

**V(A). Planned Program (Summary)**

**Program # 5**

**1. Name of the Planned Program**

Food Safety

Reporting on this Program

**V(B). Program Knowledge Area(s)**

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
501	New and Improved Food Processing Technologies	30%		60%	
503	Quality Maintenance in Storing and Marketing Food Products	30%		40%	
504	Home and Commercial Food Service	40%		0%	
	<b>Total</b>	100%		100%	

**V(C). Planned Program (Inputs)**

1. Actual amount of FTE/SYs expended this Program

Year: 2013	Extension		Research	
	1862	1890	1862	1890
Plan	8.5	0.0	6.9	0.0
Actual Paid Professional	13.1	0.0	10.5	0.0
Actual Volunteer	0.0	0.0	0.0	0.0

2. Actual dollars expended in this Program (includes Carryover Funds from previous years)

Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
431024	0	104538	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
1342980	0	323742	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
1159589	0	863987	0

**V(D). Planned Program (Activity)**

## 1. Brief description of the Activity

**MAES.** With advances in technology, food safety research has become more complex and more interdisciplinary. The needs remain great, to assure a safe food system for consumers who have increasing expectations for high quality food. In 2013 MAES research on food safety issues provided new information and strategies to growers, processors, and manufacturers. Some highlights of research progress in 2013 include:

- Researchers are using NMR and MRI techniques to develop a sensor method for rapid detection of foodborne pathogens, a critical step in identifying pathogen sources during food processing and distribution in minutes to hours instead of days. The benefits of timely detection and corrective actions to producers, processors, distributors and consumers are enormous. The new technology embraces nanotechnology, immunology, microbiology and advanced NRM/MRI techniques.
- Food scientists have examined the effects of desiccation stress on survival of *Escherichia coli* K-12 and have extended these studies to *E. coli* B and to *Salmonella enterica*. Several different conditions of desiccation and recovery have been studied including the length of drying time, temperature of drying and rehydration, growth conditions prior to desiccation, and composition of the rehydration media. In collaboration with mechanical engineers, they have measured changes in membrane fluidity during rehydration.
- *Escherichia coli* 0157 is a foodborne pathogen that can be transmitted by contaminated ground beef and is shed naturally in cattle feces. Researchers studied the fecal prevalence of *E. coli* 0157 in cattle fed diets containing distillers' grains to see if there was a connection, and found that DGS had no effect on the pathogens' prevalence in cattle populations.
- *Clostridium difficile* is a spore-forming bacillus that causes antibiotic-associated diarrhea in hospitalized patients. Recent findings have suggested that this organism can be transmitted through meats from animals to humans. Researchers compared animal and human strains at the physiological level and found that strains of the bacteria isolated from animals tend to grow faster than human strains at 37 degrees C. The methodology was proven to be effective in recovering the bacteria from inoculated meats.
- Lower sodium cheese has health benefits, but there has been a concern that reducing sodium, which also acts as a preservative, might make the cheese more susceptible to contamination. However, a study of the ability of *Listeria* bacteria to survive in low-sodium commercial sliced process cheeses showed that sodium reduction in processed cheese did not promote the growth of *Listeria* at any temperature or brand tested.
- Using non-thermal processes to pasteurize liquid and solid foods is an area of increasing interest to food processors, as they offer the possibility of preparing fresh-like, minimally processed safe food. Bioengineering researchers are developing non-thermal plasma and concentrated high intensity electric field based methods for low temperature pasteurization of both liquid and solid foods. In 2013 a prototype system was built and researchers used the process for low temperature pasteurization of whey protein beverages. The results were successful and showed that the new process maintains the physical and chemical properties of whey protein beverages while killing microbes.

**Extension.** In 2013, Extension continued to play a significant role in keeping Minnesota safe from food-borne illness in homes, community events and businesses. Food safety education is provided through at least six program offerings:

- Food Safety for Food Service Managers and Employees
- Cooking Safely for a Crowd
- Food Safety for Consumers
- Food Preservation Food Safety for Entrepreneurs and Home Growers

- Farm to School/Market

In 2013, the team sought to make food safety education available to more people efficiently through online offerings. To that end, the team developed and delivered three online courses, including an online food manager certification course, an online Serve It Up Safely food manager certification renewal course, and a food allergen training for food service employees. By the end of 2013, five new online educational offerings were available. 1) A 15-minute Cooking Safely for a Crowd educational presentation that helps volunteer groups train their groups and meet the requirements of state food safety laws. 2) Twenty food preservation five-minute mini-modules that teach consumers about food preservation; 3) a Twitter feed that disseminates news about current Food Safety topics; 4) a Food Safety e-News publication for individuals in the food service industry; and, 5) a food preservation e-News for individuals interested in food preservation.

**2. Brief description of the target audience**

Research supports the food development industry and food processing industry, while the direct audiences of the outreach efforts are food service workers through relationships with the National Restaurant Association, food handlers in community locations, fishermen and farmers, and high-risk audiences through the organizations they trust.

Audiences for **Extension** offerings include food managers needing re-certification, persons interested in working in the food service industry, consumers and producers for locally-grown food markets, home food preservers, high-risk audiences such as seniors, caregivers and daycare providers, local producers and school districts engaged in farm-to-school initiatives, and volunteers who cook for a crowd. Often, compliance with state laws motivates the target audience to participate in programming. As noted above, online offerings are making food safety training more accessible to these audiences and the general public. Seventeen percent of program participants are persons of color. This is largely due to the team's outreach to food service workers and to cultural adaptations for Minnesota's growing Latino population.

**3. How was eXtension used?**

In 2013, the program team used eXtension to search for educational resources and to research issues related to Food Safety.

**V(E). Planned Program (Outputs)**

**1. Standard output measures**

2013	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
<b>Actual</b>	2456	528046	10	0

**2. Number of Patent Applications Submitted (Standard Research Output)**

**Patent Applications Submitted**

Year: 2013  
 Actual: 0

**Patents listed**

**3. Publications (Standard General Output Measure)**

**Number of Peer Reviewed Publications**

<b>2013</b>	<b>Extension</b>	<b>Research</b>	<b>Total</b>
<b>Actual</b>	2	7	9

**V(F). State Defined Outputs**

**Output Target**

**Output #1**

**Output Measure**

- Number of individuals who learn about prevention, detection, control and intervention technologies.

<b>Year</b>	<b>Actual</b>
2013	216

**Output #2**

**Output Measure**

- Number of food handlers receiving food safety training and education in safe food handling practices.

<b>Year</b>	<b>Actual</b>
2013	567

**V(G). State Defined Outcomes**

**V. State Defined Outcomes Table of Content**

O. No.	OUTCOME NAME
1	Number of reported changes in prevention, detection, control and intervention technologies.
2	Number of growers, producers and food workers completing GAPs, GMPs, HAACP, food safety certification (like ServeSafe), and on farm BMP programs to increase food safety.
3	Number of food handlers adopting recommended hand washing practices.
4	Number of food handlers reporting taking steps to reduce cross-contamination.
5	Research will increase number of viable technologies to improve food safety. (Measure: number of viable technologies developed or modified for the detection and characterization of food supply contamination from foodborne threats)
6	Research will increase understanding of the ecology of threats to food safety from microbial and chemical sources. (Measure: Number of projects focused on increased understanding of preharvest and postharvest process impacts on microbial and chemical threats)

**Outcome #1**

**1. Outcome Measures**

Number of reported changes in prevention, detection, control and intervention technologies.

Not Reporting on this Outcome Measure

**Outcome #2**

**1. Outcome Measures**

Number of growers, producers and food workers completing GAPs, GMPs, HAACP, food safety certification (like ServeSafe), and on farm BMP programs to increase food safety.

**2. Associated Institution Types**

- 1862 Extension
- 1862 Research

**3a. Outcome Type:**

Change in Condition Outcome Measure

**3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2013	406

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

Significant numbers of first generation Latino Minnesotans are employed in the food industry. Moreover, significant entrepreneurship is happening in the food industry within the Latino culture. To maintain the reputation and credibility of this culture as they integrate into Minnesota's communities, food establishments must stay safe from food-borne illnesses.

**What has been done**

Spanish Certified Food Manager classes were implemented to meet the needs of significant numbers of Latino food service workers in the state.

**Results**

The quantitative outcome above describes the outcome of all Food Safety programs. Assessment of the Spanish Four-Part Certified Food Manager Class indicated that 81 percent of students obtained passing grades with an average passing score of 85 percent. This can be compared to national average passing rates (73 percent) and passing test scores (80 percent). In a preliminary 2-3 week follow up survey, most new managers reported increased frequency of hand-washing, use of a calibrated thermometer, and preparation and monitoring of sanitizer containers. A one-

month post training observation showed that a wider variety of people were sources of information, with the information "hub" narrowed to a single food manager.

#### 4. Associated Knowledge Areas

KA Code	Knowledge Area
503	Quality Maintenance in Storing and Marketing Food Products
504	Home and Commercial Food Service

#### Outcome #3

##### 1. Outcome Measures

Number of food handlers adopting recommended hand washing practices.

##### 2. Associated Institution Types

- 1862 Extension

##### 3a. Outcome Type:

Change in Action Outcome Measure

##### 3b. Quantitative Outcome

Year	Actual
2013	557

##### 3c. Qualitative Outcome or Impact Statement

###### **Issue (Who cares and Why)**

According to the latest Centers for Disease Control statistics, one of six Americans will get sick from foodborne illness every year. Places of risk include food establishments, public events and festivals and homes.

###### **What has been done**

Almost all foodborne illness can be prevented by practicing safe food handling practices, including simple hand-washing during food preparation. Food safety educational programs for all target audiences respond to critical junctures of food processing when behavior change makes a difference.

###### **Results**

Employees in food service establishments who attended Food Safety training reported statistically significant improvement in behaviors related to food safety including handwashing, glove use and bare-hand contact of ready-to-eat food. When asked about perceived restaurant behaviors, statistically significant changes were reported in understanding enforcement of food safety policies and important management practices.

#### 4. Associated Knowledge Areas

KA Code	Knowledge Area
503	Quality Maintenance in Storing and Marketing Food Products
504	Home and Commercial Food Service

#### Outcome #4

##### 1. Outcome Measures

Number of food handlers reporting taking steps to reduce cross-contamination.

##### 2. Associated Institution Types

- 1862 Extension

##### 3a. Outcome Type:

Change in Action Outcome Measure

##### 3b. Quantitative Outcome

Year	Actual
2013	649

##### 3c. Qualitative Outcome or Impact Statement

###### **Issue (Who cares and Why)**

For the most recent year of data available (2005), there were 41 known foodborne illness outbreaks in Minnesota. Of these, 31 were known to be the result of problems in food service establishments (76 percent).

###### **What has been done**

Most food-borne illness can be prevented if managers and food service workers handle food correctly and prevent contamination on surfaces where food is handled.

###### **Results**

Employees in food service establishments who attended Food Safety training reported statistically significant improvement in behaviors related to safety, including bare-hand contact with ready to eat food and cleaning and sanitizing of food contact surfaces. When asked about perceived restaurant behavior, statistically significant changes were reported in use of temperature log sheets, enforcing food safety policies, and overall management practice and knowledge. Those who received specific courses on food allergens reported they will change food handling practices, create a plan and train other key individuals at the food service establishment on safe food handling practices as well as what to do when someone is having a reaction.

#### 4. Associated Knowledge Areas

<b>KA Code</b>	<b>Knowledge Area</b>
503	Quality Maintenance in Storing and Marketing Food Products
504	Home and Commercial Food Service

## **Outcome #5**

### **1. Outcome Measures**

Research will increase number of viable technologies to improve food safety. (Measure: number of viable technologies developed or modified for the detection and characterization of food supply contamination from foodborne threats)

### **2. Associated Institution Types**

- 1862 Research

### **3a. Outcome Type:**

Change in Knowledge Outcome Measure

### **3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2013	0

### **3c. Qualitative Outcome or Impact Statement**

#### **Issue (Who cares and Why)**

Consumers demand safer, healthier and higher quality food products. In order to satisfy those expectations, food scientists and engineers must be able to understand the problems caused to food products by processing and storage and develop solutions. NMR and MRI based methods are unique because they are non-destructive, non-invasive, and fast compared with conventional food safety tests.

#### **What has been done**

Researchers studied NMR and MRI based techniques to characterize and evaluate the shelf stability of food products as affected by formulation, processing and storage conditions. This has led them to develop an NMR/MRI based nano-particle sensor method for rapid detection of foodborne pathogens. This method will allow the identification of foodborne pathogen sources during processing and distribution in minutes to hours instead of days.

#### **Results**

The benefits of timely detection and corrective actions to producers, processors, distributors, regulators and consumers are enormous. Conventional detection methods involve multiple time-consuming and labor-intensive steps due to the difficulties in isolating the pathogens from the food and the fact that pathogens are usually present in extremely low numbers. The new methodology combines nanotechnology, immunology, microbiology, and advanced NMR/MRI techniques. It represents a new approach to a complex problem.

#### 4. Associated Knowledge Areas

KA Code	Knowledge Area
501	New and Improved Food Processing Technologies
503	Quality Maintenance in Storing and Marketing Food Products
504	Home and Commercial Food Service

#### Outcome #6

##### 1. Outcome Measures

Research will increase understanding of the ecology of threats to food safety from microbial and chemical sources. (Measure: Number of projects focused on increased understanding of preharvest and postharvest process impacts on microbial and chemical threats)

##### 2. Associated Institution Types

- 1862 Research

##### 3a. Outcome Type:

Change in Knowledge Outcome Measure

##### 3b. Quantitative Outcome

Year	Actual
2013	0

##### 3c. Qualitative Outcome or Impact Statement

###### **Issue (Who cares and Why)**

Highly unsaturated oils, due to heat treatments including frying and baking, produce highly toxic compounds which absorb into food.

###### **What has been done**

Researchers studied the formation of toxic aldehydes in heat treated fats and fatty foods. They compared the formation of these toxic substances in both high and low polyunsaturated fatty acid vegetable oils, fats and fatty foods. They then compared the retardation of the toxic aldehyde formations in the presence of various concentrations of added natural and synthetic antioxidants.

###### **Results**

The results have provided food scientists with information about corn, soybean, peanut, and canola oils as well as lard and beef tallow, and how to retard the formation of toxic compounds when producing fried and baked foods.

#### 4. Associated Knowledge Areas

KA Code	Knowledge Area
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501	New and Improved Food Processing Technologies
503	Quality Maintenance in Storing and Marketing Food Products

#### **V(H). Planned Program (External Factors)**

##### **External factors which affected outcomes**

- Appropriations changes

##### **Brief Explanation**

Staffing shifts have changed the degree to which Extension provides consultative services to industries regarding food handling technologies and systems; therefore, we are not reporting on outcome #1 in 2013.

#### **V(I). Planned Program (Evaluation Studies)**

##### **Evaluation Results**

Evaluation of food safety program examines the degree to which education and certification programs change actual food management behaviors in the workplace and other places where there is "cooking for a crowd." By changing the precursors to outbreaks of foodborne illness, Extension is decreasing the likelihood of foodborne illness among those eating out. In addition, program evaluators have been monitoring the degree to which materials and programs adapted for Spanish-speaking workers are achieving goals similar to those in English-speaking programs. In 2013, we demonstrated that participation in a Spanish Four-Part Certified Food Manager class resulted in passing rates eight percent higher than national passing rates, and scores that were five percent higher than the average of national passing scores.

##### **Key Items of Evaluation**

Food safety training and program evaluation appears to demonstrate that implementing culturally sensitive and language appropriate interventions result in improvements in knowledge, behavior and restaurant level system and communication. In fact, in 2013 participation in a Spanish Four-Part Certified Food Manager class resulted in passing rates eight percent higher than national passing rates, and scores that were five percent higher than the average of national passing scores.