Food Allergens: Regulatory & Allergen Control Considerations

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Food Allergy

- Continues to be a major public health issue in the U.S. and around the world
  - Overall economic impact of childhood food allergies estimated to exceed $24.8 billion in the U.S.

- IgE-mediated food allergies are estimated to affect:
  - 6-8% of infants and children
  - 3.5-4.0% of adults in the U.S.
  - (~15 million Americans have food allergies)

- 18% increase in children under 18 years of age
  - Peanut ~1.1% in US (~3 million Americans)
    - US (children) allergy 0.4% to 1.4% (1997-2007)
    - UK peanut sensitization 1.3% to 3.2% (1989-1995)

Food Allergens

- Humans consume 1000s of plant and animal proteins in the diet on a daily basis

- Only a small number of proteins from plant and animal origin cause an IgE-mediated immune response in only a small number of humans

- Why are some proteins allergenic while others are not?

- What factors are involved in the development of IgE-mediated food allergen?
What Are The Causative Agents of Food Allergies?

- Naturally-occurring proteins
- Heat-resistant
- Resistant to digestion/proteolysis
- Resistant to extremes in pH
- Usually major proteins of the food
- Foods can have 1 or many allergens in them
Factors That May Trigger Development of Food Allergy

The Risks of Uncontrolled Allergens

- Health risk – undeclared allergens can cause consumers to have reactions

- Regulatory risk – undeclared allergens can lead to product recalls, FDA/FSIS audits, etc.

- Business risk - loss of customers, law suits, failed audits (SQF, etc.), cost of product recalls, loss of consumer confidence, loss of retail space for products with your ingredients, allergen control/sanitation, down time, etc.
Regulatory Status

- Labeling laws/regulations in many countries impose a zero threshold for source labeling of ingredients.

- Food industry is acutely aware of allergens.
  - However, there is little or no guidance on action levels/thresholds.
    - How much allergenic residue is too much OR how clean is clean enough??

- Public health authorities have not established regulatory action levels for any of the allergenic foods.
  - With the exception of Japan (10 µg/g protein limit for labeling).
Food Allergen Labeling and Consumer Protection Act (FALCPA) of 2004

- Law amended the Federal Food, Drug, and Cosmetic Act
  - Requires food manufacturers to label food products that contain a major food allergen by common name in the ingredient statement or use a “contains” statement

- Examples:
  - Ingredients: Lecithin (soy), whey (milk)
  - Contains: Soy, Milk

- Voluntary use of precautionary allergen labeling (i.e. May Contain, etc.) is allowed
Food Allergen Labeling and Consumer Protection Act (FALCPA) of 2004

- The focus has remained on the Big 8
- Highly refined oils are also exempt for FALCPA
- Some pan-release uses of soy lecithin are exempt from FALCPA (Solaе petition)
- Commingling of raw agricultural commodities was exempted from labeling provisions of FALCPA
  - But what about the finished products made from these commodities?
    - soy in wheat flour, soy in corn flour, peanut in wheat flour, wheat in rolled oats, etc.
  - USDA Grain Standards Allow for a % of commingled material but FDA seems to be now approaching potential risk on a case-by-case basis
FSMA Preventive Controls Final Rule:  
*Fed Reg Vol. 80, No. 180 (Sept. 17, 2015)*

- Current Good Manufacturing Practice, Hazard Analysis, & Risk-Based Preventative Controls for Human Food

- 21 CFR Parts 1, 11, 16 106, 110, 114, 117, 120, 123, 129, 179, and 211
  - [Docket No. FDA-2011-N-0920]
  
Preventive Controls for Human Food Rule

- Requires allergen control plans to be implemented by food companies
  - In many facilities, allergen cross-contact will be identified as a hazard that is reasonably likely to occur

- Preventive control management components:
  - Monitoring
  - Corrective actions/corrections
  - Verification
Food Allergen Controls

● Applicable to facilities that handle any of the priority food allergens

● Procedures, practices, and processes to control food allergens must include:
  – Ensuring protection of food from allergen cross-contact
  – Labeling the finished food [to include all food allergens]

● Must be written

● Validation not required (but recommended)
First time food allergens ranked #1 in RFR entries for the first time

Bakery (cookies & cakes) and chocolate/confections accounted for 32/88 entries (36%)
U.S. FDA Food Allergen Recall Incidents 1988-2016

* Includes FDA recalls & alerts
Learning from FDA Food Allergen Recalls and Reportable Foods

By Steven M. Gendel, Ph.D., Jianmei Zhu, Ph.D., Nichole Nolan, M.P.H. and Kathy Gombas

<table>
<thead>
<tr>
<th>Food Class</th>
<th>Number of Recalls</th>
<th>% Class I</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bakery</td>
<td>153</td>
<td>62</td>
</tr>
<tr>
<td>Snack</td>
<td>62</td>
<td>62</td>
</tr>
<tr>
<td>Candy</td>
<td>45</td>
<td>63</td>
</tr>
<tr>
<td>Dairy</td>
<td>39</td>
<td>58</td>
</tr>
<tr>
<td>Dressing</td>
<td>38</td>
<td>59</td>
</tr>
</tbody>
</table>

Table 1: Foods Most Often Involved in Allergen Recalls

<table>
<thead>
<tr>
<th>Allergen</th>
<th>Number of Recalls</th>
</tr>
</thead>
<tbody>
<tr>
<td>Milk</td>
<td>174</td>
</tr>
<tr>
<td>Wheat</td>
<td>130</td>
</tr>
<tr>
<td>Soy</td>
<td>118</td>
</tr>
</tbody>
</table>

*Some of the recalls involved multiple allergens

Table 2: Food Allergens Most Often Involved in Recalls

<table>
<thead>
<tr>
<th>Cause</th>
<th>Number of Recalls</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wrong package or label</td>
<td>82</td>
</tr>
<tr>
<td>Terminology</td>
<td>59</td>
</tr>
<tr>
<td>Failure to carry forward information from an ingredient to final label</td>
<td>41</td>
</tr>
<tr>
<td>Cross-contact</td>
<td>28</td>
</tr>
<tr>
<td>Ingredient mislabeled from supplier</td>
<td>21</td>
</tr>
</tbody>
</table>

Table 3: Causes of Food Allergen Recalls
Current Regulations: USDA FSIS

- USDA FSIS also requires labeling of priority allergens
  - Wheat, Crustacean Shellfish, Eggs, Fish, Peanut, Milk, Tree Nuts and Soy

- Labeling policy outlined in FSIS Notice 29-13
  - April 30, 2013

- FSIS Directive 7230.1 (March 10, 2015)
  - Initiated monthly verification task beginning on April 12, 2015 to determine whether establishments accurately control and label the “Big 8” food allergens
  - Verify that all of the ingredients listed in a “May Contain” or “Produced in a facility” statement on incoming food & food ingredients are listed on the final product label, except when:
    - The producer contacts the supplier and confirms in writing that the statement is a cautionary statement, and no such ingredient is in the product; AND
    - Includes a written statement in its hazard analysis documentation to support why the precautionary allergen statement is not carried forward to the finished meat or poultry product
FSIS/ USDA Food Allergen Recalls
Calendar Years 1999-2016
Allergen Control Strategies
Where Allergen Risks Occur

- Raw Materials
  - Suppliers
  - Co-Packers
  - Purchasing
- Operations/Production
  - Scheduling
  - Rework
- Packaging & Labeling
- Engineering & System Design
- Sanitation
- Training
  - Minimizing Human Error
- Research & Product Development

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Food Industry Operations:
Scale-Up
Retail and Food Service
Allergen Management

• Form an allergen control team
• Conduct a risk assessment to identify the high risk issues
• Develop an allergen process flow diagram (allergen map)
• Develop an allergen control plan specific to each processing facility
• Review the ACP on some regular basis and especially for new products, introduction of new processing capabilities, new ingredients
Key Concepts for Effective Allergen Control

- Dedicate
- Segregate
- Separate
- Clean/Sanitize
Key Food Industry Lessons

• Major company recalls
  – Rework
  – Inadequate cleaning of shared equipment
  – Line cross-overs
  – Packaging errors
  – Ingredient suppliers
  – Custom processors
Supplier Qualification/Purchasing

- Address allergens as part of a comprehensive risk-based approval process
  - Require allergen disclosure - are allergens used in the product, on shared equipment, in the same facility?
  - Does the supplier have a documented allergen control plan and validated cleaning/sanitation procedures?

- Require advanced notification of changes that affect allergen status of ingredients sold to your company

- Ensure purchasing group only uses approved suppliers!!
  - Have approved secondary suppliers in case of problems with existing sources
Product Development Strategies: Allergen Gating Process

- Develop an approach to review potential new products at the concept stage to identify potential allergenic components.

- Use the allergenic components if they are truly necessary
  - Only use allergenic ingredients if they make a discernable difference to taste or functionality.

- Create a process to assure that the processing facility is notified before start-up
  - Do not add allergens to existing products or facilities without allergens without understanding the implications for the system.
Receiving

- Review and inspect incoming shipments of raw materials for allergen information

- Develop a company-wide system for tagging all raw materials for easy identification in your facilities (Ex. color coding, symbols/icons, etc.)

- Assure that each incoming container is appropriately tagged and placed in the appropriate storage area

IAFP (http://www.foodprotection.org/resources/food-allergen-icons/)
Storage – Raw Material

- Segregate allergenic raw materials/products separately to avoid cross contact where possible
  - Avoid storing allergenic ingredients above non-allergens or different allergens where possible

- When storing ingredients from same source together (e.g. all milk) consider the allergen load (butter oil – low; lactose – low to moderate; casein – high)

<table>
<thead>
<tr>
<th>Same Over Same</th>
<th>Less Over More</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>RBD Soy Oil</td>
<td>Butter Oil</td>
</tr>
<tr>
<td>Soy Lecithin</td>
<td>Lactose</td>
</tr>
<tr>
<td>Soy Protein Concentrate</td>
<td>Sodium Caseinate</td>
</tr>
</tbody>
</table>
Mark or tag allergenic ingredients to allow their easy identification in storage and to help assure the items are returned from the staging area to the appropriate storage shelf/area.
Production Strategies

- Use clearly designated staging areas for allergenic ingredients/products
  - Use segregated/color coded utensils to avoid allergen cross contact
- Clearly label opened, partially used ingredient bags and return these items to the appropriate storage area

http://remcoproducts.com/
Production Strategies

• Schedule long runs of allergenic products wherever possible (minimize changeovers)
  – Schedule manufacturing of allergenic products just prior to end of shifts with major clean-up
  – Introduce allergenic components into the products as late in the process as possible

• Clearly label in-process totes/containers, rework storage containers with the allergen content
  – Best use of rework – “exact-into-exact”
Labeling & Packaging Strategies

- Most common cause of recalls
  - Incorrect label information
  - Incorrect label applied to product

- Be careful about gang printing or mixed bundles of packages/labels
  - Use color coding or icons for outer-wraps on bundled packaging for easy identification
  - Visually check for correct label information before start-up
  - Vision systems or bar code readers can be effectively used for formulation and label verification

- Control labels so obsolete stock is destroyed immediately
Cleaning & Sanitation Strategies

- Wet and dry cleaning approaches present different challenges

- Wet cleaning:
  - CIP and COP commonly used
    - Caustic/Alkali detergents used for remove protein (allergen)
    - Consider appropriate time, temperature, detergent concentration, and physical action
    - Hand cleaning may be the most effective approach on valves, mixers, etc.
Cleaning & Sanitation Strategies

- **Dry cleaning:**
  - Vacuuming
  - Scrapping
  - Wiping
  - Sweeping
  - Pigs for piping
  - Dry ice (watch for contamination of adjacent lines!)
  - Steam cleaning (careful not to introduce too much water!)
  - Pressurized air (watch for contamination of adjacent lines!)

- Push-through or flushing material (sugar, maltodextrin, salt, vegetable oil, etc.) can be an effective way to scour equipment
Cleaning & Sanitation Strategies

- Consider allergen content/potency of ingredient
- Uniform formulation vs. particulate
- Allergen composition – stickiness
- Push-through: an effective practice, but careful with particulates
Cleaning & Sanitation Strategies

- Equipment design
  - Access and ability to thoroughly clean; no static or hidden areas

- Develop and implement clear SSOPs
  - Personnel must be trained, dedicated, alert, and thorough
  - SSOPs must be clear and easily understood
    - Explain not only ‘How’ but ‘Why Is It Important’
Cleaning & Sanitation Strategies

- Establish target allergen residue levels for effective allergen cleaning
  - recommend non-detectable (<2.5 ppm) or 5 ppm

- Verify that allergen cleaning is done consistently each time
  - Visual inspection
  - document it – keep compliance records

- Periodically audit and confirm that allergen cleaning is done in accord with established procedures
Cleaning & Sanitation Strategies

• Visually clean is the standard in the food industry
  – If residue is present on the equipment surface, a positive ELISA is likely
  – No need to test – clean again

• Visual inspection can be quite effective
  – Analytical validation and verification of allergen removal used to support visual inspection
  – Swabbing equipment surfaces (contact surfaces and hard to reach areas), testing CIP final rinse water (when possible), push-through material is commonly done for allergen assessment
Possible Detection Methods

• **Quantitative Methods:**
  • Enzyme Linked Immunosorbent Assay (ELISA)
  • Polymerase Chain Reaction (PCR)
  • Mass Spec Methods (LC-MS/MS)
  • Surface Plasmon Resonance (SPR)

• **Qualitative Methods:**
  • Lateral Flow Devices (ELISA LFD)
  • General Protein Tests
  • ATP/Bioluminescence Tests
How To Decide What Test to Use in a Specific Situation?

• The specificity of the test method is one concern – general protein, allergenic source protein, DNA, or ATP

• The sensitivity of the test method is a second concern;
  • Will the method support the corporate target level?
  • Can you correlate the method results to the corporate target level?
Picking the Best Test Method

General Comments

- **Recommended to validate removal of allergenic residue using specific ELISAs**
  - ATP and general protein tests do not detect proteins from allergenic sources specifically so the effectiveness of these tests ALONE as the sole approach must be carefully examined

- **Surrogate testing (protein, ATP) can be helpful in some cases**
  - ATP or general protein swabs can provide a good quick check on sanitation effectiveness during **routine** cleaning
Lateral Flow ELISAs

• Lateral flow device (strip test/ dipstick)
  – Qualitative ELISAs
  – Used primarily for sanitation assessment, but can be used for food product testing
  – 10 minute assay time
  – 5 ppm limit of detection depending matrix

Figure 1: Principle of a strip test: Anti-allergen antibody-coated colored beads form a complex with allergens in the sample and anti-allergen antibodies on the strip. This leads to a colored test line indicating a positive (i.e., allergen-containing) sample. A colored control band indicates correct performance of the test.
Lateral Flow Devices (LFD)
LFD Test Results

J.L. Baumert, D.H. Tran; 11 - Lateral flow devices for detecting allergens in food; Handbook of Food Allergen Detection and Control, 2015, 219 - 228
Re-Validation

- No fixed acceptable frequency of testing, experience is the best teacher
- More frequently in early stages of product manufacturing
- Depends on level of confidence in product, process, SSOP, test methods, etc.
Prevent Re-Contamination

- Protect clean equipment and areas
- Follow procedures, in sequence
- Control people and activities
- Remove allergen ingredients
- Label and seal clean systems
- Communicate during and after cleaning
- Re-inspect prior to start-up
- Flush and examine first product
Change Management

- When *anything* changes, then you must re-evaluate the entire allergen control plan
  - Re-Validate by doing a new Quantitative Risk Analysis
  - Does the existing Allergen Control Plan still work with the new conditions?
FARRP

English & Spanish Versions
http://farrp.unl.edu/allergencontrolfi

Neogen


GMA

http://www.gmaonline.org/forms/store/ProductFormPublic/managing-allergens-in-food-processing-establishments
Thank You for Your Attention

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