#7. VARIATIONS OF RECIPE BLOCK FLOW DIAGRAMMING

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The USDA form for process HACCP (Figure 1; all figures follow summary) is a cumbersome document, because the columns are so narrow that one cannot put much information in them. However, the information that is required is appropriate to the control of a recipe process. This article discusses some other formats that lend themselves much better to documentation and are applicable to retail operations.

Figure 2 is a HACCP for sushi rice. The purpose of this flow diagram is to document the safety technology associated with the preparation of sushi rice. Inherently, sushi rice is safe because of the added acid, but in order for it to be accepted officially by the regulatory authority, one must fully document the hazards and critical controls.

The first line is "Process." Its purpose is to specifically identify the recipe HACCP.

The second line, "Assumption," shows, in this case, that it is assumed that the prerequisite programs (i.e., Good Manufacturing Practices) are in effect in the operation.

In, the third paragraph, "Hazard," the overall identification of the hazard is written. This is where one establishes what the risk is and how the risk is controlled. Sushi dates back at least 1,500 years, long before the advent of refrigeration. In those days, how would one assure the safety of this product without refrigeration in a home, for instance, at 80 or 90ºF for a period of hours? The tuna would spoil, but the cooked rice would grow *Bacillus cereus* while giving no indication that it had become hazardous. Adding rice vinegar to the rice is the basic controlling factor to get the pH below 4.4. This allows the rice to sit at ambient temperatures without any risk. The sugar makes the vinegar a little mellower.

A simple format that works well for HACCP analysis is to put the flow diagram on the left side of the page and use the space on the right for specific discussion of the hazards and controls associated with each process step. For example, you can see that step #7 in Figure 2 is the critical control point, where the pH of the rice is reduced to less than 4.4 to control the outgrowth of *B. cereus* and other pathogenic spores that can outgrow. While *Salmonella* can grow down to a pH of 4.1, there should be no *Salmonella* if food contact surfaces are kept clean and people wash their hands. Step #8 is one of the monitoring (inspection) steps, at which point someone checks with a pH strip, pH meter, or some other method, to verify that the hazard control standard has been met.

Figure 3 is the quality-assured recipe for sushi rice. This is an important document, because the block flow diagram does not necessarily include the ingredient weight percents, etc. This recipe exactly matches the hazard analysis and the controls established in Figure 2. Applying these two documents, then, one has absolute control.

The principle reason for the recipe is that the HACCP flow diagram, while it is a powerful analytical tool, is unreadable by most chefs and cooks. They are used to reading recipes. Hence, the HACCP writer would use the format of Figure 3 as the recipe for the cook to follow.

Another alternative to documenting a HACCP'd procedure is to use pictures. Figure 4 is a pictorial HACCP for hand washing. When the procedure is not a cooking procedure, but a work procedure (e.g., cleaning cutting boards, washing hands, etc.), a pictorial flow chart is highly effective. Again, you will see the basic sections identified—the process and hazards—and the standards and operating procedure to be followed with microbiological standards and targets that will be met if one follows the procedure as specified.

Summary

The principles of process HACCP are fully applicable to a retail kitchen operation. Preparing even one chicken breast in a frying pan is a process. A critical difference between a processing plant and a kitchen is that the cook is used to following a recipe. The HACCP flow diagram, then, is the analytical tool by which the hazards can be identified; critical limits are specified; and monitoring, corrective action, and verification are properly worked out so that the process is robust and has a very low risk of failure.

Two formats are presented for the cook to use. One is the HACCP recipe, which is for the cook to use in food preparation. The second is a pictorial flow diagram, which is more applicable to an employee procedure such as hand washing, cleaning cutting boards, etc. It could also be used if a pictorial recipe procedure were appropriate.

Once the procedures are specified, taught to employees when they are hired, and then, checked on, it is simple for the operation to show "due diligence" in case a customer alleges that the food made him/her ill. At the same time, this analysis and specification of procedures quality assures that every time the process is done, one will get the same result.

Before continuing with discussion of the manual, the next article will provide a summary review of the importance of HACCP.

FIGURE 1. NACMCF PROCESS HACCP PLAN

Prerequisite programs

- Leadership and adequate resources
- SSOPs, maintenance, pest control
- GMPs: Person hygiene, receiving, storage, shipping
- Organization and training
- Supplier certification
- Quality measurement

Corrective Action Log

1. Description of problem and how eliminated
2. Evidence of control after elimination
3. Measures to prevent recurrence
4. Measures to prevent distribution of adulterated product

Process Flow Chart: Process Steps and Control Measures For _____	CCP or QCP	Hazard Analysis & Critical Limit	Monitoring Procedures & Process Target Frequency; Record, and Person Responsible	Corrective Action; Record, Person Responsible	Verification Procedure; Record, Person Responsible

FIGURE 2. SUSHI RICE HACCP

Process: Preparation of the acidified rice that is used as the core ingredient of sushi menu items.

Assumption: Good manufacturing practices are effective in the operation.

Hazard: Traditionally, the sushi is not refrigerated. If the tuna species is chosen carefully, it will be free of parasites. If the fish have been frozen, this changes the spoilage bacteria so that they will not convert histadine to histamine. The risk that remains is the possible multiplication of *Bacillus cereus* multiplication in the rice. Lowering the pH of the rice to a level at which there is no *B. cereus* multiplication (<4.9 pH) can control this possible hazard in sushi rice as it "sits out" at room temperature for 24 hours. (If the rice is refrigerated, and the tuna is kept below 40°F, *B. cereus* will not multiply and pH control is not necessary. However, this is not sushi.) The actual pH of the rice in most recipes is 3.9 to 4.2.

Process Step, Procedure, and Control	Hazard and Control Analysis: a. hazard identification; b. critical limit; c. employee monitoring procedure / frequency and person; d. verification-who, when, how
Pre-preparation	
1. O Assemble all ingredients and utensils. Check that everything is ready.	Check that the tuna or other fish is fresh and has a very low APC count (for example < 10,000 CFU / g) to control the possible production of histamine. Use frozen fish to control the risk of parasites since it is very difficult to buy parasite-free fish. If appropriate, check for ciguatoxin. Check that the correct amount of acid (rice vinegar) has been measured (4.47% of the recipe total weight).
↓	
2 O Wash rice in colander until water runs clean. Drain rice. (If rice is enriched, do not wash it since that will remove the added B vitamins.)	Inspect the rice for rocks and remove if any are present..
Preparation ↓	
3. O Place drained rice in pan or rice cooker. Add water (70°F). Cover container and bring rice and water to a boil (212°F). Ti 70°F To >200°F t 10 m.	This pasteurization-cook will reduce all vegetative pathogens to a safe level. Spores of *C. botulinum, B. cereus* and *C. perfringens* will be activated.
↓	
4. O Reduce heat to simmering temperature (190°F). Continue to cook until rice is done. Ti >200°F To 190°F t 20 m.	The *Clostridia* and *Bacillus* spores survive.
↓	
5. O While rice is cooking, combine the vinegar, sugar, and salt in small stainless steel bowl or pan. Heat the vinegar mixture until sugar has dissolved. Set aside Ti 70°F To 150°F t 5 m.	This must be done in a stainless steel container, or other type of container that does not react with the acid.
↓	
6. O After rice is done, empty the pan of rice into a *hangiri* (small shallow container). Spread rice evenly over bottom of the pan with a *shamoji* (a large wooden or stainless steel spoon). Let cool Ti 200°F To <120°F t 5 m.	The time is too short for any risk.
↓	
7. O **CCP** Run spatula through the rice (~80° F) using right and left slicing motions to separate grains of rice. At the same time, slowly add the vinegar mixture (~80°F). Fan the rice as the vinegar mixture is being added. Ti 120°F To <80°F t 10 m.	**CCP** The vinegar, sugar, and salt mixture will reduce the pH of the rice to <4.4 pH. This controls the outgrowth of *B. cereus* which will not multiply at <4.9 pH. At pH of <4.6, the risk (if there is one) for *C. botulinum* is controlled. CCP - pH is 4.4 or less
↓	
8. I Check the pH of the rice. It must be <4.6. The target pH is 4.3 (± 0.3pH) **No** ←	This is the monitoring step to assure that the hazard control standard has been met.
Storage **Yes** ↓	
9. S Store at room temperature (70 to 80°F.) Use within 24 hours. Ti 80°F To 80°F t <24 h.	The rice will spoil safe, because of airborne yeast and mold that get into the rice during mixing. The foodborne illness hazards are controlled.
↓	
Leftovers - >24 hour none. Discard any leftover sushi rice.	

FIGURE 3. QUALITY-ASSURED HACCP RECIPE PROCEDURES

Recipe Name: **Sushi Rice** | Portion size (vol.): | Number of casings:
Recipe #: | Number of portions: | Preparation time:
Production style: | Final yield (AS): | To be prepared by:
| Final Yield: | Supervisor:
Written by: Date:2/99 | SA/QA by: P. Snyder Date:3/99 |

Gp. #	Ingred. #	Ingredients and Specifications	Weight %	Weight	
I	1	Rice, short grain, 3 1/2 cups	38.14	682.5 g.	24.1 oz.
	2	Water, 4 cups	52.53	940.0 g.	33.2 oz.
II	2	Rice vinegar*, 5 tablespoons plus 1 teaspoon	4.47	80.0 g.	2.8 oz.
	3	Sugar, 5 tablespoons	3.63	65.0 g.	2.3 oz.
	4	Salt, 4 teaspoons	1.23	22.0 g.	0.8 oz.
		Total weight	100.00	1789.5 g.	63.2 oz.

* Nakano Rice Vinegar (4.2% acetic acid)

Pre-preparation

1. Assemble all ingredients and equipment
2. Wash rice in colander until water runs clean. Drain thoroughly. (If enriched rice is used, do not wash the rice because washing removes enrichment B-vitamin and mineral mixture.)

Preparation

3. Place drained rice in pan or rice cooker. Add water. Cover container with close fitting lid and bring the water containing the rice to boil (212°F).
4. Reduce heat to a simmering temperature (190°F) and continue to cook for 15 to 20 minutes (until all the water has be absorbed).
5. Remove from heat. Take off the lid and spread a clean, white cloth or paper towel over the top of the pot. Replace the lid and let stand for 10 to 15 minutes. (The towel absorbs any excess moisture in the rice.)
6. While the rice is cooking, combine the vinegar, sugar and salt in a small stainless steel bowl or pan. Heat the mixture until the sugar has dissolved (150°F), stirring constantly. Remove from heat. Set aside.
7. Empty the rice into a *hangiri* (nonmetallic shallow container) and spread the rice evenly over the bottom with a *shamoji* or large wooden spoon (or stainless steel spoon). Let cool at room temperature. (As an alternative, the rice can be spread on a stainless steel pan and cooled to 80°F in about 30 minutes.)
8. **CCP** Run a spatula through the rice (~80°F) using right and left slicing motions to separate the grains. At the same time, slowly add the vinegar mixture (~80°F). (You may not need all of it. Avoid using too much or the rice will become mushy.)
9. The rice should be fanned as the vinegar mixture is added. A helper may be required for this step.
10. Check the pH of the rice mixture. It must be less than 4.4. The expected pH is about 4.3.
11. The fanning and mixing take about 10 minutes [until the rice reaches room temperature (75°F)].
12. Do not refrigerate the rice, but keep it covered with a clean, white cloth or paper towel, at room temperature (75°F) until it is ready to be used.
13. Sushi lasts just one day. It should not be used as a leftover. (There is no hazard, but the sushi rice will spoil due to yeast and mold growth.)

Process step #	Start food ctr. temp., ºF	Thickest food dimension (in.)	Container size H x W x L (in.)	Cover Yes/No	Temp. on/ around food	End food ctr. temp., ºF	Process step time, hr./min.

FIGURE 4. DOUBLE HAND WASHING WITH A FINGERNAIL BRUSH HACCP

Dept.: _____ Person responsible: _____ Effective date: _____

Process: To wash fingertips and hands to reduce by 10^{-5} pathogens from feces and vomit on fingertips and underneath fingernails and reduce 10^{-2} pathogens from food when preparing food in the kitchen.

The Hazard: When an employee arrives from home, or after using the toilet, the employee must be assumed to have $\leq 10^{6}$ pathogens on his or her fingertips and underneath fingernails. This concentration must be reduced to ≤ 10 to assure that the transfer of pathogens to the food that the employee handles is at a safe level. When working in the kitchen, an employee might touch contaminated food such as raw poultry and then, must reduce pathogens by 10^{-2} to reduce the pathogens to a safe level.

Standards and Operating Procedure

Get ready. Check to see that there is an adequate supply of unscented, non-antibacterial hand detergent, an Anchor Surgeon's Scrub nail brush, and disposable paper towels at the hand sink.

Wet hands. Turn on the water. Let it flow rapidly at 2 gallons per minute until warm (110 to 120ºF). It is the water that removes the pathogens.

Apply detergent to the fingernail brush. Place enough detergent (1/2 teaspoon or 3 to 5 ml) to build a good lather on the fingers.

Brush and lather, particularly fingertips and fingernails. Hold the brush with the bristles up, and touch the tips of the fingers of the hand that held the toilet paper to the tips of the bristles. Gently brush the tips of the fingers, without bending the bristles, while water runs over the fingers and washes the pathogens down the drain. Continue until the brush and the fingers have no lather (about 12 to 15 seconds).

If this is the first fingertip wash when coming from home, put more detergent on the nail brush and brush the fingertips on the other hand, because all fingertips could be contaminated (for example, cleaning up after animals at home).

Lay the nail brush down with bristles up. This allows the water to run off so that the brush dries, and bacteria cannot multiply.

Second wash for additional toilet/food pathogen reduction or first wash for reduction of food pathogens to a safe level. Add 1/2 teaspoon or 3 to 5 ml of hand detergent to the palm of one hand. This wash without the nail brush reduces pathogens another 100 to 1. If it follows use of the nail brush, it gives a total of >100,000-to-1 reduction of pathogens on fingertips. When working with food, there are only moderately low levels of pathogens on fingertips, and this 100-to-1 reduction is sufficient to make the fingers safe from food pathogens.

Lather and wash hands (and arms if you will be mixing salad or dough). Massage the hands together and between the fingers. Wash the arms up to the tips of the shirt sleeves, if appropriate. Thoroughly rinse all of the lather from the fingertips, hands, and arms in flowing warm water. When the deterget and lather are gone from the skin, the pathogens are reduced to a safe level.

Dry hands using paper towel(s). Use clean, disposable paper towel(s) to thoroughly dry hands and arms. This reduces the microorganisms an estimated, additional 100 to 1.