Welcome to lecture 17, Hazard Analysis Critical Control Points. That is a mouthful and we will refer to this as the HACCP program throughout this lecture. This topic can be a bit dry so please take comfort that this is a short lecture for an extremely important system.

The goals of this lecture are to define HACCP. Recognize the role of the HACCP system as a food protection tool. And to list and define the seven principles of the HACCP system.

HACCP is recommended as the best method for ensuring food safety and has been used for many years to monitor and protect food from contamination. We will see that FSMA has HACCP as one of its requirements. The HACCP method follows the flow of food to identify and prevent problems. In other words, if we plan to let people eat our foods, we must identify any step along the way from fields, to processing, to preparation where problems could occur. The greatest amount of attention is place on food and how it is handled during storage, preparation, and service. That may seem an odd thing to say, but HACCP also addresses other issues such as the food packaging.

This is a key concept. The HACCP system is designed to identify and control potential problems BEFORE they happen. The last thing most companies want is to issue a recall. They lose profits. They lose their reputation. This causes many issues and if you have a good HACCP system data has shown consistently that you are far less likely to have a recall.

Pretty much anyone can use a HACCP system. They can be tailored for restaurants, retail food stores, institutions, health-care facilities, or other food service operations. They can be tailored to suit what those places are selling, what type of clients are served, and the facilities and equipment used during food production. As you can imagine, HACCP systems are so important that there are 3rd party businesses that actually teach HACCP. For example, if you wanted to open your own food establishment, you could enroll in one of their workshops. They will even help you write your own HACCP plan.
The advantages of the HACCP system is that it enables food managers to identify the foods and processes that are MOST likely to cause foodborne illness. HACCP approach is based on controlling time, temperature, and other specific factors that are known to contribute to foodborne disease outbreaks. Like previously mentioned, people using HACCP systems are far less likely to have to issue recalls.

Prior to the enactment of the Food Safety and Modernization Act (FSMA, discussed in Lecture 19), preventing foodborne illness was not approached in a science-based manner. HACCP was designed to fill this void. Companies with effective HACCP plans are far less likely to have to recall products, and less likely to have contamination issues.

HACCP is so important that the FDA is starting to warn processors over HACCP violations. They have the authority to block the importation of foods if the producers do not adhere to a HACCP plan. I think you will find that seafood producers are one of the most likely to not have their HACCP plans in place. Recall that we import a considerable amount of seafood in the United States.

There are seven principles of HACCP and we are going to discuss these individually. You can read them here and on the next slide and we will talk about each independently on the following slides.
The first principle of HACCP is hazard analysis. Hazard analysis begins with a thorough review of menu items to identify potentially hazardous foods. In addition to the biological hazards, chemical and physical hazards must also be identified. Looking at the picture at right, what type of hazard is this? Biological, chemical, or physical?

This brings us to another key concept. Knowledge of the biological hazard sources and the foods they most frequently contaminate is essential to an effective HACCP plan. For example, if your food involves eggs, you should be aware that 1% of all eggs are contaminated with *Salmonella*. This is something you must consider when you design your HACCP plan.

The following are the factors that will influence an establishment’s risk of foodborne illness. These include the type of customers served, the types of foods on the menu, the nature of the organisms, past outbreaks, the size and type of food production operation, and the extent of employee training. We are going to return to the importance of employee training at the end of the class.

Continuing with hazard analysis, principle 1 of the HACCP, hazard analysis and risk estimation provide a logical basis for determining which hazards are significant and must be addressed in the HACCP plan. The severity of a hazard depends on its consequences. For example, look at the snapshot of a HACCP plan below. They broke their process into Step 1 and Step 2. The identified hazards in Step 1 including glass, hair, and *Salmonella*. Then they examine the likelihood of each occurring. The likelihood of glass is low, but the severity is high. The likelihood of hair was low and the severity medium. The likelihood of *Salmonella* is medium and the severity is high. Again you need to go through each step in the process and decide which ones apply to your foods.

After the hazards have been identified, preventative measures are established including controlling the temperature of food, cross contamination control, and good personal hygiene practices. Here we come right back to our three rules of food safety!
Principle 2 - Identify Critical Control Points (CCPs)

A critical control point is an operation in the flow of food which will prevent, eliminate, or reduce hazards to acceptable levels and includes:

- cooking, reheating, hot-holding
- chilling, chilled storage, and chilled display
- receiving, thawing, mixing ingredients, and other food-handling stages

Which brings us to principle 2, Identifying the Critical Control Points or CCPs. A critical control point is an operation in the flow of food which will prevent, eliminate, or reduce hazards to acceptable levels. In other words, we can prevent problems from *Salmonella* by cooking. We can prevent problems by proper reheating and hot-holding. There is chilling and chilled storage, etc. Largely these are concerned with temperature and avoiding temperature abuse.

Principle 2 - Identifying CCPs (Continued)

The most commonly used CCPs are cooking, cooling, reheating, and hot- or cold-holding.

To stress that, identifying the CCPs or critical control points, the most commonly used CCPs are cooking, cooling, reheating, and hot- or cold-holding.

Principle 2 - Identifying CCPs (Continued)

Identification of CCPs begins with following the flow of food:

- Purchase of products and ingredients from sources inspected and approved by regulatory agencies.
- Receiving and storing products and ingredients.
- Preparation steps which may involve thawing, cooking, and other processing activities.

How do we identify the CCPs? We follow the flow of the foods. Purchase products and ingredients from sources inspected and approved by regulatory agencies. So know your source for your ingredients. Receiving and storing products and ingredients. Be sure that when items arrive at your grocery store, things that should be frozen, are frozen. And preparation steps are really important. Again, cooking, heating, etc.

Key Concept

- Controlling the temperature of food products throughout the flow of food is the most essential preventative measure for ensuring a safe food.

This brings us again to a key concept. Controlling the temperature of food products throughout the flow of food is the most essential preventative measure for ensuring a safe food. Just recently there have been a number of outbreaks that involved juice. In response, the FDA has introduced a HACCP plan specifically designed for juice. This can give any juice producer some guidelines to follow for their facility.

Principle 3 - Establishing Thresholds

Critical limit thresholds are established to effectively block biological, chemical, and physical hazards. Thresholds must be easily measured or observed and please note that is underlined, and they include factors such as time, temperature, water activity, and pH.

Once we find critical control points, we have to establish thresholds and this brings us to principle 3. Critical limit thresholds are established to effectively block biological, chemical, and physical hazards. Thresholds must be *easily measured or observed* and please note that is underlined, and they include factors such as time, temperature, water activity, and pH.
Here is an example of a threshold that we have discussed many times. Ground beef must be cooked to an internal temperature of 160°F for 15 seconds to destroy Shiga toxin-producing *E. coli*. How would you test that the temperature is correct? Think about that before going to the next slide. In order to achieve that temperature in giant burgers such as that one the right, the meat must be baked. That is one thing you must consider if you scale up your operations, temperatures must stay in range.

Observation and measurements must be made to determine whether critical control points are under control. So this is our fourth principle. We need to monitor the CCPs. For example, you monitor temperatures using a thermometer. Monitoring is a critical part of a HACCP system and provides written documentation that can be used to verify that the HACCP system is working properly. If you have worked in a restaurant, you may have been asked to write down temperatures of foods or refrigerators and this is why.

Which quickly brings us to our principle 5, establishing corrective actions. If a critical limit is exceeded the problem should be identified and corrected immediately. This is one reason to constantly monitor CCPs because things can be corrected immediately. For example, if you see on the right hand side here, this is a monitoring for a refrigerator. The monitoring can be set to send out an alarm if the temperature exceeds a pre-set range. This monitor is set to ~80 degrees so this is an ultralow temperature freezer. Preventative measures should also be used to prevent the limits from being exceeded again. So if an alarm goes off, you need to find out why, and prevent it from happening again.

And you also want to verify that your HACCP system is working. The verification process has 2 stages. In the first part you want to verify that the established critical limit will prevent, eliminate, or reduce hazards to acceptable levels. In the second part you want to verify that the overall HACCP plan is operating effectively.
I think this is a good point to put all of this together in one slide. This is a HACCP analysis for production of frozen whole lobster, whole cooked lobster, and cooked frozen lobster from Brazil. If you look at this you can see the stages of processing, the critical control points they identified, notice that biological, chemical, physical all are represented here. You can see the hazards they identified like possibility of parasites and preservatives, and survival of microorganisms. And then you can see the monitoring of the CCPs. They have parameters such as temperature, they have frequency, and they have recording. And then finally, and this is very important, they have identified corrective actions to take if there is a problem.

It is not necessary that you memorize the HACCP system you saw on the previous page. You don’t need to memorize the one here either. I just show you these so you can see how different companies put together or visualize their HACCP plans. There is one last step we need to talk about and that is establishing recordkeeping systems. And this is principle 7. An effective HACCP system requires the development and maintenance of a written HACCP plan. It must include each CCP and the limits established for that CCP. It must be updated regularly. One of the first things that inspectors will do if there is a problem with a particular facility is ask to see that HACCP plan. It needs to be accurate, well maintained, and up to date.

That brings us back to another key concept. Education and training are key to the successful implementation of a HACCP program. There are a lot of programs for training available. I just show you a link here because this one is inexpensive. Some are $200-$300.

The HACCP system in summary, is designed to follow the flow of food through the production process to identify potential problems BEFORE they occur. HACCP plans should include 7 principles each designed to decrease the likelihood of foodborne disease outbreaks.
As promised, this is a relatively short lecture. I did want to acknowledge the use of this book in creating this lecture. This book is out of print or we would likely use it for this class!