

Willette M. Crawford, PhD, MPH¹, Kevin Gerrity², Mansoor A. Baloch, PhD³, John Guzewich⁴

¹Office of Food Safety, U.S. FDA Center for Produce Safety and Applied Nutrition, ² Division of Domestic Field Investigations, U.S. FDA

³ Environmental Health Services Branch, Centers for Disease Control and Prevention, ⁴ Office of Food Defense, Communication, and Emergency Response, U.S. FDA Center for Food Safety and Applied Nutrition.

Background

Fresh Produce Outbreaks

- Eighty-seven multistate FBIOs from 1996-2009 where contamination likely occurred on the farm
- Produce is uniquely challenging due to production environment

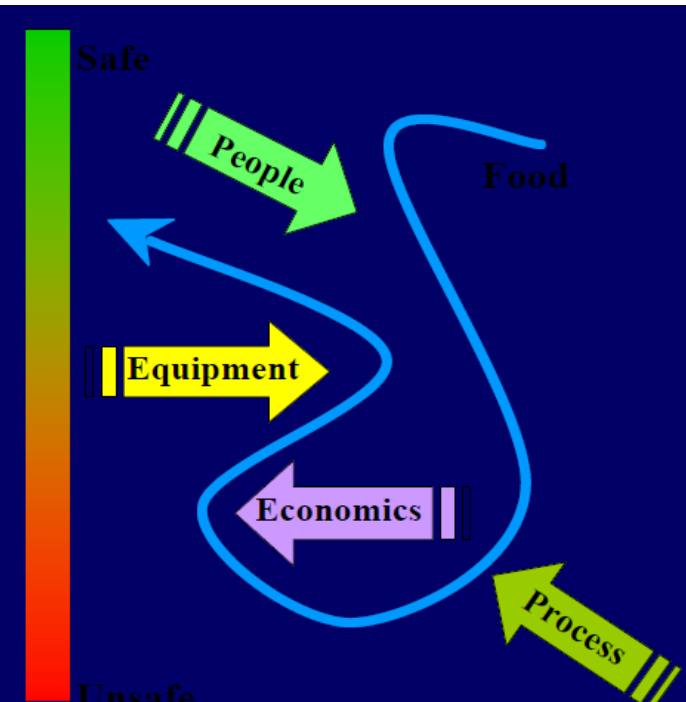
E. coli O145 Outbreak

- Multi-state FBIO of *E. coli* O145 infection in Spring of 2010
- Shredded romaine lettuce from one processing firm
- No likely contamination source identified at the processor or farm
- Non-O157 Stx-producing *E. coli* (STEC) found in soil at farm
- No deficiencies in Good Agricultural Practices

Environmental Assessment (EA)

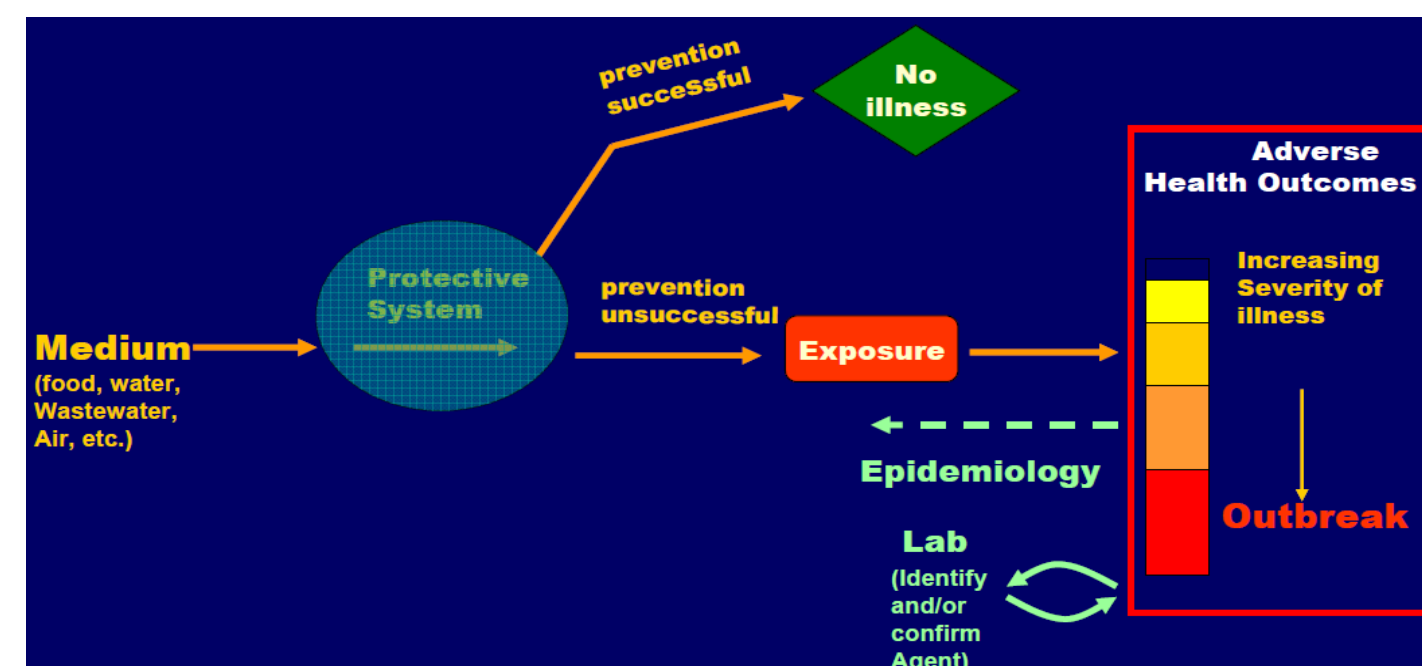
❖ Contributing Factor – “What” happened to cause illness

❖ Environmental Antecedent – “Why” the failure happened



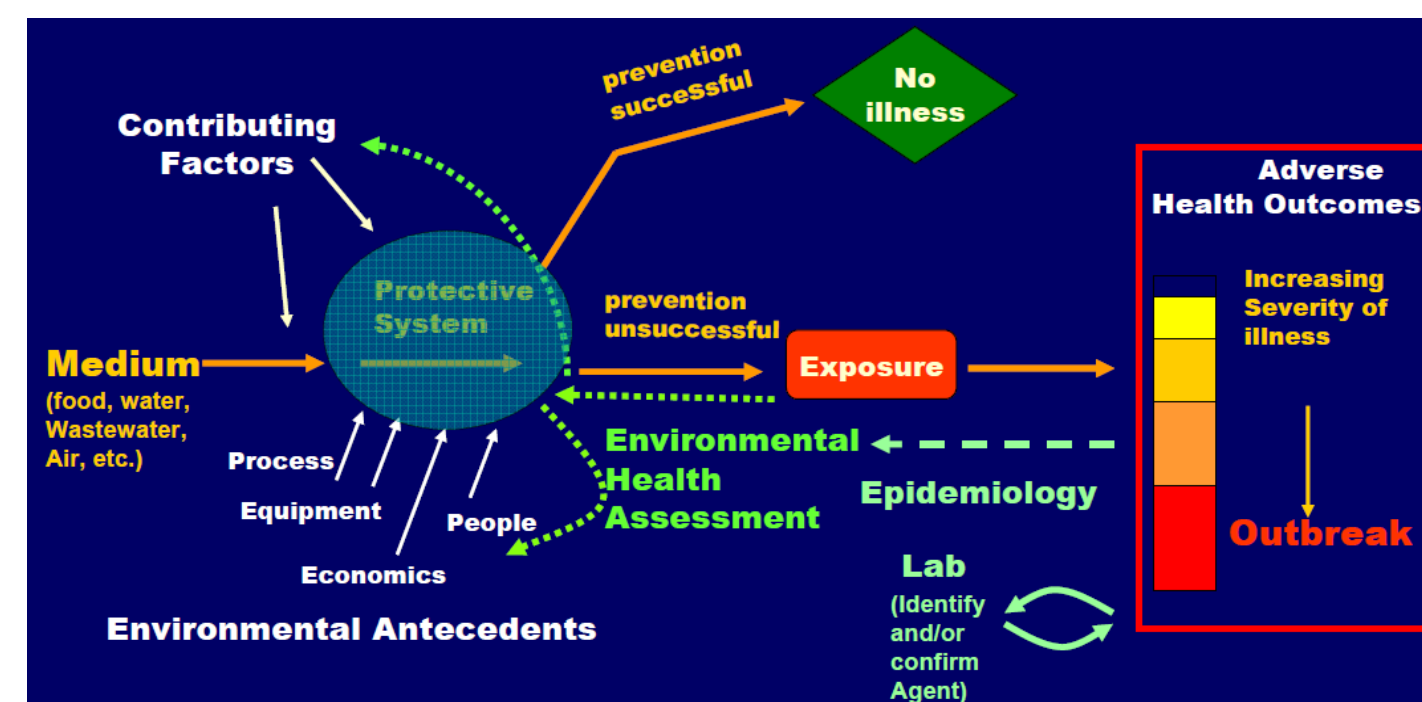
Investigation Approaches

Traditional Outbreak Approach



- Epidemiologic, traceback, & farm investigations conducted to identify contaminant & affected product
- Limited inferences made about contributing factors

Environmental Assessment Approach



- Determine how “environment” contributed to introduction & transmission of hazard
- Factors evaluated depend on environment (e.g. air, water, soil, ingredients, climate, equipment, etc.)

Novel Approach

O145 Systems-based EA Approach

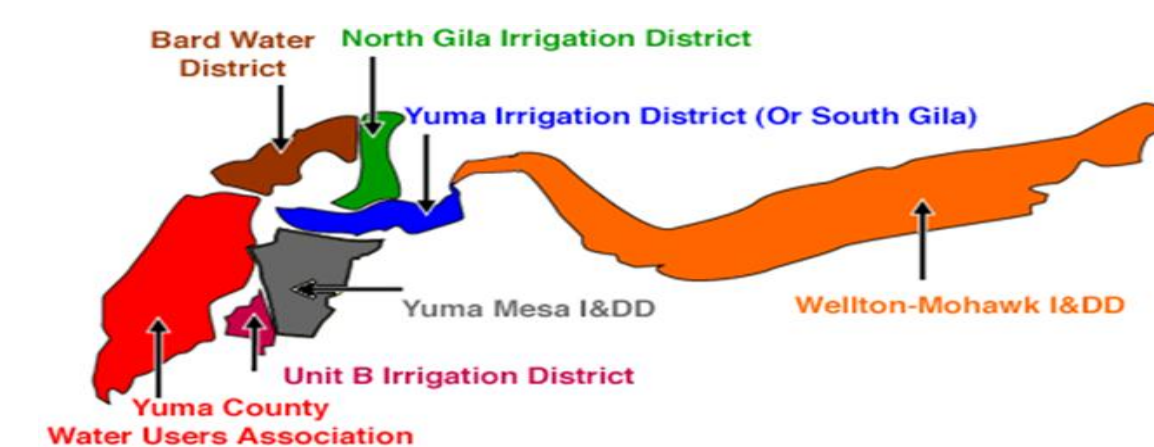
- Identified possible sources of STEC & transmission routes
- Inspected irrigation canal system
- Hydrologic analysis

Potential STEC Sources



- Animal feeding operations (CAFOs)
- Housing wastewater treatment
- Seasonal sheep grazing
- RV park along canal

Hydrologic Analysis



- Higher cumulative precipitation
- High levels & intensity of rainfall may have created runoff & increased microbial contamination in canal

Moving Forward

E. coli O145 EA Findings

- CAFOs & sheep not likely source due to lack of transmission mechanism
- No evidence of drainage from housing development into canal system observed
- RV Park was likely source based on location, proximity to farm, & presence of STECs

Conclusions

- Identified preventive control strategies to reduce future contamination & outbreaks
- Systems-based approach enabled discovery of important environmental risk factors not typically explored by traditional investigation approach
- EA approach helps FDA achieve long-term goal of outbreak prevention

Acknowledgements

- CA and AZ Leafy Greens Marking Agreements
- CAFOs of Yuma County
- AZ Dept. of Ag
- AZ Dept. of Environmental Quality
- AZ Dept. of Water Resources
- AZ Dept. of Health Services
- Yuma County Dept. of Public Works
- Wellton-Mohawk Irrigation & Drainage District
- CDC National Center for Environmental Health