

Environmental Health Investigations During Outbreaks

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OUTLINE

1. Background
2. Systems Approach: Basis for Environmental Health Investigations
3. Environmental Assessments during Outbreak Investigations
 - 2006 Spinach – *E. coli* O157:H7 Outbreak
 - 2010 Lettuce – *E. coli* O145 Outbreak
 - 2011 *Campylobacter jejuni* – Guillain Barré Syndrome Outbreak
4. Remaining Challenges

BACKGROUND

National Center for Environmental Health
Division of Emergency and Environmental Health Services



BACKGROUND



Farm production



Processing



Store



Consumer

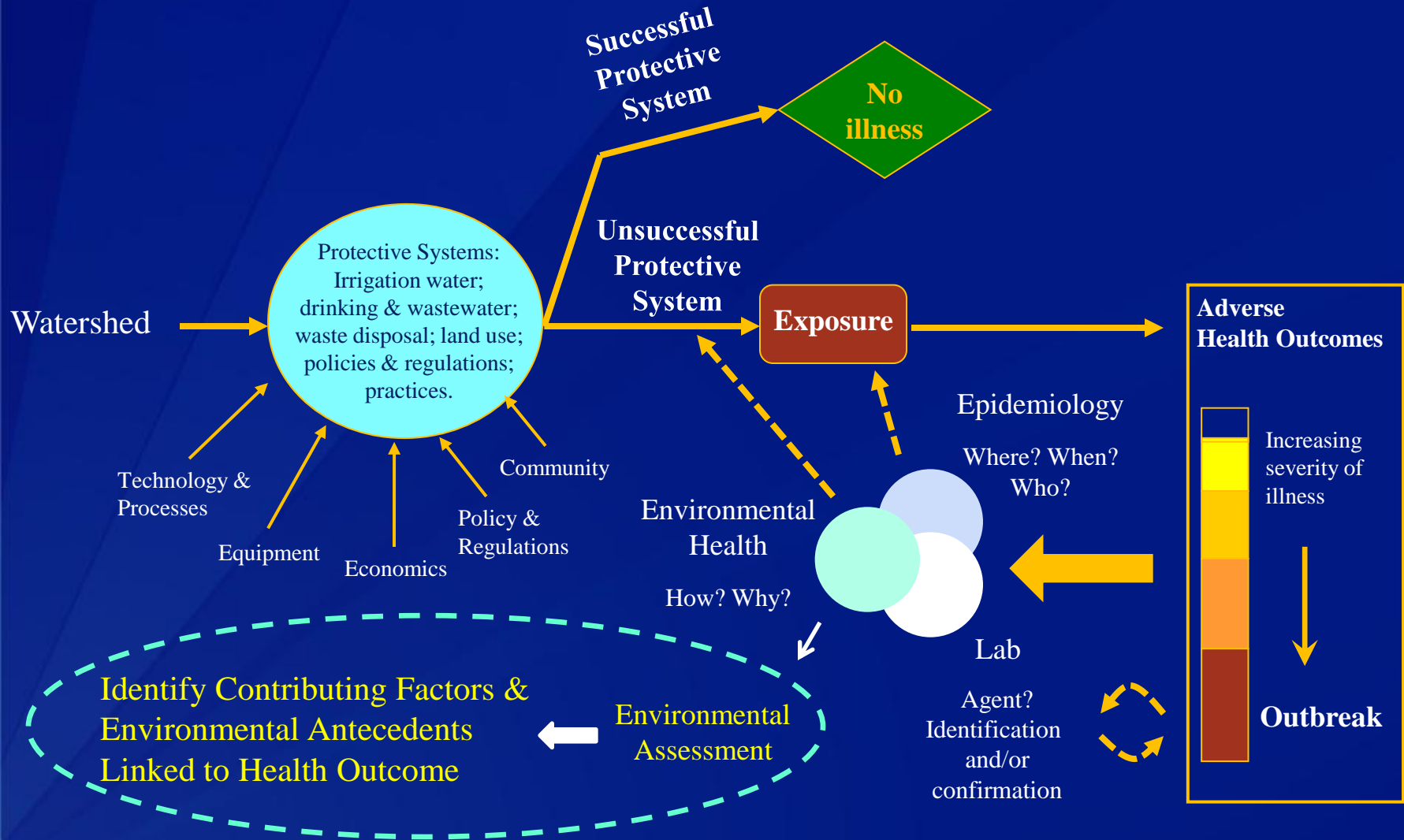


SYSTEMS APPROACH: BASIS FOR ENVIRONMENTAL HEALTH INVESTIGATIONS

National Center for Environmental Health
Division of Emergency and Environmental Health Services



SYSTEMS APPROACH: BASIS FOR ENVIRONMENTAL HEALTH INVESTIGATIONS

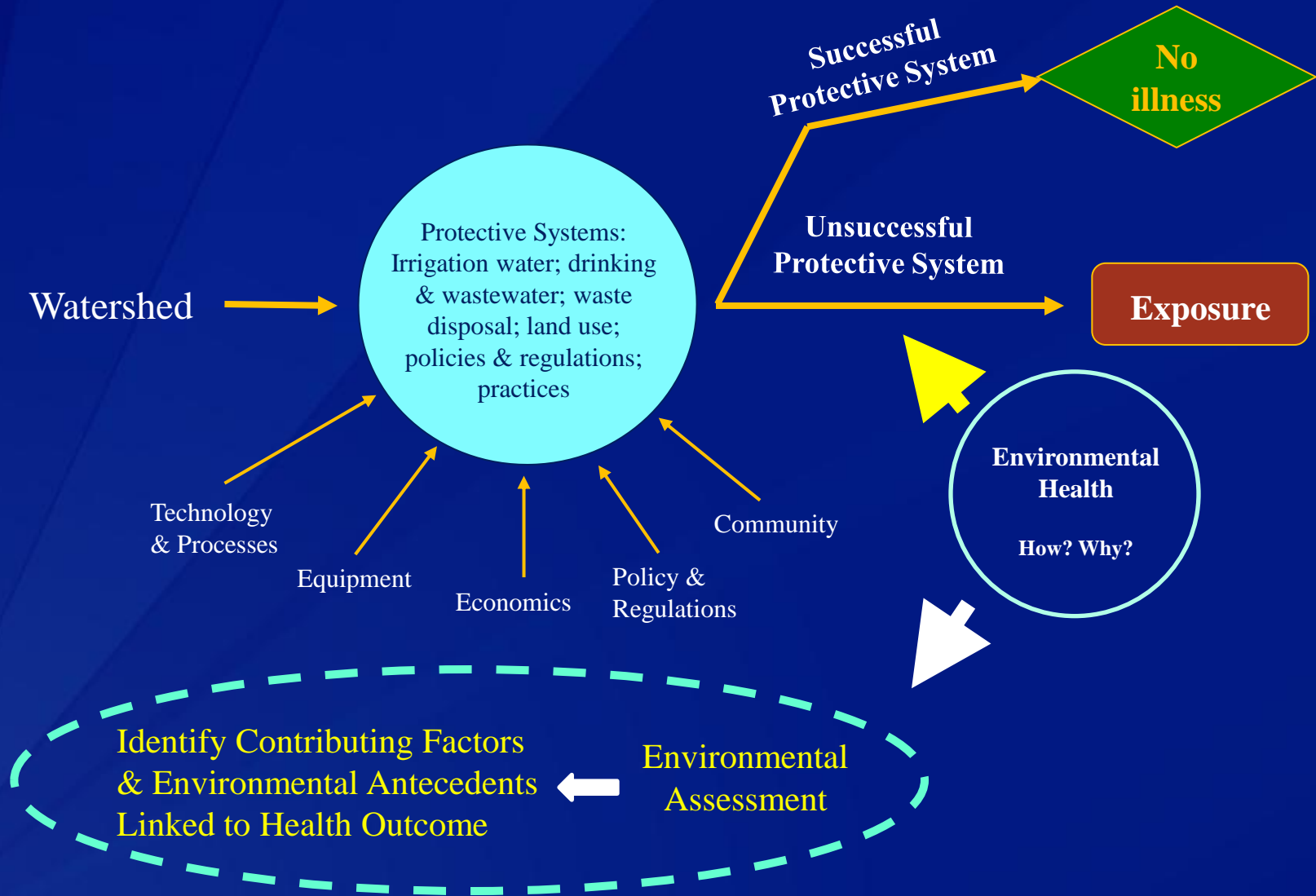


ENVIRONMENTAL ASSESSMENTS DURING OUTBREAK INVESTIGATIONS

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ENVIRONMENTAL ASSESSMENTS DURING OUTBREAK INVESTIGATIONS



ENVIRONMENTAL ASSESSMENTS DURING OUTBREAK INVESTIGATIONS

Exposure Assessment: Case-control study design

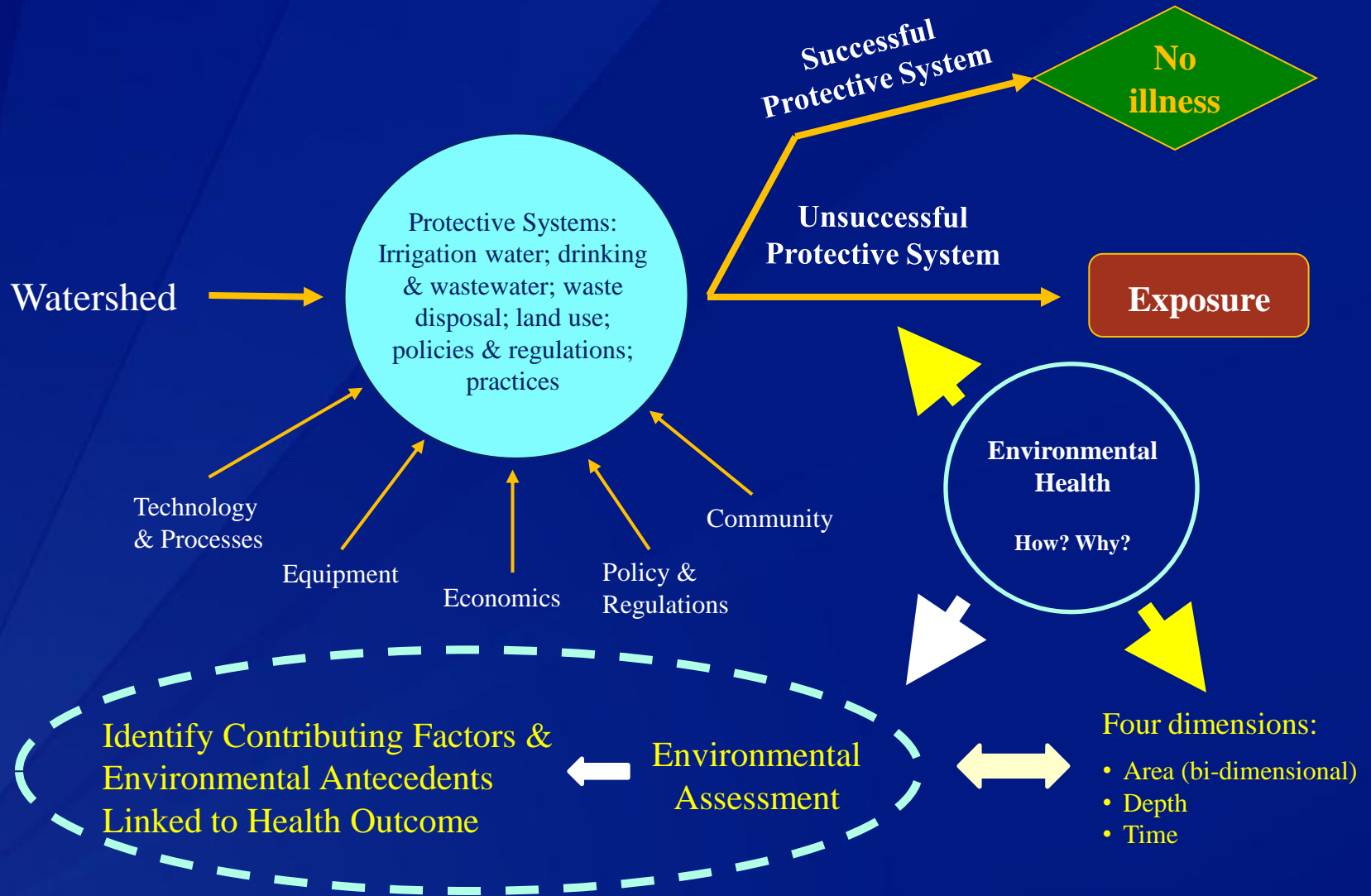


Exposure?

Illness?

Investigators
at beginning
of investigation

ENVIRONMENTAL ASSESSMENTS DURING OUTBREAK INVESTIGATIONS



ENVIRONMENTAL ASSESSMENTS DURING OUTBREAK INVESTIGATIONS



Winter

Spring

Summer

Fall

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec

ENVIRONMENTAL ASSESSMENTS DURING OUTBREAK INVESTIGATIONS

❑ 2006 Spinach – *E. coli* Outbreak

- Multiple states reported *E. coli* O157:H7 infections to CDC
- Epidemiologic investigation:
 - fresh spinach identified as vehicle of infection
 - Cases: >500 (200 hospitalizations/4 deaths in 26 states)
- Bagged spinach traced-back to four farms in CA
- Laboratory work: *E. coli* O157:H7 PFGE genetic matches from patients and spinach to environmental samples at a single farm

ENVIRONMENTAL ASSESSMENTS DURING OUTBREAK INVESTIGATIONS

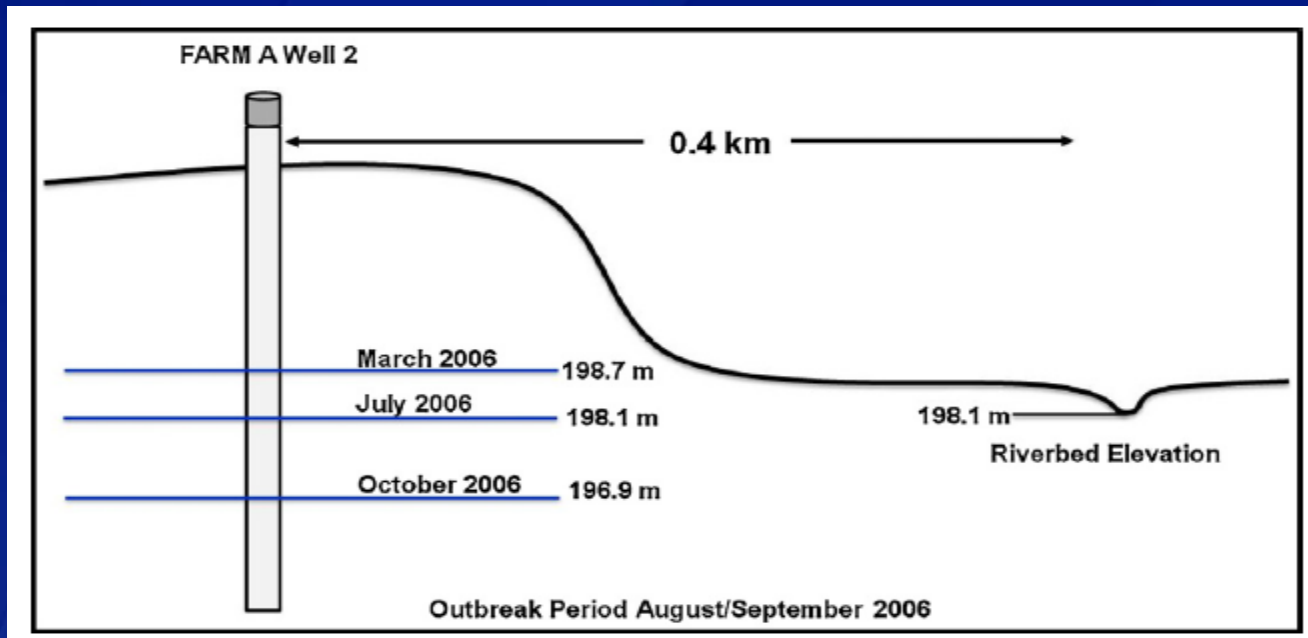
□ 2006 Spinach – *E. coli* Outbreak

- Environmental assessment:
 - Surface runoff from grazing areas
 - Irrigation wells
 - Cultivated fields
 - Use of surface water for irrigation
 - Well construction
 - Surface water-ground water interactions
 - Rate of pumping –intense pumping
 - Depth of GW table
 - GW recharge



ENVIRONMENTAL ASSESSMENTS DURING OUTBREAK INVESTIGATIONS

2006 Spinach – *E. coli* Outbreak



Estimation of percolation losses in San Benito River for August and September 2006.

	August 2006	September 2006
Hernandez Reservoir releases (thousand m ³)	4437	2796
Diversion to Paicines Reservoir (thousand m ³)	833	324
Difference = approximate percolation losses in San Benito River other than losses due to evaporation (thousand m ³)	3604	2472

ENVIRONMENTAL ASSESSMENTS DURING OUTBREAK INVESTIGATIONS

❑ 2010 Lettuce – *E. coli* Outbreak

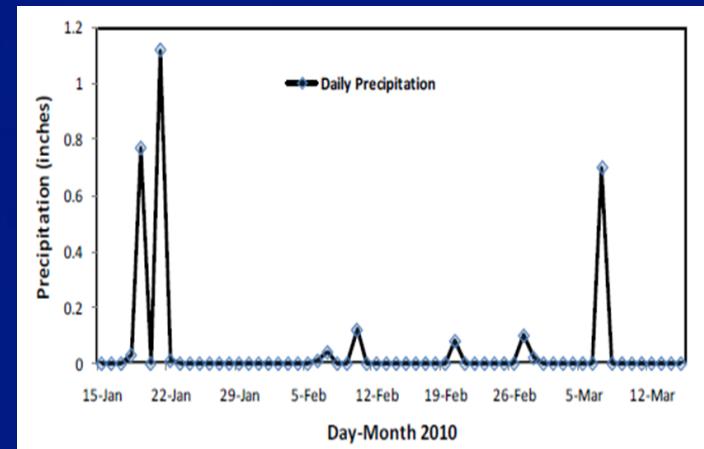
- Epidemiologic investigation:
 - First STEC O145 associated-foodborne-outbreak reported in the US
 - 26 confirmed cases and 7 probable cases (MI, OH, NY, PA, TN)
 - 12 hospitalizations and 3 HUS
 - Vehicle: Epi-Aid issued outbreak associated with romaine lettuce
- Lettuce traced-back to a farm in Yuma County, AZ
- Laboratory work:
 - NY reported isolating *E. coli* O145 from lettuce
 - PulseNet confirmed lettuce isolate as PFGE match to outbreak strain

ENVIRONMENTAL ASSESSMENTS DURING OUTBREAK INVESTIGATIONS

2010 Lettuce – *E. coli* Outbreak

Environmental assessment:

- Hydrology
 - Sources of Irrigation Water
 - Precipitation Events
 - Gila River overflow; runoff to irrigation canals → pathways?
- Non-point Sources for Microbial Pollution (pathogen loads)
 - Animal: cattle and dairy farms, and seasonal sheep grazing
 - Human: housing development and RV park with OWW systems



ENVIRONMENTAL ASSESSMENTS DURING OUTBREAK INVESTIGATIONS

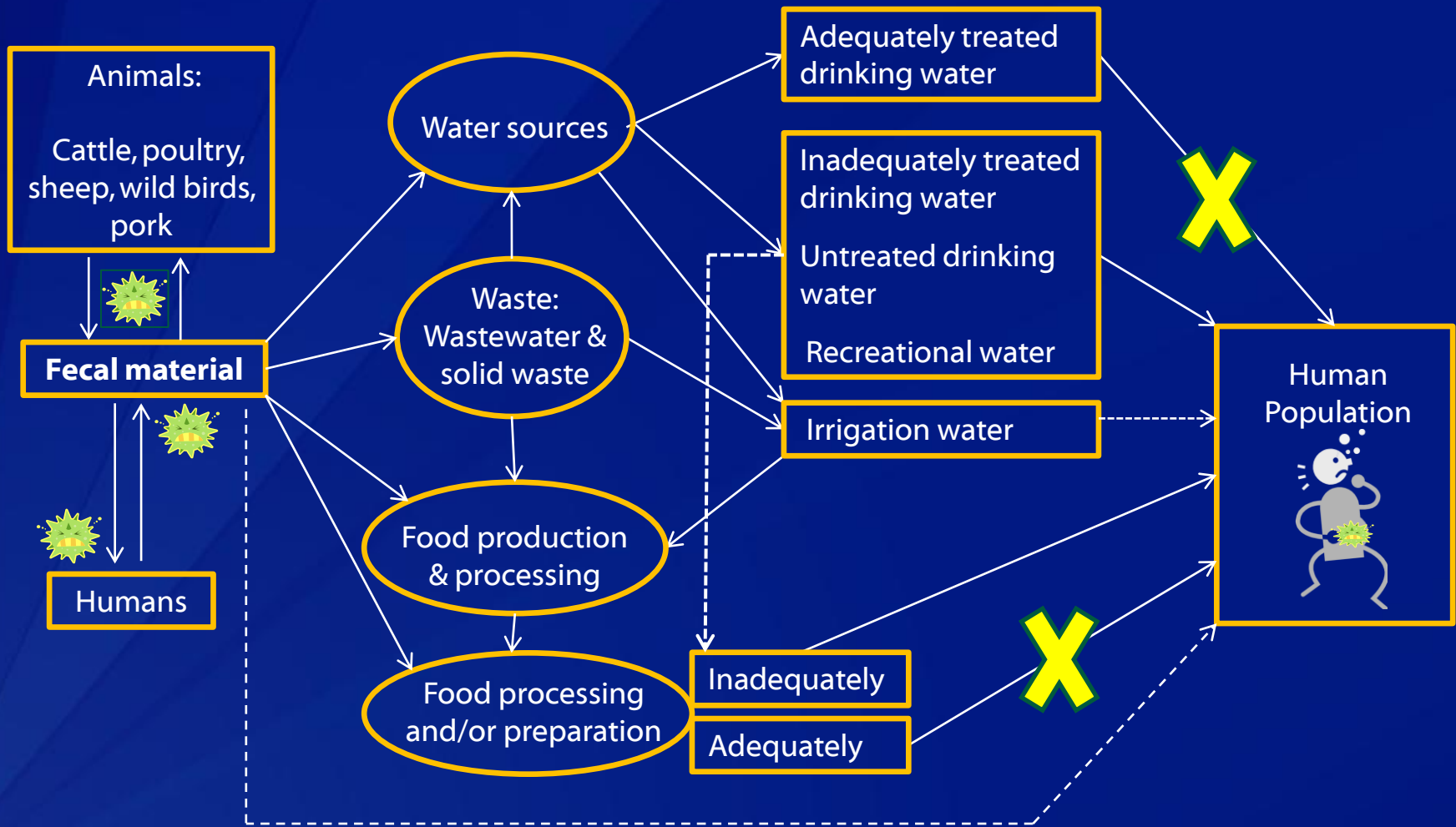
□ 2011 *Campylobacter jejuni*–Guillain-Barré Syndrome Outbreak

- Epidemiologic investigation: July 8–26
 - Water and food → potential human exposures to *C. jejuni*
 - As of July 21
 - 83% of GBS cases had antecedent diarrhea (*C. jejuni* infections)
 - GBS subtypes getting specified
 - As of August 26
 - 26 AFP patients had GBS (May 1–July 15 onset)
 - ❖ 18 in SLRC (2/3 in northern part of the city)
 - ❖ 8 Yuma County residents



ENVIRONMENTAL ASSESSMENTS DURING OUTBREAK INVESTIGATIONS

2011 *C. jejuni*-GBS outbreak: potential pathways of contamination (lit rev)



ENVIRONMENTAL ASSESSMENTS DURING OUTBREAK INVESTIGATIONS

C. jejuni-GBS Outbreak: Epidemiologic, Biologic, and Clinical Characteristics of *C. jejuni*

Epidemiologic

Reservoir/Source	Cattle and other mammals, avian species / Feces
Affected human hosts	Humans of all ages –often in clusters of cases
Links to Guillain-Barré Syndrome (GBS)	One person in 1,000 <i>C. jejuni</i> -infected people develops GBS
	One person in 3 with GBS had antecedent <i>C. jejuni</i> -infection

Biologic/Laboratory

Culture temperature	37°C and 42°C
Growth and survivability	Gram-negative, micro-aerophilic bacteria; Survivability: 4 weeks in water and 5 weeks in urine at 4 °C, and 2 months in human bile at 37°C

Clinical

Cause of diarrheal illness	Common
Clinical manifestations	Acute gastroenteritis and colitis
Outcome of infection	Usually self-limited

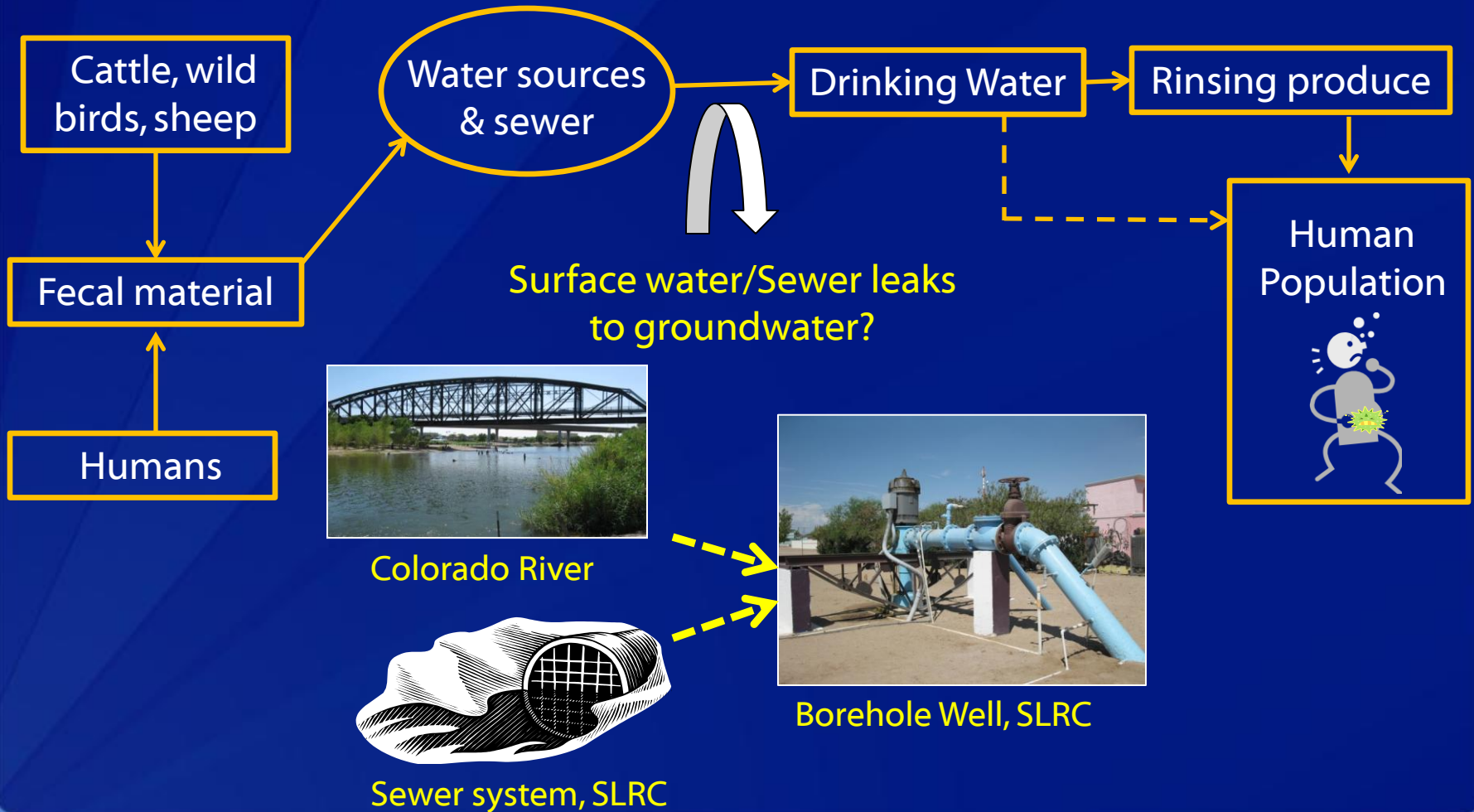
ENVIRONMENTAL ASSESSMENTS DURING OUTBREAK INVESTIGATIONS

EH investigations are not routine sanitary surveys or inspections



ENVIRONMENTAL ASSESSMENTS DURING OUTBREAK INVESTIGATIONS

***C. jejuni*-GBS outbreak:** potential pathways of contamination



REMAINING CHALLENGES

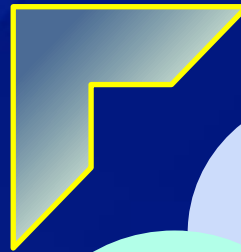
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REMAINING CHALLENGES

Earlier involvement of EH team during outbreak investigations

**Exposure Minimization
& Prevention**



Epidemiology

Where? When?
Who?

Environmental
Health

How? Why?

Lab

Agent?
Identification,
confirmation

Week:

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 ...



REMAINING CHALLENGES

Shifting the paradigm about EH investigations; they:

- Are neither routine sanitary surveys nor sanitary inspections
- Require and foster stakeholders' collaboration at local, State, and national levels
- Are holistic, four-dimensional approaches to identify sources and pathways of food & water contamination
- Are intended to help in minimizing exposures and formulating preventive measures



Thank you!

Questions?

For more information please contact Centers for Disease Control and Prevention

1600 Clifton Road NE, Atlanta, GA 30333

Telephone: 1-800-CDC-INFO (232-4636)/TTY: 1-888-232-6348

E-mail: cdcinfo@cdc.gov Web: <http://www.cdc.gov>

The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention.



DISCLAIMER

The findings and conclusions in this presentation are those of the author and do not necessarily represent the views of the Centers for Disease Control and Prevention.