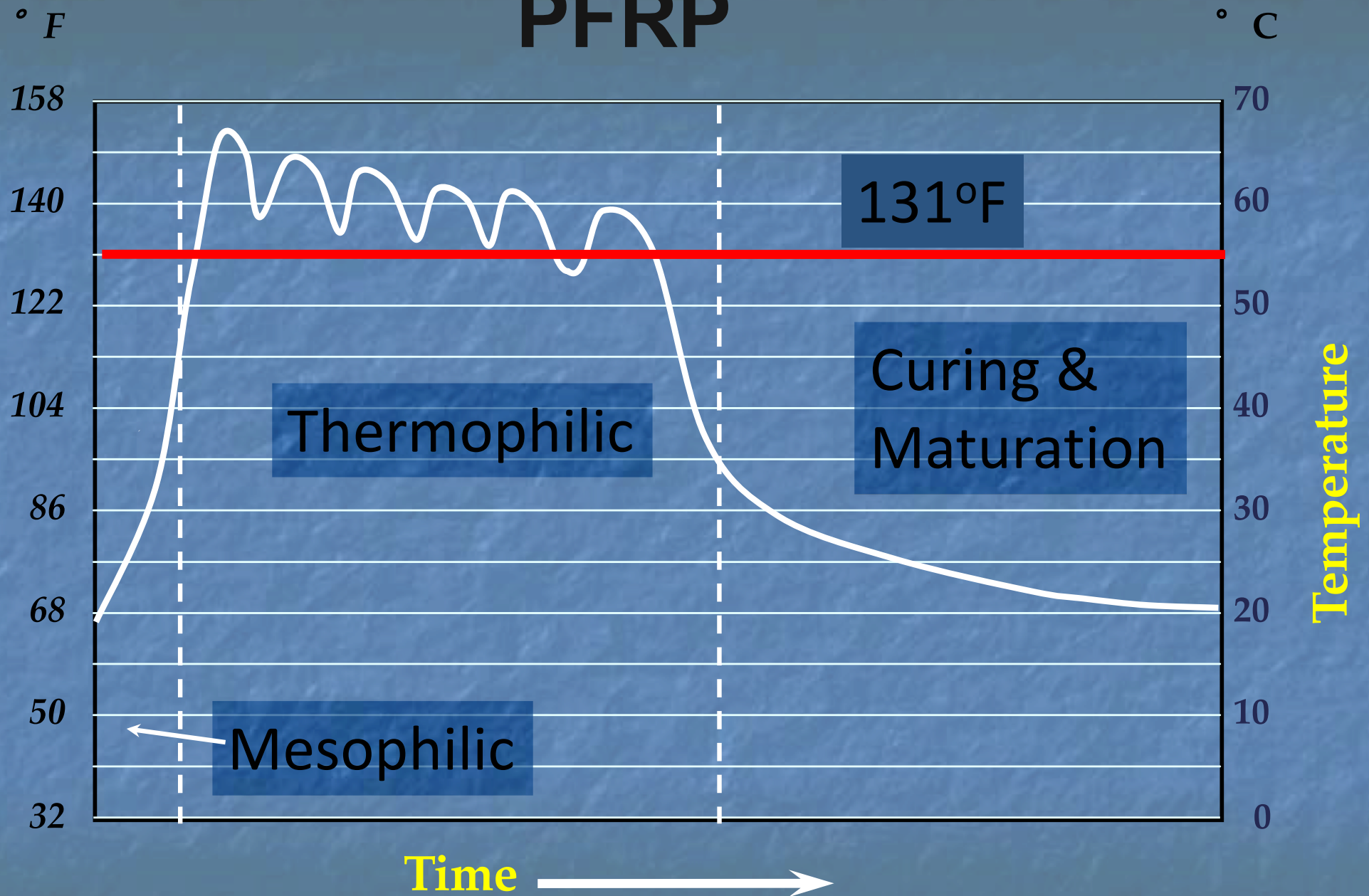
Fecal streptococci	Present in manures; more environmentally resistant than coliforms/salmonella
Enterococci	Subgroup of F. Strep., survival rate high; antibiotic resistance well established



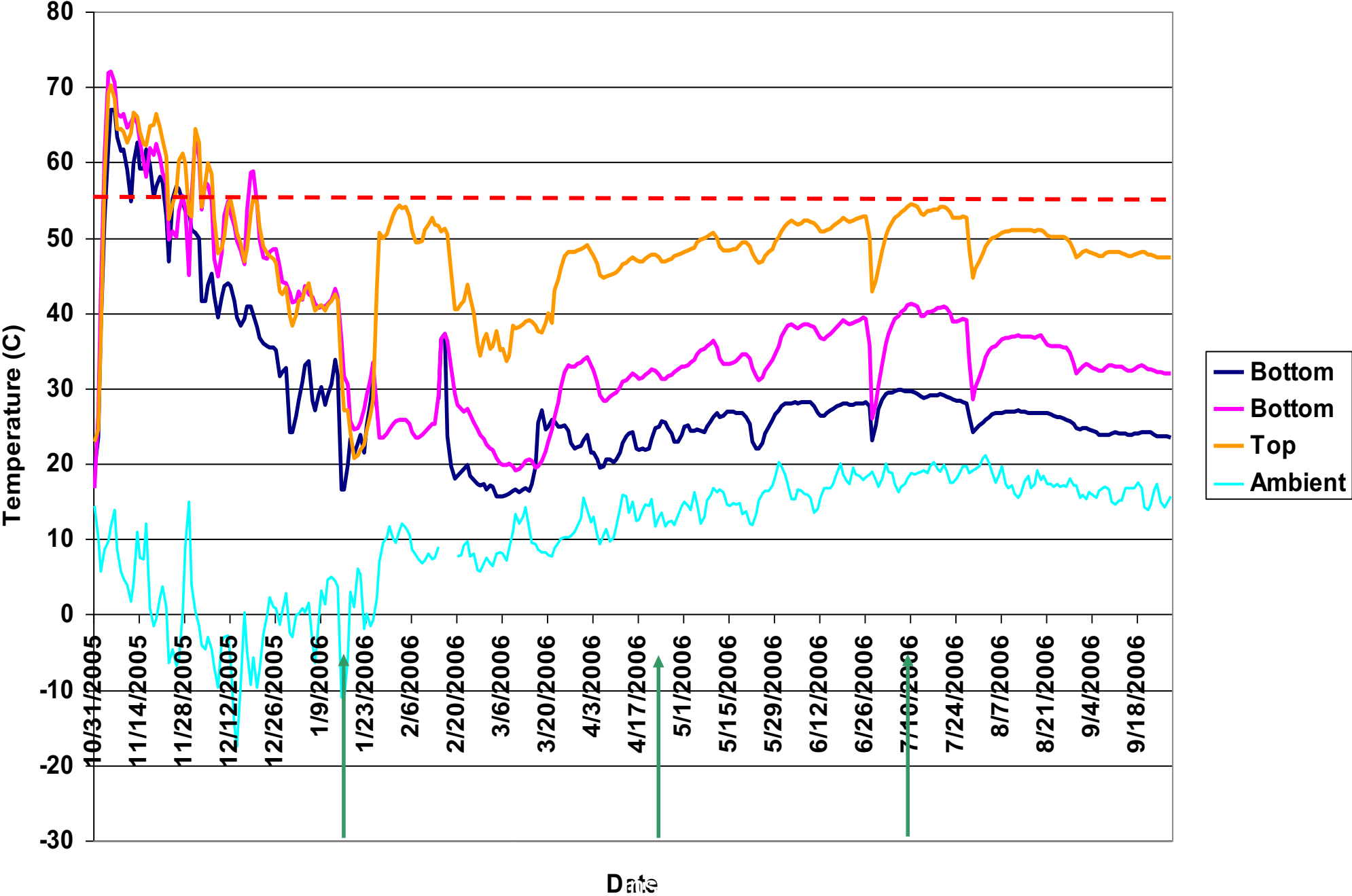
PFRP

- *Process to Further Reduce Pathogens*
- Time and Temperature requirements to assure pathogen reduction
- Aerated Static Pile and In-vessel:
131°F (55°C) or higher for 3 days
- Turned windrow:
131°F (55°C) or higher for 15 days or more with 5 turnings

PFRP



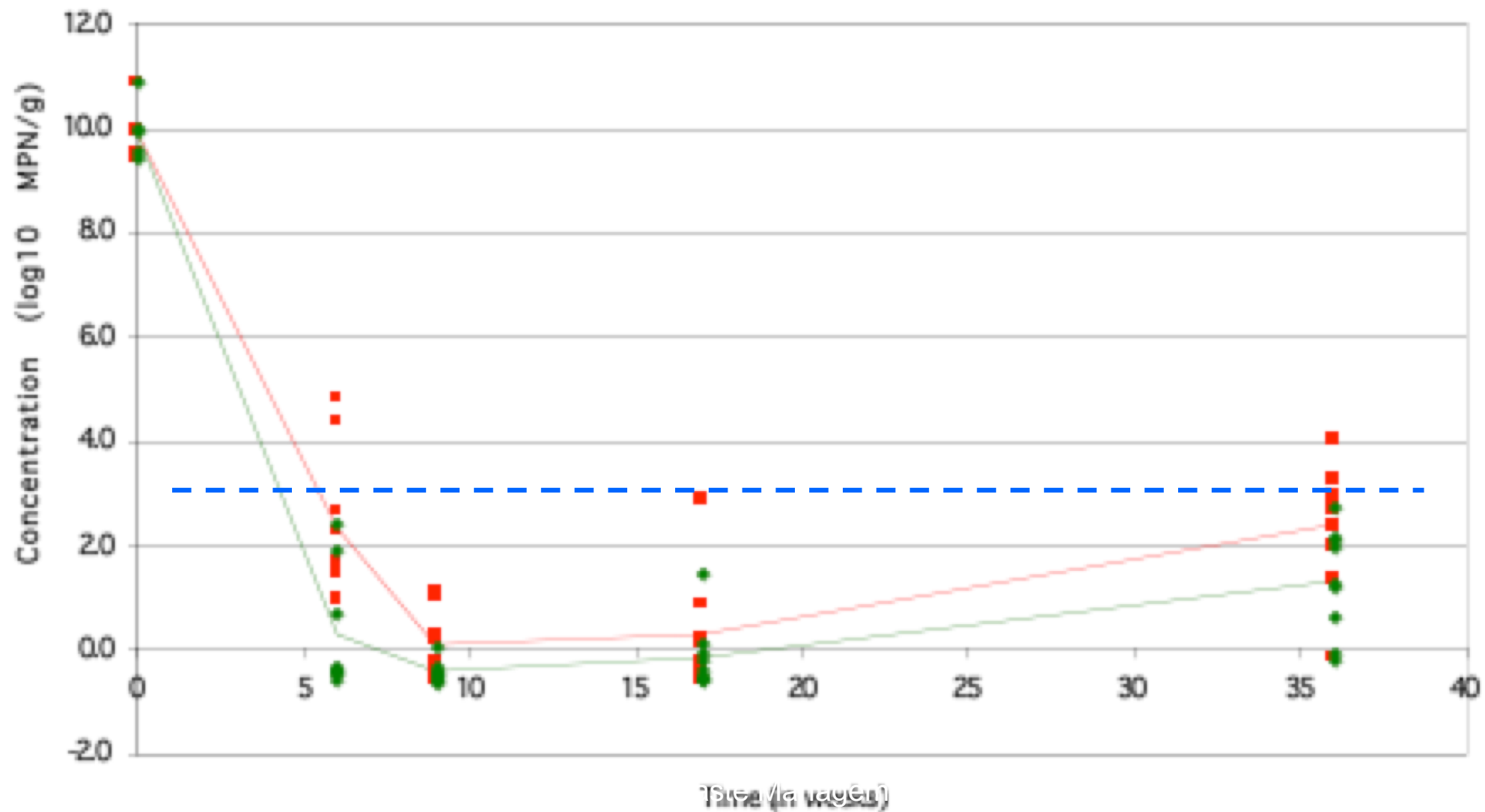
Average Daily Temperature Cortland Pile



Fecal coliforms and *E. coli* in Deer Feces

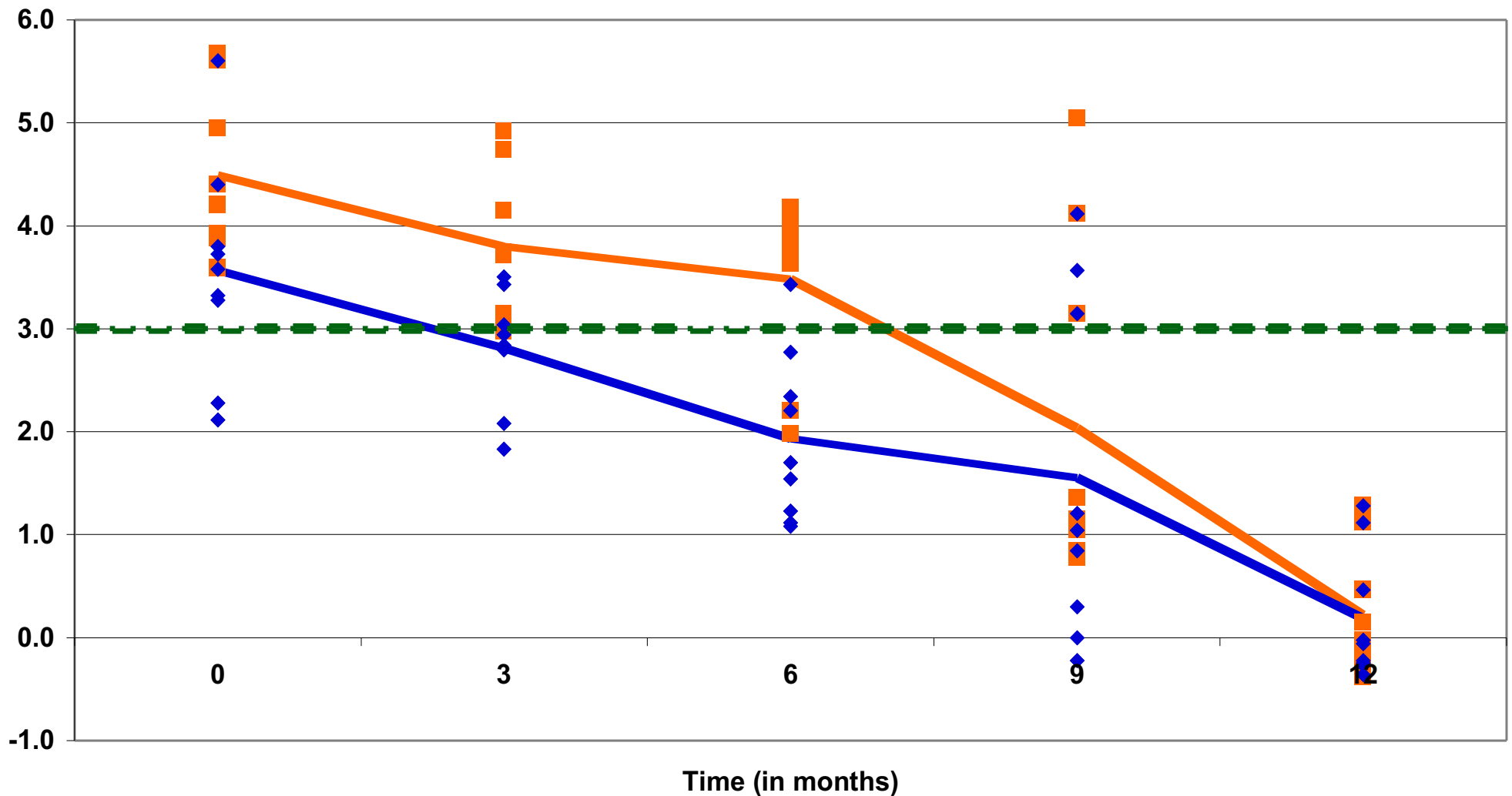
■ Fecal coliforms ◆ *E. coli*

Fecal Coliform and *E. coli* Concentration in Deer Goo over Time



Fecal coliforms and *E. coli* in Compost over Time

Fecal Coliform and *E. coli* Concentration in Compost over Time



USEPA Part 503 Rules Pertaining to Composted Sewage Sludge

Class A: Compost requirements:

Fecal coliform -1000 MPN in sewage sludge compost deemed by USEPA to be suitable for unrestricted use

OR

Salmonella <3MPN/4g.)

USEPA Part 503 Rules Pertaining to Composted Sewage Sludge

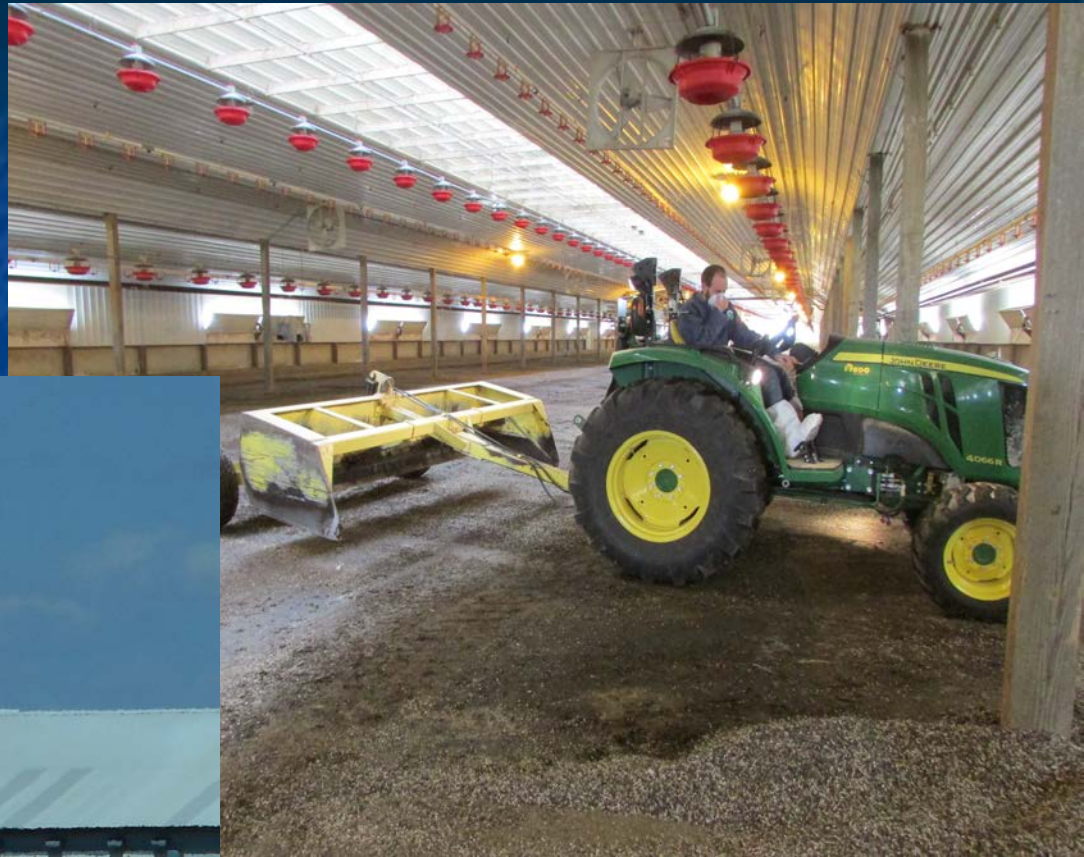
Class B: Compost requirements:

< 2 million MPN fecal coliform with use restricted to low public contact sites;

$\geq 40^{\circ}\text{C}$ (104°F) for at least 5 days
and

$> 55^{\circ}\text{C}$ (131°F) for at least 4 hours

PPE



Use of Devices



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Personal Protection

- Appropriate PPE for the disease: Coveralls, Tyvek, gloves, masks, glasses, face shields, respirator, strong tape, head covering, hats, and shoes or boots ear protection. Identify yourself.
- Used PPE must be bagged as you are entering the clean area. Durable shoes /clothing- disinfected.
- wash and change clothes prior to entering any living or food service area outside the facility.
- Wash hands and face prior to eating, drinking, or smoking. Wash hands before and after toilet use.



- **Wash Hands don't touch your face**
- Require good dust masks and respirators when required at operations where unprocessed or dusty material is handled.
- All cuts or wounds should be cleaned and bandaged and protected from exposure until healed.
- If a person has a compromised immune system it is important that they are fitted with protective equipment or might want to find a different line of work.
- PHONES/ Devices



Managing Feedstock & Equipment to Reduce Contamination

- Train personnel to know where all people are for personal health and safety.
- Use a clean Bucket to move finished material, some facilities have multiple buckets for different purposes
- Turn windrows, oldest to youngest.
- Sanitize all equipment used in a dirty or contaminated at the clean/dirty line.
- Control traffic patterns, use good signage.
- Avoid driving on piles.





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