

Outbreak of *Salmonella* Rissen associated with Ground White Pepper

The Epi Investigation



Jeffrey Higa, MPH

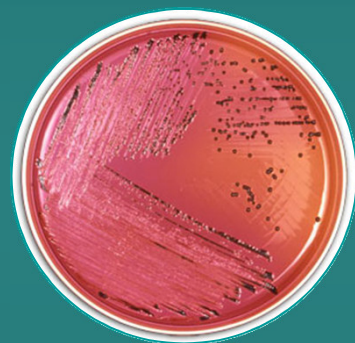
California Department of Public Health
Infectious Diseases Branch



PulseNet

- ◆ National network of PH labs coordinated by CDC
 - State and local health departments
 - Federal agencies: CDC, FDA, and USDA/FSIS
- ◆ Perform standardized molecular subtyping (or “fingerprinting”) of foodborne disease-causing bacteria by pulsed-field gel electrophoresis (PFGE)
 - PFGE patterns are submitted electronically to CDC
 - Constant monitoring of trends
- ◆ Many outbreak investigations start in response to a “blip” in PulseNet

PFGE / PulseNet 101...



PFGE



PulseNet

TEEX01.0014

PFGE identifies the
DNA fingerprint (strain)

PulseNet

- Collects nationwide data
- Assigns PFGE pattern #s
- Identifies clusters

Salmonella serotype Rissen

- ◆ Uncommon *Salmonella* serotype in U.S.
 - 18 human isolates in 2006, 5 in 2005, 7 in 2004
 - No S. Rissen outbreaks previously reported in U.S.
- ◆ Fairly common *Salmonella* serotype in Southeast Asia
 - Among top 10 *Salmonella* isolates in Thailand
 - Food sources include:
 - ◆ Pig and pork products: Thailand
 - ◆ Chicken: Thailand
 - ◆ Tropical seafood: India



How This Outbreak Started

◆ Feb 23, 2009

- California notes increase in S. Rissen isolates
 - ◆ 7 during 12/08 -2/09, only 1 in previous 12 months
 - ◆ Cases clustered in northern/central CA
 - ◆ No common exposures noted

◆ March 2, 2009

- Nevada posts 3 S. Rissen isolates to PulseNet
 - ◆ Cases clustered in northern/central NV bordering CA
- Oregon reports 2 S. Rissen cases
 - ◆ Cases both consumed Vietnamese food

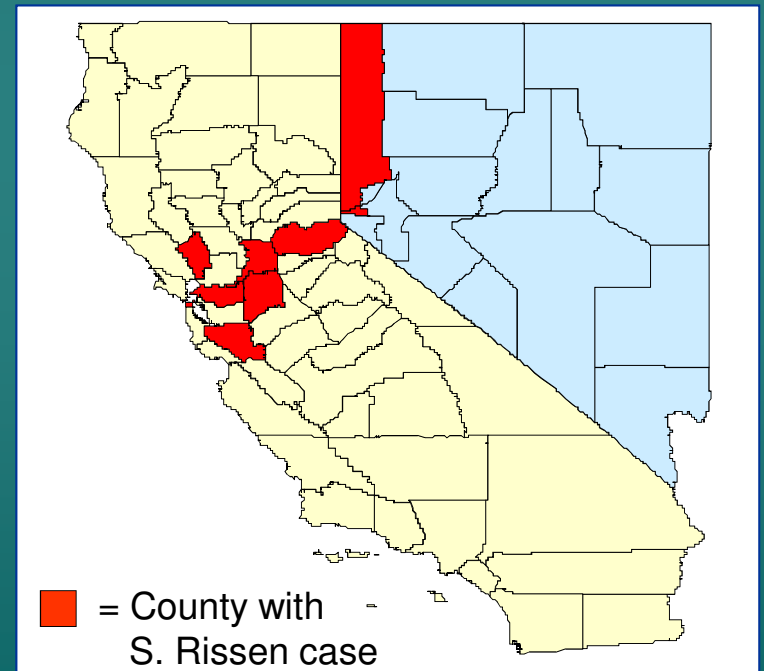
How This Outbreak Started (cont'd)

- ◆ PFGE pattern TEEX01.0014

- Never before seen in human isolates in U.S.

- ◆ Geographic clustering

- PFGE-matched cases in 4 western states: CA, NV, OR, WA
- CA and NV cases clustered from San Francisco Bay to Carson City/Reno area




Confirmed Case Definition

A person with:

- ◆ *S. Rissen* infection,
- ◆ PFGE pattern matching the outbreak strain, and
- ◆ Illness onset date or *Salmonella* isolation date on or after September 16, 2008

Methods: Hypothesis Generation

- ◆ Historical data
 - PulseNet, VetNet, Global Salm Survey, and EFORS databases reviewed for cluster strain
- ◆ Open-ended interviews
 - Case interviewed about meals, activities, daily routine during exposure period
- ◆ OR “Shotgun” questionnaire 
 - Checklist of 300+ exposures
- ◆ Review of hospital records

[8]	Y	?	N	FRESH VEGETABLES (Not frozen)
A	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	celery
B	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	mini-carrots in sealed bag
C	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	loose or bagged carrots (full size)
D	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	cucumbers
E	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	broccoli
F	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	cauliflower
G	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	green bell peppers
H	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	red bell peppers
I	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	asparagus
J	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	fresh corn
K	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	snow peas (eaten in pod)
L	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	fresh beans
M	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	brussel sprouts
N	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	eggplant
O	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	zucchini or other "soft" squash
P	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	any "hard" squash (pumpkin, acorn, etc.)
Q	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	white or yellow onions
R	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	green onions (scallions)
S	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	leeks
T	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	avocado (or guacamole)
U	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	any homegrown fresh tomatoes (eaten raw)
V	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	any store-bought fresh tomatoes eaten at home (raw)

Methods: Environmental Investigation

◆ Oregon

- Cultured suspect foods at Vietnamese/Chinese restaurants where cases dined prior to illness

◆ Nevada (Washoe County)

- Cultured suspect foods from a resort buffet named by several cases
- Obtained list of ingredients in each item served at buffet (cases then interviewed using list of menu items)

◆ California

- Manufacturing facility of implicated product inspected, product tested, traceback/traceforward conducted

Historical Salmonella Data

◆ PulseNet

- PFGE matched food isolate from whole black peppercorn from Vietnam imported Sept 2006; routine import testing, not OB related

◆ VetNet

- No S. Rissen isolates in previous 5 years

◆ EFORS

- No outbreaks due to S. Rissen ever reported in U.S.

◆ Global Salm-Survey (WHO database)

- S. Rissen most commonly reported by Thailand; frequently isolated from humans and food (types unk)

Hypothesis Generating Interviews

- ◆ Interview exposure data compared with 2006-07 FoodNet population survey data for CA;
3 highly suspect food exposures identified
 - Bean sprouts: 33% cases vs. 12% FoodNet
 - Cilantro: 55% cases vs. 35% FoodNet
 - Black pepper: 67% cases, no FoodNet data available
- ◆ Approximately half reported eating at an Asian restaurant or had Asian surnames
- ◆ 4 cases reported eating at same resort buffet in Reno, NV

Hospital-Associated Cases



- ◆ Approx. 30% of cases hospitalized prior to or during time of specimen collection
 - Generally older (median age 74 years) with underlying medical conditions
- ◆ Cases hospitalized at different facilities; however, several cases were patients at same Healthcare Maintenance Organization (HMO A)
 - All HMO A facilities in northern CA receive prepackaged meals from one food service company (Food Provider B)

Hospital-Associated Cases (cont'd)

- ◆ Hospital records and menus collected
 - None hospitalized for gastrointestinal issues
 - Of those diagnosed with *S. Rissen* infection during hospital course:
 - ◆ Few developed gastroenteritis, some UTI, and other infections including peritonitis and pneumonia
 - ◆ For several, *S. Rissen* was incidental finding
 - Although menus and information about type of diet collected, could not obtain information about specific menu items consumed
 - ◆ No consistent type of diet (e.g., low sodium, regular, diabetic) among cases

Challenges

- ◆ Exposure period hard to define for several cases
 - Many had vague/unclear onset dates
 - ◆ No GI symptoms; several urine isolates
 - ◆ Mild diarrhea on/off for a month or more
- ◆ Ingredients common in Asian cuisine suspected, but could not account for all cases

Challenges (cont'd)

- ◆ Three distinct populations within outbreak but in geographically distinct region
 - Community cases with exposure to Asian restaurants or foods
 - ◆ Generally younger and healthy
 - Cases exposed to same large resort buffet in Nevada
 - ◆ Exposures occurred between 12/08-2/09
 - Cases hospitalized prior to or during time of specimen collection
 - ◆ Generally older with underlying health conditions

Investigation Breakthrough!

- ◆ Oregon restaurant investigation
 - White and black pepper both positive for S. Rissen
 - ◆ Both types of pepper were Lian How brand from UIFC Union City
 - ◆ PFGE confirms outbreak strain
 - Cilantro and bean sprouts test negative
- ◆ Washoe County Health District (NV) resort buffet investigation
 - Outbreak strain of S. Rissen isolated from Lian How ground white pepper
 - Lian How ground black pepper, cilantro, and bean sprouts test negative

S. Rissen Positive



Lian How ground white pepper collected from Oregon and Nevada restaurants test positive for outbreak strain.

Lian How ground black pepper collected from Oregon restaurant tests positive for outbreak strain; however, cross-contamination suspected.



Questions Answered

Lian How White Pepper Accounts for all three groups

- ◆ Community cases with exposure to Asian restaurants
 - White pepper traditional spice used in Asian cooking
 - UIFC Union City source of white pepper to several Asian restaurants, especially in northern CA
 - Several restaurants had white pepper in shakers on customer tables
- ◆ Cases exposed to same resort buffet in Reno
 - Lian How white pepper in several foods

White pepper added.....



....in the kitchen

and at the table



Questions Answered (cont'd)



Lian How White Pepper Accounts for all three groups

- ◆ Cases hospitalized prior to or during time of specimen collection
 - One UIFC consignee (Food Provider B) prepared prepackaged meals for several hospitals in northern California, including HMO A hospitals
 - Lian How white pepper used in preparation of several cold salads (e.g., egg salad, tuna salad) as well as some hot food items
- ◆ UIFC Union City source of implicated vehicle
 - Accounts for geographical clustering

87 S. Rissen cases

- 65 California
- 10 Nevada
- 8 Oregon
- 3 Washington
- 1 Idaho

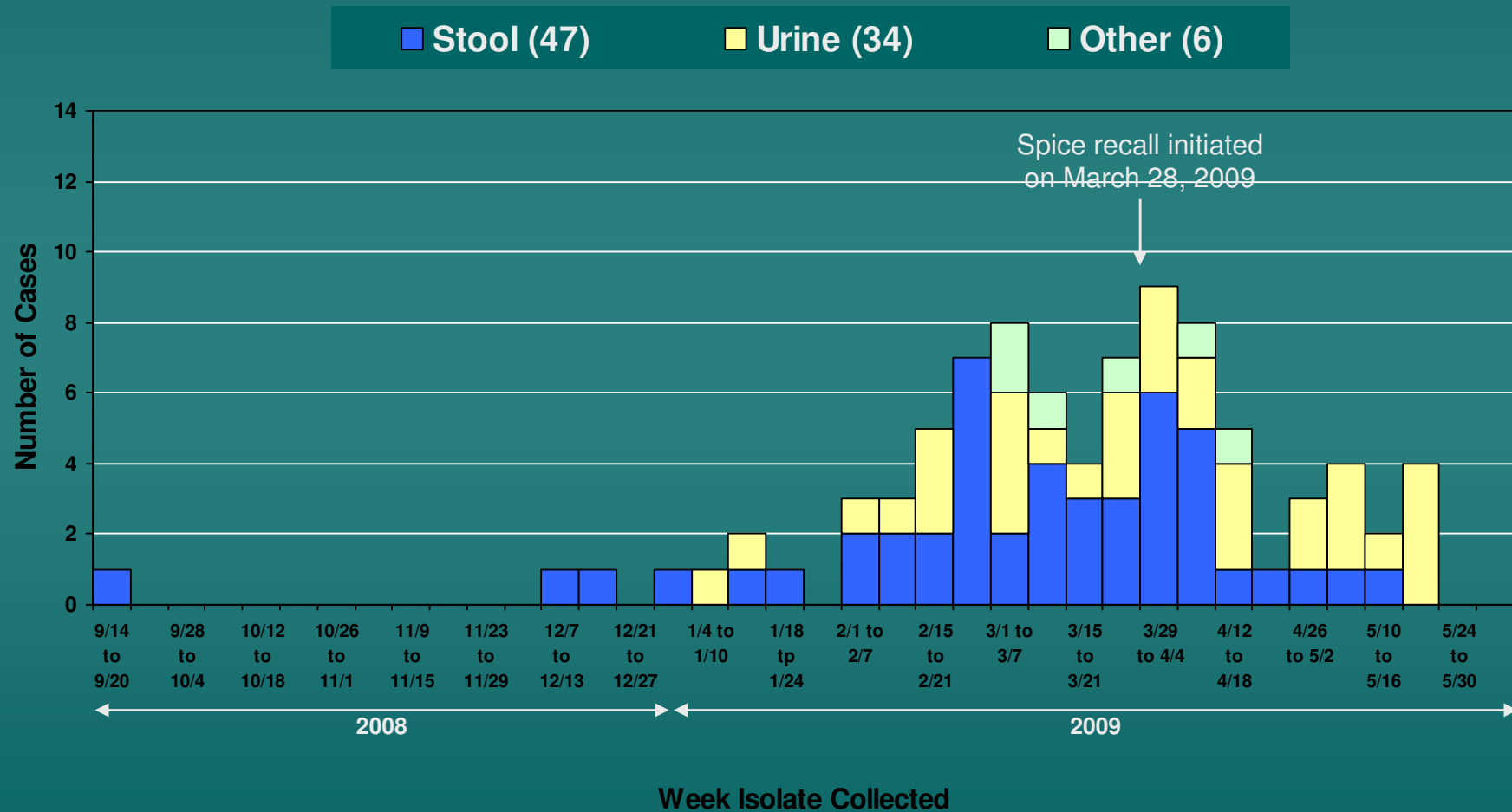
Cases from geographically outlying areas had traveled to areas (primarily Reno, NV) where implicated white pepper was distributed.

 = County with S. Rissen case

Results: Demographics

- ◆ Confirmed case count: 87 from 5 states - 65 CA, 10 NV, 8 OR, 3 WA, 1 ID
- ◆ Specimen source: 54% stool, 39 % urine, 7% other
- ◆ Gender: 64% female
- ◆ Median age: 52 years (range: 5 mths to 94 yrs)
- ◆ Onset dates (n=32): 12/9/08 to 4/29/09
- ◆ Collection dates: 9/16/08 to 5/22/09
- ◆ Hospitalizations: 8 (9%) due to GI illness
- ◆ Deaths: 1

***Salmonella* Rissen Cluster 0903NVTEE-1**
Epidemic Curve by Specimen Collection Week and Specimen Type,
Multi-State, September 2008 - May 2009 (N=87)
(as of June 4, 2009)



Range: September 16, 2008 to May 22, 2009

Discussion

- ◆ Outbreak of rare strain of *Salmonella*
- ◆ Distinct populations impacted
- ◆ Sampling/testing of multiple suspect products was crucial to this investigation
 - Case recall of spice consumption in food prepared outside of home was poor
 - Restaurant recall of spices used also poor; e.g., restaurant denied white pepper use when it was on customer tables
 - Ground white pepper probably would have not been implicated in case-control study

Pepper Again!



U.S. Department of Health & Human Services

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News & Events

What's New in Food

Red & Black Pepper Spice Recalls Linked to the *Salmonella* Montevideo Outbreak Investigation (Updated March 30, 2010)

The Food and Drug Administration is actively working with the Centers for Disease Control and Prevention, the U.S. Department of Agriculture's Food Safety and Inspection Service, the state of Rhode Island and other states to investigate the *Salmonella* Montevideo foodborne illness outbreak.

The CDC reports that more than 250 people have been infected with a matching strain of *Salmonella* Montevideo in at least 44 states and the District of Columbia. Analysis of an epidemiologic study comparing foods eaten by individuals who were sickened identified salami/salame as a possible source of illness:

<http://www.cdc.gov/salmonella/montevideo/index.html>.

Daniele International Inc. recalled a variety of ready-to-eat Italian-style meats after *Salmonella* was associated with its products. A complete listing of the recalled products, which are regulated by the U.S. Department of Agriculture's Food Safety and Inspection Service, can be found at: http://www.fsis.usda.gov/News_&_Events/Recall_006_2010_Products/index.asp.

The FDA has been investigating the supply chain of black and red pepper supplied to Daniele International Inc. Based on recent test results, Mincing Overseas Spice Company, Dayton, N.J.; and Wholesome Spice Company, Brooklyn, N.Y. are recalling products. Both supplied pepper to Daniele International Inc. and to other companies, who are also recalling products, including seasoning mixes.

Acknowledgements

- ◆ State and local health departments
 - California
 - Idaho
 - Nevada
 - Oregon
 - Washington
- ◆ Federal agencies
 - U.S. Centers for Disease Control and Prevention
 - U.S. Food and Drug Administration

Contact Info

Jeffrey Higa, MPH

California Department of Public Health
Division of Communicable Disease Control
Infectious Diseases Branch
Disease Investigations Section

Jeffrey.Higa@cdph.ca.gov
(310) 217-6906

Outbreak of *Salmonella* Rissen associated with Ground White Pepper: Environmental Investigation

Maha Hajmeer, Ph.D.
Carol Myers, M.S.

California Department of Public Health

Union International Food Co. (UIFC)

- ◆ UFC manufactured and repackaged a variety of foods - shelf-stable sauces, edible oils, spices, nuts, dried foods, and teas.
- ◆ Primary focus of the investigation - white pepper operations and overall sanitation of the facility.
- ◆ Investigation > five months

Anatomy of Investigation

- ◆ S. Rissen – white and black pepper positive samples
 - 03/26/09
 - previously opened containers at a restaurant
- ◆ CalFERT was activated
- ◆ GMP inspections AND environmental investigation
 - Initiated 03/27/09
- ◆ Continued epi work (IDB, other states, CDC)
- ◆ Ongoing traceback
- ◆ 1st public notification – press release
 - 03/28/09

CalFERT Activities

California Food Emergency Response Team

```
graph TD; A[California Food Emergency Response Team] --> B[Traceback]; A --> C[Inspection/GMPs]; A --> D[Environmental];
```

Traceback

Inspection/GMPs

Environmental

Traceback

- ◆ Traceback: Identify the source and the distribution of a product.
- ◆ Epi data and lab results reviewed.
- ◆ Supporting documentation for the movement of suspect product is collected and analyzed.
- ◆ Create flow diagram and timeline to place suspect food at point of service.

Traceback

- ◆ Inspections and further investigations?
- ◆ Is a recall is needed?
- ◆ Has product been distributed, re-packaged, co-packed, and/or further processed?

Inspection(s) & Findings

- ◆ Good Manufacturing Practices (GMPs)
- ◆ Sanitation
- ◆ Production operations (flow, lots, etc)

Inspection(s) – Findings

- ◆ FDB Regulatory Action
 - Notice of Violations
 - Embargoes
 - Voluntary Condemnation and Destruction
 - Preliminary Injunction
 - ◆ Firm ordered to submit plans and protocols requested by CDPH.

Environmental Investigation

Activities

```
graph TD; A[Activities] --> B[Document collection]; A --> C[Recalls/ Press releases]; A --> D[Sample collection];
```

**Document
collection**

**Recalls/
Press releases**

**Sample
collection**

Document Review

- ◆ Co-packing
- ◆ Traceforward
- ◆ Customer list
- ◆ Invoices
- ◆ Seed suppliers
- ◆ Distinction between Southern and Northern CA firms' operations

Document Review – *Findings*

- ◆ UIFC co-packed for other companies
 - Sub recalls by companies
- ◆ Invoices and customer lists connected UIFC to retail and restaurants where Lian How and Uncle Chen white pepper samples, matching the outbreak strain, were collected.
- ◆ Suspect white pepper seed originated from Vietnam.
- ◆ Southern and Northern CA facilities were operated as separate businesses and did not share raw ingredient, suppliers, or customers.

Recalls/Press Releases - Findings

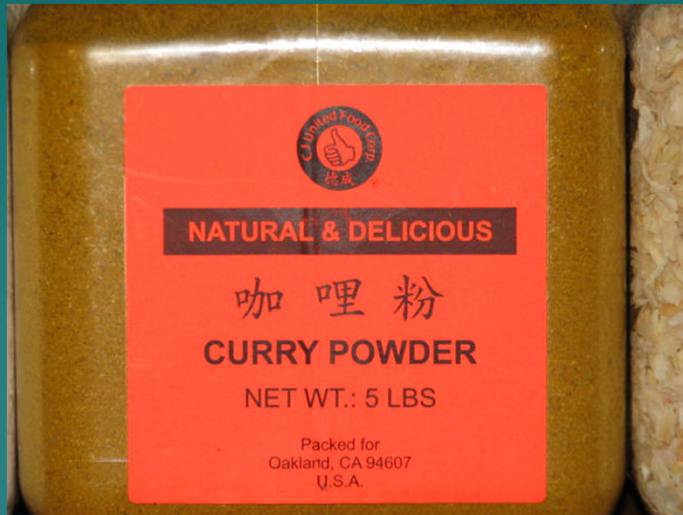
- ◆ 3/28/09: CDPH PR – Lian How Brand, 12 spices including white and black pepper
- ◆ 3/30/09: UIFC PR – included Uncle Chen retail 5 oz whole and ground pepper and 3 other spices
- ◆ 4/2/09: UIFC recall included all spices, all peppers in any package size (22 spices)
- ◆ 4/14/09: UIFC recall included all Lian How and Uncle Chen retail and institutional products including oils, oil blends, and sauces

Recalls/Press Releases - Findings

Recalls – Companies UIFC co-packed for

- ◆ 4/17/09 CJ United Spices "Natural and Delicious" Black and white pepper curry powder
 - 4/23/09 Expanded recall included 4 more spices
- ◆ Lucky International Trading, Cloud Nine, and Fortune Food

Samples of Recalled Products



Sample Collection – Environmental & Product

Facility – 65,000 sq ft:

- Sauce/oil bottling room
- White pepper grinding room
- Sauce mixing room
- Sauce fermenting and warehouse
- Repack area – spices
- Main warehouse – raw spices, teas, nuts, seeds

White Pepper Grinding Room



White Pepper Grinding Room



White Pepper Grinding Room



White Pepper Grinding Room



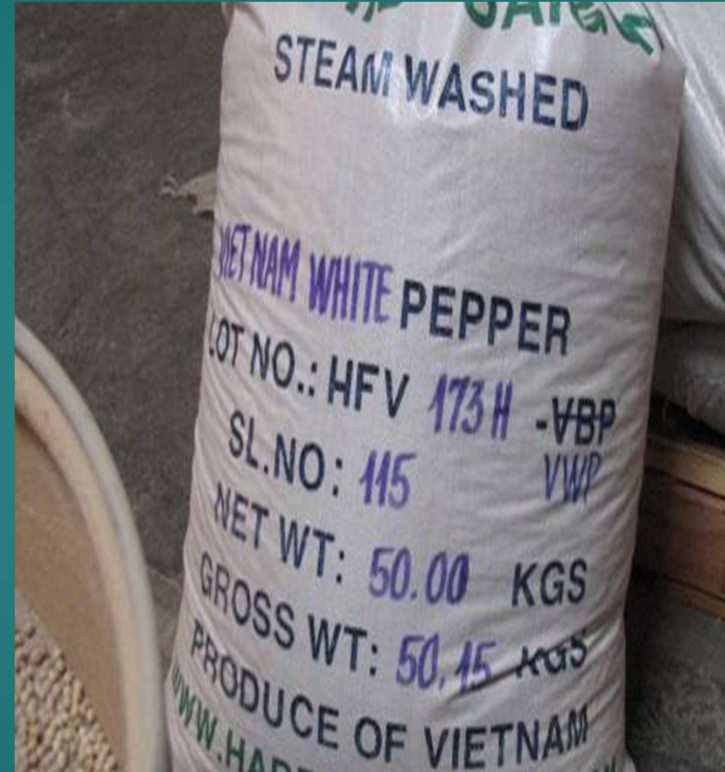
White Pepper Grinding Room



White Pepper Grinding Room



White Pepper Grinding Room



Repackaging Area



Repackaging Area



Repackaging Area



Environmental Samples - Findings

White Pepper Grinding Room – Before Sanitation

36 swabs collected: 34 = positive *S. Rissen*
14 = matched outbreak strain

Positive sites: drain, shovel, outlet, wall, outside of metal hopper

Repack Area

20 swabs collected: 4 = positive *S. Rissen*
2 = matched the outbreak strain

Positive sites: scale, floor, cardboard funnel

Environmental Samples - Findings

Sauce Mixing Room – Before Sanitation

5 swabs collected: 1 = positive *S. Rissen*
 1 = matched the outbreak strain

Warehouse

A variety of raw ingredients and product samples (ground chilies, mustard flour, minced garlic) were collected from closed bulk containers: all samples were negative for *Salmonella*

Product Samples - Findings

White Pepper Seed

104 – 1lb samples collected from Lot HFV 173H-VWP: 1 = positive *S. Rissen* and matched the outbreak strain

Sauces and Oil

A variety of finished Uncle Chen and Lian How oil and sauce product samples were collected: All samples were negative for *Salmonella*

Finished Product Samples - Findings

- 1 container of Lian How ground black pepper (5 lb) collected = negative *Salmonella*
- 1 bag of Uncle Chen ground white pepper (5 lb) collected = positive *S. Rissen*, matched outbreak strain
- 1 container of Lian How ground white pepper (5lb) collected = positive *S. Rissen*, matched outbreak strain

Finished Product Samples - Findings



CalFERT Environmental Sampling

April 2009

- ◆ After UIFC had sanitized rooms and equipment 50 swabs were collected.
 - 30 from sauce/oil bottling room and warehouse area; all negative
 - 20 from sauce mixing room
 - ◆ 7 positive *Salmonella*
 - ◆ 1 matched the outbreak strain
 - No swabs from pepper grinding room

Findings – UIFC 1st Cleaning



Positive *S. Rissen* from a roll up door (sampler was on a 10' ladder door)



Reinstalled same cabinet with pepper dust: Positive *Salmonella* from walls behind cabinet

UIFC Clean Up

May – June 2009

- ◆ Professional company cleaned and sanitized facility
- ◆ Design changes: installation of 72" stainless steel sheets in production rooms, removal of ceiling insulation, floors sealed with epoxy, and stainless steel kickboards installed
- ◆ Removal of all pepper grinding and bulk handling equipment from pepper grinding room
- ◆ All production equipment disassembled and cleaned and sanitized

UIFC Clean Up

May – June 2009

- ◆ Production rooms: installation of new doors and plastic strips
- ◆ Replaced wood pallets with plastic ones
- ◆ Installation of filtered air system
- ◆ June: Firm conducted environmental testing for *Salmonella* and resanitized areas yielding positive results

New Installations and Equipment



CalFERT Environmental Sampling

October 2009

Sauce/oil bottling, white pepper grinding, and sauce mixing rooms:

- 50 swabs collected: 1 = positive *S. Rissen* that matched the outbreak strain
- sample collected (swabbed underneath and inside scale frame and under stainless steel lip), from same scale that was used in production during case exposure dates
- firm stated they had cleaned and sanitized scale, however scale was not appropriate for use

Scale yielding positive S. Rissen 10/27/09



Conclusions

- ◆ Of the 391 environmental samples collected at UIFC 63 tested positive for *Salmonella*.
- ◆ *S. Rissen* outbreak strain was found in or on equipment, walls, floors, raw ingredients (including white ground pepper and whole white pepper seed), finished white ground pepper, and in-process white ground pepper.

Conclusions

- ◆ Firm lacked proper SOPs and SSOPs to ensure that the cleaning and sanitizing of equipment and facility structures was completed between specific lots and batches of product.
- ◆ The lack of adequate sanitation and an appropriate air handling system most likely led to contaminated white pepper dust being dispersed throughout adjacent rooms. UIFC then packaged and distributed adulterated white pepper to a variety of customers.

Acknowledgements

- CDPH:
 - Emergency Response Unit
 - Food and Drug Laboratory Branch
 - Food Safety Inspection Unit
 - Infectious Diseases Branch
 - Industry and Education Unit
- Food and Drug Administration
 - San Francisco District Office (SANDO)
 - SANDO laboratory
- CDC and other states
 - Oregon Department of Health

Thank You