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A "SAFE HANDS" HAND WASH PROGRAM FOR RETAIL FOOD OPERATIONS

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Abstract

This article reviews and discusses the physiology and microbiology of the skin surface, the hand washing process, and the variables associated with correct hand washing.

Due to a lack of adequate hand washing by individuals who prepare, process and handle food in the retail food system, foodborne illness due to fecal-oral transfer continues to be a problem. As a result, the public is demanding that employees in the food service industry wear plastic gloves when serving or preparing food items. The perceived purpose of glove use by food preparation and food production personnel is to prevent the transfer of pathogenic microorganisms that may remain on the surface of fingertips when individuals do not wash their hands and fingertips at all, or adequately after using the toilet or after touching other highly contaminated items, surfaces, or objects.

A simple hand wash program that is adequate and necessary for preventing the transfer of pathogenic microorganisms is described. If employees are trained to use this hand wash program so that the removal of transient pathogenic microorganisms from hands and fingertips is assured, the use of gloves is negated. This hand wash program is being used successfully by thousands of employees in retail food operations in the U.S. to assure the control of fecal-oral foodborne illness. The success of this program is due to:

1. A specific focus that every employee can understand--the failure of toilet paper, when it is used, to reliably protect the fingertips from contamination by fecal material and pathogenic microorganisms.
2. The use of a fingernail brush when hands are washed, which provides over 350 times greater removal of transient microorganisms from the hands than hand washing without a brush.
3. A management focus on methods of preventing the hand transmission of fecal microorganisms. When management is provided with step-by-step instructions on how to conduct a Safe Hands program, employees are trained to wash their fingertips and hands correctly and adequately, and to know why these procedures are necessary. Employees are given positive reinforcement and in-service training so that hand washing technique improves and the hand washing procedure becomes habitual.

History of Hand Washing

In the 1840s, the significance of hand transfer of pathogenic bacteria was recognized when Ignaz Semmelweiss and Oliver Wendell Holmes asserted that physicians carried the agent of "childbed fever" (Group A beta-hemolytic streptococcus) on their hands. However, hand washing and disinfection to prevent spread of disease and illness was not practiced until the later part of the 19th century due to the efforts of Pasteur and Lister *(13)*. This knowledge has lead to studies and procedures in health care settings, (e.g., surgery, patient contact, etc.) that minimize contamination and prevent the transfer of life-threatening pathogenic microorganisms from one individual to another *(32)*. Many of these studies have involved hand washing techniques and hand washing devices, as well as different soaps, detergents and antimicrobial preparations *(58, 59, 60, 61, 62, 85)*. It has also become a standard practice, in the past 15 years, for health care personnel to wear gloves in order to provide protection to themselves from blood-transmitted diseases, as well as to prevent transmission of pathogens *(17, 54)*.

It has also been established that unwashed hands can transmit pathogens, especially fecal pathogens, to food products after a food worker uses the toilet *(12, 18, 20, 24)*. When consumed in food, these pathogens can cause illness and disease *(16, 33)*.

In 1986, the Centers for Disease Control (CDC) **Guidelines for Hand Washing and Hospital Environmental Control** *(37)* recommended the following procedure to prevent transmission of infectious diseases in hospitals: "For routine hand washing, a vigorous rubbing together of all surfaces of lathered hands for at least 10 seconds, followed by thorough rinsing under a stream of water. Plain soap can be used. If bar soap is used, it should be kept on racks that allow drainage of water." If liquid soap is used, the soap container should be replaced when empty because of the possible introduction during refilling and growth of pathogens in the liquid soap. These recommendations are designed to prevent transfer of infectious organisms from one person to another in health care settings.

Hand washing procedures used by food workers must be adequate to eliminate pathogenic microorganisms from hand surfaces. The 2005 FDA Food Code (34*)* recommends the following:

> ***§ 2-301.11 Cleaning Condition***
> *FOOD EMPLOYEES shall keep their hands and exposed portions of their arms clean.*
>
> ***§ 2-301.12 Cleaning Procedure***
> *(A)…FOOD EMPLOYEES shall clean their hands and exposed portions of their arms, including surrogate prosthetic devices for hands or arms for at least 20 seconds, using a cleaning compound in a HANDWASHING SINK…*
> *(B) FOOD EMPLOYEES shall use the following cleaning procedure in the order stated to clean their hands and exposed portions of their arms…*
> *(1) Rinse under clean, running warm water;*
> *(2) Apply an amount of cleaning compound recommended by the cleaning compound manufacturer;*
> *(3) Rub together vigorously for at least 10 to 15 seconds while:*
> *(a) Paying particular attention to removing soil from underneath the fingernails during the cleaning procedure, and*
> *(b) Creating friction on the surfaces of the hands and arms or surrogate prosthetic devices for hands and arms, finger tips, and areas between the fingers;*
> *(4) Thoroughly rinse under clean, running warm water; and*
> *(5) Immediately follow the cleaning procedure with thorough drying…*

The only standard hand washing procedure for food workers to use that assures removal of pathogenic microorganisms (such as those from fecal sources) from fingertips, is that developed and described by the Hospitality Institute of Technology and Management *(94)*. The emphasis of this hand washing procedure is the use of a fingernail brush and a large volume of flowing water.

In most food production and foodservice operations, food workers receive little or no training concerning hand and fingertip washing. Regulatory authorities only check to see if there is a hand wash sink in the food preparation / production / service area, if this hand washing area is supplied with soap, and if the sink functions properly. Checking operational hand washing facilities provides no verification that employees are washing their hands sufficiently to reduce fecal pathogens on their hands and fingertips to a safe level.

As more American consumers become aware of the danger of pathogen transmission in food, they become concerned that food workers are not washing their hands after using the toilet or touching contaminated items. Since consumers have no way of knowing if food workers have washed their hands, they are demanding that foodservice personnel wear plastic gloves. People assume that if food workers wear plastic gloves when handling food, food products are safe to consume. This logic is based on the presumption that gloves prevent transmission of microorganisms on hands and fingertips to food. However, this is not the case, because microorganisms found on hands and fingertips contaminate both exterior and interior glove surfaces when gloves are put on *(93),* unless hands and fingertips have been washed thoroughly. Plastic gloves used in foodservice operations may also have pinholes or other defects that allow microorganisms from hands and fingertips to escape through the glove surfaces (52).

The purpose of this paper is to discuss critical issues in hand washing and present the most effective protocol to assure "safe hands" for food production, preparation and service personnel. This protocol is the double hand wash that specifies the use of a fingernail brush during the first wash.

Physiology of the Skin

In order to understand the principles of safe hand washing, one must understand the physiology of the skin. The skin is the largest and most accessible organ of the human body. The skin provides protection by serving as an impenetrable barrier between bacteria-free tissues of the body and an environment that is contaminated with all types of microorganisms *(2)*. When a cross section of human skin is examined under the microscope, it can be seen that it is basically composed of two layers, the epidermis and dermis, which lie atop the subcutaneous layer of tissue. The dermis and subcutaneous tissue are free of microbial flora *(97)*. However, bacterial flora are on and within the epidermis and can become established in the hair follicles and in the sweat and sebaceous glands *(75, 76)*. See ***Figure 1.***

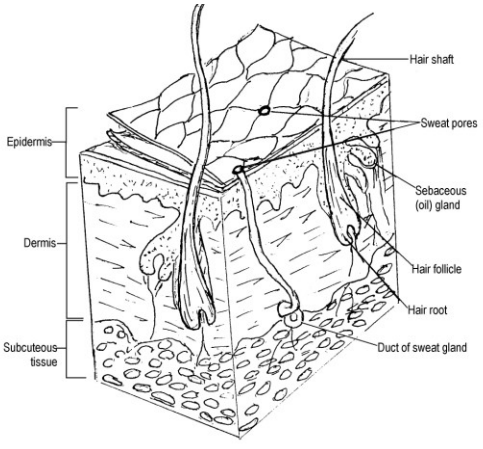

Figure 1. Illustration of Cross-section of Human Skin

Although skin appears smooth, the epidermis actually contains many cracks, crevices, and hollows, which can trap and provide favorable growth areas for bacteria *(75, 76)*. The outer surface (stratum corneum) of the skin is also covered with a protective, waxy cuticle or sebum that can help microbes adhere.

The average human has a skin area of about 1 to 75m^2 that is composed of a mosaic of about 10^9 flat, pavement-like cells known as skin scales or squames. The cells are about 25µ m square and 3 to 5µ m thick. These cells that are lost in the process of desquamation, a complete layer being lost every 1 to 4 days *(75)*. These dead cells are microscopic and are lost in a shower or bath, deposited in clothing, and scattered into the air. The loss of this outer layer is important in the distribution of both transient and resident microflora. The greater the body movement, the more cells will be dispersed in the air *(21, 87)*. Routine bathing and hand washing have a direct influence on the microflora of the stratum corneum and determine the kinds and amount of microorganisms that remain or are dispersed with the dead cell fragments.

Microflora of the Skin

Microorganisms carried on the skin of the human body have been divided into two distinct populations: resident and transient *(61, 62, 85)*. **Resident microorganisms** are considered as permanent inhabitants of the skin of most people and are found on the superficial skin surface (epidermis). However, 10 to 20% of this total resident flora are found within the epidermal layer of skin and in skin crevices, where skin oils and hardened skin make their removal difficult and complete sterilization of skin impossible *(90, 96)*. It is impossible to completely remove all microflora from the skin, even with a surgical scrub. This is one reason surgeons wear gloves. The other reason is to protect themselves from pathogens of patients.

Resident microorganisms include the coagulase-negative staphylococci; members of the *Corynebacterium, Propionibacterium,* and *Acinetobacter* species; and certain members of the *Enterobacteriaceae* family *(36, 96)*. Corynebacteria and oxygen-requiring coagulase-negative staphylococci comprise the majority of the resident microflora *(13, 96)*. The anaerobic bacterium, *P. acnes*, that causes acne, particularly in oily parts of the skin, is also a member of the resident flora. Low populations of yeasts (*Pityrosporum)* are also present as resident bacteria *(77)*. Types and numbers of resident microorganisms vary from individual to individual, and in different regions of the body *(77)*. Most resident microflora do not cause foodborne illness.

Table 1 is a list of microflora that were isolated on the hands of nurses, medical house staff, and unit secretaries of an oncology unit of a large urban teaching hospital.

Table 1. Species Isolated from Hands of 22 Health Care Personnel*

Category and Species	No. of Isolates	Percent of Category
Gram-positive cocci		
Staphylococcus epidermidis	70	39.3
Staphylococcus saprophyticus	35	19.7
Staphylococcus capitus	21	11.8
Streptococcus haemolyticus	16	9.0
Alpha streptococci	11	6.2
Staphylococcus aureus	10	5.6
Staphylococcus simulans	4	2.2
Gram-negative bacilli		
Klebsiella-Enterobacter sp.	15	55.6
Acinetobacter sp.	5	18.5
Pseudomonas sp.	4	4.8
Proteus-providencia sp.	3	11.1

Category and Species	No. of Isolates	Percent of Category
Yeast		
Candida parasilosis	10	38.5
Rhodotorula rubra	6	23.1
Candida albicans	4	15.4
Candida guilliermondii	4	15.4
Candida glabrata	2	7.7
Total	231	

* Adapted from Larson et al. *(55)*.

This table shows that some, but not all, individuals carry *Staphylococcus aureus* on their skin. The population of *Staphylococcus epidermidis* far out numbers *S. aureus* on healthy skin *(61, 85)*. *Staphylococcus aureus* (cause of staphylococcal food poisoning) is the only true pathogenic organism included in the resident microflora group of skin. About 35% of normal adults carry *S. aureus* in the anterior nostrils of the nose and are particularly susceptible to infection when the normal protective skin barrier is broken *(77)*. It is generally considered safe to consume 1,000 *S. aureus* per gram of food, because foodborne illness due to the growth of this pathogen requires a population of 10^6 *S. aureus* per gram of food to produce a sufficient amount of illness-producing toxin *(74, 33)*.

The presence of resident microorganisms on the skin aids in preventing pathogenic microorganisms from becoming attached and causing their specific illnesses or diseases *(92)*.

Transient microorganisms. As the name implies, these are organisms that are found on and within the epidermal layer of skin, as well as other areas of the body, where they do not normally reside. Almost all disease-producing microorganisms belong to this category *(96)*. They are organisms that may take advantage of some disturbance in the normal resident microflora to gain a foothold and cause infections and symptoms of disease or illness. Transient microorganisms are deposited on the skin through direct contact or by aerosol.

The Association for Professionals in Infection Control Guidelines for Infection Control Practice (APIC) *(54)* defines transient flora ("contaminating or noncolonizing flora") as microorganisms isolated from the skin but not demonstrated to be consistently present in the majority of persons. Transient microflora are of concern in health care settings and food operations because of the likely transmission of this type of microflora by hands. Unless transient microorganisms are removed from hands by washing with soap and water using mechanical friction, or reduced by the application of some antiseptic hand rub, spread of pathogenic microorganisms and food spoilage microorganisms, such as *Pseudomonas* spp.*,* can occur.

Transient microorganisms (bacteria, yeast, molds, viruses, and parasites) can be of any type, from any source with which the body has had contact, and are found on the palms of hands, fingertips, and under fingernails *(77, 80)*. Pathogens that may be present on the skin as transient types include: *Escherichia coli, Salmonella* spp.*, Shigella* spp.*, Clostridium perfringens*, *Giardia lamblia*, Norwalk virus, and Hepatitis A virus. High levels of transient microorganisms (bacteria, viruses, and parasites) attach to hand, fingertip, and fingernail surfaces when:

1. Fecal contamination remains on hands and fingertips after using the toilet, changing diapers, or cleaning up after pets at home.
2. Contaminated raw products (e.g. raw meat, poultry, fish, unwashed fruits and vegetables) are touched.
3. Infected cuts and boils are touched or picked, or if a person has an infected fingernail.

Table 2 is a list of pathogens of fecal origin that can be transmitted by hands and have been implicated in foodborne and waterborne disease or illness outbreaks, and the dosage or

population of microorganisms necessary to cause illness. When the number of pathogens, or toxins produced by pathogenic microorganisms in food or water is less than that required to cause illness or disease, the risk of consuming the food is acceptable.

It becomes evident by examining ***Table 2*** that transfer of relatively small populations of *Shigella* spp., *E. coli* O157:H7, and viruses by hands to food represents the greatest threat for causing illness if these pathogens are not removed by adequate hand washing.

Table 2. Foodborne Illness Hazards: Threshold and Quality Levels

Agent	Healthy person (Estimated illness dose)* (Number of microorganisms)
VEGETATIVE BACTERIA	
Escherichia coli	10^6 to $>10^{10}$ CFU (dose) *(26)*
Escherichia coli O157:H7	10 - 100 CFU (dose) *(16, 33)*
Campylobacter jejuni	> 500 CFU (dose) *(16)*
Salmonella spp.	1 to 10^9 CFU (dose) *(16)*
• *S. anatum*	10^5 to $>10^8$ CFU (dose) *(66)* [a]
• *S. bareilly*	10^5 to $>10^6$ CFU (dose) *(67)* [a]
• *S. derby*	10^7 CFU (dose) *(67)* [a]
• *S. meleagridus*	10^7 CFU (dose) *(65)* [a]
• *S. newport*	10^5 CFU (dose) *(66)* [a]
• *S. pullorum*	10^9 to $>10^{10}$ CFU (dose) *(67)* [a]
• *S. pullorum*	10^9 to $>10^{10}$ CFU (dose) *(67)* [a]
• *S. typhi*	10^4 to $>10^8$ CFU (dose) *(45)* [a]
Shigella spp.	10^1 to 10^6 CFU (dose) *(16)*
• *S. flexneri*	10^2 to $>10^9$ CFU (dose) *(27, 28)*
• *S. dysenteriae*	10^1 to $>10^4$ CFU (dose) (*57)*
Staphylococcus aureus	10^5 to $>10^6$ CFU./g [toxin level] (*33, 43, 74)* [b]
Vibrio cholerae	10^3 CFU (dose) *(16, 46)*
Vibrio parahaemolyticus	106 to 109 CFU (dose) *(16, 91)*
Yersinia enterocolitica	3.9 x 107 CFU (dose) *(16)* [c]
Listeria monocytogenes	$>10^3$ (*33)* to $>10^5$ *(31)* CFU (dose)
PARASITES	
Cryptosporidium parvum	<30 cysts *(16)*
Toxoplasma gondii	1 cyst *(16)*
Trichinella sprialis	1 to 500 larvae *(16)*
VIRUSES	
Hepatitis A virus	unknown, probably <100 *(16)*
Norovirus	unknown, probably <100 *(16)*
Rotaviruses	10-100 virus particles *(33)*

* Number in parenthesis indicates references.
CFU = Colony forming units]
[a] Results from feeding studies. Data from outbreaks indicate lower values.
[b] Indicates number of pathogenic bacteria necessary to produce sufficient amount of illness producing toxin.
[c] Probably lower.

Differences in Hand Microflora of Food Workers and Non-food Workers

The type and number of microorganisms found on hands are also a function of the work environment, as reported by deWit *(23)* and Restaino *(87)*. ***Table 3*** is a list of the types of bacteria found and differences in populations on the hands of food workers and non-food workers.

Table 3. Microbial Populations of Pre-washed Workers Hands in Food and Non-food Industries*

				% of workers hands with:		
Food Industry	**Number of Persons**	**Total No. Bacteria (log_{10})**	**Entero-bacteriaceae (log_{10})**	***Salmonella***	***E. coli***	***S. aureus***
Chicken Slaughterhouse	14	6.20	3.53	36	86	100
Cattle Slaughterhouse	20	7.30	3.90	5	100	65
Pig Slaughterhouse	20	6.78	3.38	30	95	95
Egg Products I	20	6.28	3.59	25	60	55
Egg Products II	20	5.81	2.08	0	30	70
Fish	19	6.28	2.62	0	15	45
Dairy Plant	26	5.81	1.98	0	19	54
Deep-Frozen Foods	18	6.28	2.49	0	50	50
Dried Vegetables	14	5.97	2.34	0	7	29
Biscuit Factory	28	6.26	2.34	0	11	46
Chocolate Factory	28	5.63	1.76	0	4	29
Non-Food Industries						
Wool Factory	15	5.31	2.06	0	80	53
Glass Factory	14	5.95	1.74	0	0	64
Can Factory	15	5.68	1.14	0	0	60

* Adapted from deWit, J. C. 1985. *(23)*

Pether and Gilbert *(84)* reported isolating *E. coli* from the fingertips of 13 of 110 butchers soon after they left the meat line at a meat products plant. However, *E. coli* was not detected on the fingertips of 100 volunteers from a public health laboratory. Kerr et al. *(49)* reported that food workers are significantly more likely to carry *Listeria* spp. than clerical workers. It was also reported that frequent hand washing represents an important element of hygiene that may interrupt transmission of these organisms. Of the 87 food workers found not to carry *Listeria* spp. on their hands, 54 (62%) were considered to have used adequate hand washing. Of the 12 people carrying *Listeria* spp. on their hands, only one individual was believed to have washed their hands adequately. The authors emphasized the importance of good hand washing technique for food workers, particularly in establishments where raw food, potentially contaminated with *L. monocytogenes,* and cooked/ready-to-eat products are handled. Differences have also been reported in the type of microflora carried by the hands of health care workers *(43)*.

Survival of Transient Microorganisms on the Skin

The areas around and under the fingernails provide a microenvironment that is quite conducive to microbial growth. It is this area of the hand that often harbors the highest microbial population that is most difficult to remove *(69)*. Resident microorganisms will always be present and survive on skin. Transient microorganisms remain or are destroyed by the skin's environment at a rate determined by the skin characteristics of each individual *(92)*.

Pether and Gilbert *(84)* reported that salmonellas and *E. coli* can survive on the fingertips for a few hours. Casewell and Phillips *(15)* reported that *Klebsiella* spp. survived on artificially inoculated hands for 150 minutes. Coates et al. *(18)* reported that survival time for campylobacters (suspended in 0.1% peptone solution) on hands ranged from less than a minute to slightly more than 4 minutes. However, when the campylobacters were suspended in chicken liquor or blood, these pathogenic bacteria survived on the hands for longer periods of time (up to an hour when suspended in horse blood).

Filho et al. *(35)* reported a study of the survival of applied cultures of *Pseudomonas aeruginosa, Klebsiella pneumoniae, Serratia marcescens, E. coli,* and *S. aureus* on the fingertips and hands

of four volunteers. Over 99% of the bacteria died within 2 minutes after application, but about 10^5 cells (0.01%) remained on the fingers for up to 90 minutes.

When suspended in saline, *L. monocytogenes* survived up to 60 minutes on fingertips, but survival times were greatly extended (up to 5 hours) when the inoculum was suspended in milk *(92)*. Survival time was apparently affected by skin lipids, the skin's normal flora, or the fat content of the milk. Different serotypes displayed similar results for the percentage persistence over a 2-hour period when suspended in milk, except for an isolate of *L. monocytogenes* serotype 7, which had a greater percentage survival than other organisms tested. In contrast, *Escherichia coli* failed to survive for 1 hour under the same conditions. Hand washing with either soap or a water-based chlorhexidine hand cleanser usually failed to completely decontaminate fingertips to which an inoculum of 10^4 / CFU per fingertip suspended in milk was applied, but a solution of chlorhexidine gluconate in methanol was found to be effective.

In 1988, Ansari et al. *(7)* reported the survival of rotavirus on the finger pads of hands for up to 60 minutes.

Personal Hygiene

Management must train employees to know the importance of good personal hygiene and use this knowledge in preparation for work. This includes bathing daily, using deodorants, and keeping fingernails clean and clipped short (to $^1/_{16}$ inch).

Many people use a deodorant soap for bathing or showering. A study reported by Bibel *(11)* indicated that there was no significant difference in the number of skin microflora of individuals using deodorant soap compared to those using plain soap. However, it was noted that the resident bacterial population of the skin was changed when deodorant soaps were used. More *S. epidermidis* was seen when plain soap (Ivory®) was used, while washing with deodorant soap (Dial®) seemed to favor *Acinetobacter calcoaceticus* and *Micrococcus luteus*.

Importance of Hand Washing

Food production workers and foodservice personnel must be taught to use correct hand and fingertip washing, by management, in preparation for work. Regulatory authorities do not require the use of a fingernail brush. However, correct use of a fingernail brush to wash hands and fingertips is the best way to assure removal of transient microorganisms *(93)*.

Not only is hand washing critical in foodservice and food production operations, it is also important in homes and day care operations. Black et al. *(12),* reported a study that demonstrated a decline in diarrheal illnesses (due to *Shigella, Giardia* and rotavirus) in day care centers when employees were taught to use good hand washing procedures. The incidence of diarrhea in 2 day care centers with a hand-washing program was half that of 2 control centers for an entire 35 week study period. Employees in the hand washing program washed their hands before handling food and after arriving at the day care center, helping a child use the toilet, or using the toilet themselves. When children entered the day care center, used the toilet, were diapered, or prepared to eat, employees washed their hands using bar soap and paper towels. However, the authors did not specify what constitutes a good hand-wash procedure.

Shigella is associated with poor hygiene. The effectiveness of the simple intervention of hand washing with soap and water in preventing the spread of shigellosis was investigated. Khan *(50)* demonstrated that secondary infection rates within families in Bangladesh due to transfer of pathogenic bacteria (*Shigella)* decreased, when people were taught to wash their hands after defecation and before eating. The study population was comprised of confirmed cases of shigellosis. These and matched controls were followed up for 10 days. Several pieces of soap and earthenware pitchers for storing water were provided to the study families and they were advised to wash their hands with soap and water after defecation and before meals. Compliance

was monitored daily by observing the size of the soap and residual water. Rectal swabs of contact of both of the groups were obtained daily for culture. The secondary infection rate was 10.1% in the study group and 32.4% in the control group. The secondary case (symptomatic) rate was 2.2% in the study group and 14.2% in the control group. These results suggest that hand washing has a positive interrupting effect, even in insanitary environments.

Lack of Effective Fingertip and Hand Washing by People

In 1996, a national survey was conducted to assess hand washing behavior of adults in the United States *(3)*. More than 7,000 people participated in the two-part survey that was conducted by an international research firm. Participants were most likely to say they washed their hands after changing a diaper (78%) and before handling or eating food (81%). However, most people said they did not wash up after petting an animal (48%), coughing or sneezing (33%), or handling money (22%).

This study (*3)* also reported the observed hand washing behavior of adults in public restrooms located in 5 major cities (New York City, Chicago, San Francisco, Atlanta, and New Orleans). Of 2,129 people observed using a restroom in Penn Station in New York, only 60% washed their hands. Chicagoans washed their hands most often (78% of adults observed) after going to a public restroom, followed by adults in New Orleans (71%), San Francisco (69%), and Atlanta (64%). Across all cities, women washed their hands more often than men (74% versus 61%).

While hand washing is a simple and easy task, studies have indicated that personnel in both health care and foodservice industries have incorrect hand washing habits. Sixty percent of foodservice personnel in one study were reported not to wash their hands *(24)* as required by these types of positions. "The food handler is one link in the complex multiphase process of contaminated food - infection - enteric disease." *(90)*

Of greatest concern is contamination of hands and forearms by transient microorganisms from feces. Clothing can become contaminated from pieces of fecal matter collected on the hairs around the anal region *(65)*. When people use the toilet, their hands or forearms may become contaminated with intestinal microorganisms which include *C. perfringens,* shigellae, salmonellae, hepatitis A virus, and other enteric bacteria *(38)*. Thus, these contaminated hands / forearms can transfer intestinal microbes to foods, equipment, and other workers in the food storage and preparation areas unless correct personal hygiene and adequate hand washing procedures are followed.

A study that monitored restroom hand washing compliance by foodservice workers at a managed care facility and two commercial foodservice operations was conducted *(29)*. The workers at the managed care facility had the best compliance. This was thought to be due to the emphasis on hand washing by management personnel as well as the training and continued in-service instruction of employees.

The study (29) also monitored the number of daily hand washings for each employee in the kitchen area. The results of this study indicated that monitoring hand washing was beneficial for increasing and maintaining employee compliance with hand washing.

Horwood and Minch *(47)* reported the results of numbers and types of bacteria obtained from 34 hand washing samples obtained in 22 foodservice establishments in the Cambridge and Boston, Massachusetts areas (cafeterias, lunch rooms, drug stores, and restaurants). The range in total plate count was 6,200 to 16,000,000,000 per ml. *E. coli* was found in 13 of the 34 samples. Twenty-nine of the 30 samples showed hemolytic staphylococci, 19 showed hemolytic streptococci, and 19 showed a mixture of both hemolytic streptococci and staphylococci. The number of aerobic spore-forming bacilli ranged from 4 to 400 per ml. When this research was done over 45 years ago, the authors at that time concluded that the hands of food handlers must

be kept clean. They stressed that food handlers must be given instruction and that management must assume the responsibility for daily education and enforcement of hand washing.

Effective Test for Fingertip Washing

By reviewing the results of the study by Horwood and Minch *(46)*, it can be assumed that *E. coli* can be used as an indicator of effective fingertip washing. It is a simple matter to assess employee hand washing compliance by using *E. coli* Petrifilm™ (3M, St. Paul, Minnesota). To accomplish this, foodservice and food production personnel can be asked to rinse their fingers in a small plastic bag containing 10 ml. letheen broth. A 1 ml. sample of this "fingertip rinse" can then be plated and incubated on *E. coli* Petrifilm™. While there may be a small background count of *E. coli* from handling food, an *E. coli* count of more than 20 per milliliter indicates that fingertip washing procedures were inadequate.

Effectiveness of Toilet Paper

In under developed nations of the world, toilet paper is considered to be extremely expensive, and hence, is not used by a large portion of the world's population of people. These people use one hand to wipe themselves after defecating and then wipe their hands on some leaves or rinse their hands in water from a pitcher. When they eat or cook, they use the other hand. When these people immigrate to countries that routinely have toilet paper available, they must learn to use toilet paper, and be taught the importance of washing their hands with soap and flowing water after defecating.

The use of toilet paper was not common in the United States until after the early 1900's. The problem today is that there is a total reliance on toilet paper to keep feces off the fingertips, however there are no performance standards for toilet paper *(70)*. Consumer Reports *(5)* reviewed toilet paper performance and found a wide variation among samples tested in wet strength, tear resistance, and absorbency. As long as there are no performance standards, or standards for use, no one should assume that toilet paper provides an effective barrier to keep fingertips free of fecal pathogens.

Comparison of Hand Disinfectants and Unmedicated Hand Soaps and Detergents

Most research studies for hand washing and hand disinfectants have been done for personnel (surgeons, nurses, and other health care workers) in health care settings where patients are immune compromised or are at high risk of wound, surgical, or burn infection.

Sprunt et al. *(95)* studied the effectiveness of hand washing agents in removing infant-acquired organisms from the hands of personnel working in a hospital nursery. The following preparations were used: 3% hexachlorophene (Phiso-Hex) in liquid saponified coconut oil; 7.5% providone-iodine, 0.75% iodine (Betadine); a 70% ethyl alcohol emulsion; and **Ivory®** soap bars and tap water. The results of this study indicated that all agents were equally effective when followed by drying with a paper towel.

Results of a research study by Bannan and Judge *(9)* indicated that hand washing with bar soap (**Ivory®**) reduced a population of 2×10^9 *Serratia* to 6.2×10^5 (a 99.97% reduction in bacteria). The hand washing method used in this study did not use a nail brush or a double wash, but did use a lot of flowing water. Mahl *(63)* found that many commercial hand wash products containing antimicrobial agents do not rapidly reduce numbers of inoculated bacteria in fingernail regions to any greater extent than non-antimicrobial hand washes.

In another study of acceptable methods for washing hands for hospital procedures, Ayliffe et al. *(8),* described research in which fingertips were inoculated with cultures of *S. aureus, Staphylococcus saprophyticus, E. coli*, and *Pseudomonas aeruginosa*. Bacterial counts from the fingertips were made after disinfection with various antiseptic detergents, alcoholic solutions, or unmedicated soap. There was less than a 100 to 1 reduction in all cases. A preparation containing

70% alcohol with chlorhexadine was the most effective preparation. Antiseptic detergents were only slightly more effective against gram negative bacteria than was plain soap. Ayliffe et al. *(8)* suggested that soap and water was adequate for general hand washing procedures and that germicidal agents should only be required for aseptic procedures.

Alcohols, usually 60 to 90% ethyl or isopropyl, inactivate both the resident and transient microorganisms on the skin surface, but have no persistent effect and do not remove fecal microorganisms completely. Alcohol removes surface oils from the skin and has a drying effect. Newer emollient-containing formulations are more acceptable to users but still have a skin-drying tendency. Isopropyl alcohol is a toxic chemical, and if used in any food production area, must be carefully monitored and stored so that it cannot get into food. The FDA Food Code *(34)* does not consider the replacement of hand washing with soap and water by the use of alcohol, alcohol formulations, or alcohol wipes to be an effective method for cleaning hands in food production and food preparation areas. Even when alcohol is used as a hand antiseptic, hands must be washed with soap and water before the alcohol is applied. Studies by the author have shown that soap and water give as much or more reduction in hand microorganisms as alcohol. Since even alcohol preparations with emollients dry the skin and cause dermatitis, there is no reason to use alcohol for hand disinfection if there is an adequate supply of water for hand washing.

A discussion of the use of antibacterial agents in hand soaps and detergents for use by food workers is presented by Paulson *(82)*. Chlorhexidine gluconate (CHG) is a common antimicrobial ingredient in antibacterial soaps and will reduce resident bacteria when it is used repeatedly over a long period of time. CHG does not act as rapidly as do alcohols, and it takes several applications of CHG to reduce flora comparable to alcohol application. However, CHG is milder than alcohols (an important factor in frequent washings) and has some residual chemical activity on the skin (an advantage when gloves are worn). Paulson *(82)* suggests use at levels of 2% or lower, because higher concentrations tend to irritate the skin.

Iodophors are also used as antimicrobial ingredients in antibacterial soaps. Iodophors have a good immediate and persistent effect and are capable of removing both normal and contaminant organisms *(82)*. They are commonly used for surgical scrubs. However, these products are harsh on the skin and produce stains when spilled on clothing, counter surfaces, and floors.

Dilute sodium hypochlorite (household bleach) is antimicrobial to both resident and transient skin microorganisms, as well as bacterial spores *(82)*. It is sometimes used as a chemical hand sanitizing solution or "hand dip", after hands had been washed thoroughly. In these instances, the chlorine hand dip solution must be maintained clean and have a strength equivalent to 100 mg/L *(33)*. However, continued use of chlorine hand dip solutions is very irritating to the skin surfaces of hands.

Since a foodservice or food production unit is not an aseptic environment, the use of plain soap by food workers for hand washing should be sufficiently adequate for removing transient microflora from the hands of food workers. By using plain soap for hand washing, the excessive destruction of beneficial resident microflora, as well as excessive drying and skin irritation on hands than can lead to dermatitis, are avoided.

Quantity of Soap

Larson *et al*. *(56)* reported a study on the quantity of soap necessary for hospital personnel to use for effective hand washing. Subjects using 3-ml amounts of antiseptic soap in a single wash with no fingernail brush on uninoculated hands had slightly greater reductions in bacterial counts than those using 1 to 3 ml of plain liquid soap and 1-ml amounts of antiseptic soap, as would be expected. It was concluded that personnel should use 3 to 5 ml of soap to remove both transient

and superficial resident microorganisms from hand surfaces. From this study, it is apparent that employees must use enough soap on the fingernail brush and then on their hands to produce a good lather.

The standard for how long to wash hands is then governed by removal of the soapy lather. When the lather is gone and the fingertips are "squeaky clean" (less than 20 seconds), the population of transient microorganisms has been effectively reduced.

Detergency or Lathering Ability

There are no performance standards for the detergency (lathering ability) of soaps or hand detergents. This is another important factor in removing transient microorganisms from hands, and is influenced by type and amount of soil and mineral content of the water *(39)*. A soap product or liquid detergent with high detergency is necessary to remove a large amount of fat, protein, or other types of organic soil that bind transient microflora. Water with high amounts of calcium, magnesium, or iron is "hard" and requires high-detergency products for lathering and emulsification ability. Hand soaps or detergents must be user tested in specific food operation facilities with local water in order to determine which products lather sufficiently to clean hands in the easiest, most acceptable manner. This means that a national foodservice company should not dictate the use of one hand soap for all locations throughout the U.S. Hand soaps or detergents must be matched to type of water at the location of use.

Skin Irritation

"In healthy skin, a thin film of water repellent substance is secreted by sebaceous glands within the skin. This keeps the skin supple and helps prevent the ingress of water and dirt. The removal of this layer by irritating chemical compounds quickly leads to intense inflammation of the skin" *(39)*. For example, some antibacterial soaps, alcohol and alcohol preparations, and chlorine and iodine solutions or soaps may irritate the skin of some individuals and cause it to become excessively dry, rough, and red. When the epidermal layer of hands becomes irritated, people do not wash their hands as often or as well. Hence, it is recommended that employees involved in routine food handling and food production be provided with regular bar or liquid soap (not an antibacterial product) for routine hand washing. "An acceptable hand soap motivates hand washing by making hand washing pleasant." *(79)*

Contaminated Bars of Soap

It has been demonstrated that bacteria from contaminated bars of soap (without antibacterial additives) are not transferred from person to person during common use *(9, 42)*. These studies demonstrate that bar soap is inherently antibacterial and will not likely support the growth of bacteria. The American Infection Control Guideline *(54)* recommends that if bar soap is used, it should be provided in small bars that can be changed frequently, with soap racks to promote drainage.

Liquid Hand Soaps or Detergents

Many regulatory agencies forbid the use of bar soaps for employee hand washing and have mandated the use of liquid hand soaps or detergents for hand washing. This is not necessary. The use of liquid soap has not been demonstrated to be better for removing transient microorganisms than the use of plain bar soap for washing hands and fingertips.

Liquid soap products are frequently available in dispenser containers or bottles. Hospital studies have shown that dispensers must be replaced and not refilled. *Pseudomonas* spp., a pathogen present in many health care facilities, has been shown to grow and multiply in some liquid hand soap and detergent products. This is another reason many manufacturers add disinfectants to their liquid soaps.

The data collected from hand washing research studies indicate that regular hand soap or detergents (bar or liquid) are effective for hand washing for personnel in most food production or foodservice facilities. In aseptic food production facilities where food with a very low pathogen / total plate count must be prepared (e.g., infant formula, tube feedings), sterile gloves should probably be used after the hands are properly washed.

Fingernail Brushes

Fingernail brushes are necessary to dislodge the accumulation of debris from under and around fingernails. It is this subungual area that contains the highest number of microorganisms on hand surfaces (69). However, too frequent use of the fingernail brush or use of a nail brush that is too stiff will loosen too much of the epidermal layer on the tips of the fingers, causing the fingers to crack and bleed. [*The Super Scrub-2000, Surgeon's Nail Brush from the Anchor Brush Company, 1307 Davis Street, Morristown, TN has been found to be a highly reliable brush.*] The tips of the fingernail brush are used to produce lather on hand surfaces, particularly around the fingertips and fingernails during the first part of the double wash method of hand washing. In order to ensure removal of fecal pathogens the double hand wash method [though no longer a recommendation of the FDA Food Code *(34)*], should be required when employees begin a shift and after they use the toilet. The single hand wash method that does not require the use of a nail brush is adequate during normal food handling operations for removal of most transient pathogenic bacteria acquired by routine hand contact with food.

Measuring the Effectiveness of Hand Washing

The Hospitality Institute of Technology and Management recently conducted an inoculated finger washing experiment to evaluate the effectiveness of ordinary hand washing compared with the double hand wash. In this study, high levels of *Serratia marcescens* were placed on the thumb and first and second fingers of the hands of 3 people. One tenth milliliter (0.1 ml) of a solution containing 20,000,000 to 100,000,000 *S. marcescens* per ml. were placed on the fingers and thumb. The subjects then washed their hands using selected experimental procedures in order to evaluate the reduction of the indicator organism, *S. marcescens*. The population of *S. marcescens* was measured at each step by rinsing the thumb and first 2 fingers in 10 ml of phosphate buffer.

The first hand wash procedure tested was a simple 13-second hand wash, whereby the hands were soaped, lathered, and, during the lathering, rinsed underneath a faucet of flowing water. There was a reduction of 325 to 1 (a 99.7% reduction). The volume of water used for rinsing the hands, not the time of the wash, was the critical reduction factor.

When the hands were washed according to the double hand wash procedure using a fingernail brush and soap, the total time was about 20 seconds for the entire washing process, including the time necessary for soap removal. The first wash with the nail brush reduced the *S. marcescens* indicator organism by a factor of 62,000 to 1 (a 99.998% reduction), or 200 times more than the simple, single hand wash without a nail brush. The second hand wash, without the nail brush, which took approximately 13 seconds, reduced the indicator organism from 120, 000 to 1 (a 99.999% reduction), or 320 times more than a simple hand wash.

In order to determine the residual population of *S. marcescens* remaining on the fingernail brush, the brush was rinsed in 10 ml of phosphate buffer. Compared with the population reduction on the fingers, there was a reduction of 418,000 to 1 (a 99.9998% reduction) on the brush. This points out that the nail brush will have fewer residual microorganisms than the fingertips. Those residual microorganisms remaining on the brush could be transferred to the next person using the nailbrush. However, there will be another 99.98% reduction when that person uses the nail brush for hand and fingertip washing. Therefore, the potential for transfer of microorganisms by the nail brush is minimal. Door knobs, soap dispenser levers and paper towel dispenser levers

probably have a greater potential for cross-contamination than the common use of a nail brush for hand washing.

The normal resident microflora (skin bacteria) of the hands were also measured every time the fingers were rinsed in the phosphate buffer. No matter how many times the hands were washed, a population of skin bacteria ranging from 10,000 to 1,000,000 per ml. were recovered from the subjects' fingers and thumbs. This confirms findings of previous hand wash studies of the past 50 years that it is virtually impossible to remove all microorganisms from the skin.

Whenever people touch food, they must realize that skin cells and skin bacteria are added to the food. This has been taking place for thousands of years, and is obviously not a food safety issue. In fact, this "sharing" may be important for developing and maintaining immunity.

Drying Hands

After hands are washed and rinsed, they must be thoroughly dried. Blow dryers should not be used because they accumulate microorganisms from toilet aerosols, and can cause contamination of hands as they are dried by the drier *(51, 86)*. It is also apparent that many individuals do not dry their hands thoroughly when using a blow drier; hence, moisture, which is conducive to microbial growth, remains on hands, or people dry their hands on their clothing.

In a hand drying study reported by Redway et al. *(86)*, standard techniques were used to identify and count the bacteria associated with hand washing and drying under natural conditions. Average bacterial counts were reduced when towels (either cloth or paper) were used to dry hands, the most significant decrease being with paper towels. Hot air dryers produced a highly significant increase in all bacteria on hands (a 436% rise in some skin and enterobacteria, which is indicative of fecal contamination of the hands). In a further study, Redway et al. *(86)* reported that bacteria were isolated from swabs taken from the air flow nozzle and air inlet of 35 hot air dryers in 9 types of locations (including hospitals, eating places, railway stations, public houses, colleges, shops, and sports clubs.) Bacteria were relatively numerous in the air flows and on the inlets of 100% of dryers sampled, and in 97% of the nozzles. *Staphylococci* and *micrococci* (probably from skin and hair) were blown out of all of the dryers sampled for these type of bacteria, and 95% showed evidence of the potential pathogen *S. aureus.* At least 6 species of enterobacteria were isolated from the air flows of 63% of the dryers, indicating fecal contamination. The authors *(86)* concluded that hot air dryers have the potential for depositing pathogenic bacteria onto the hands and body and that bacteria could also be inhaled as they are distributed into the general environment whenever dryers are running. It was suggested that the use of hot air dryers should be carefully considered on health grounds, especially in sensitive locations.

Cloth roller towels are not recommended because they become common-use towels at the end of the roll, and can be a source of pathogen transfer to clean hands. Brodie *(14)* demonstrated that staphylococci can be transmitted by use of a communal towel for drying hands after washing and recommended that paper towels be used for drying hands. The use of roller towels for drying hands in food production facilities is banned by most regulatory agencies.

In 1987, Coates, et al. *(18)* showed that *Campylobacter jejuni* could survive hand washing with soap and water if hands were not dried thoroughly with paper towels. Thus, drying hands completely with single-use, disposable paper towels is the preferred method of hand drying in foodservice and food production facilities.

Hand Lotions

Hands may become dry and irritated with frequent hand washing, and therefore there is a tendency for personnel to want to use hand lotions. However, the use of hand lotions in food production and food service units is discouraged, as it is in health care units, because of possible

contamination of these products *(10, 71)*. If the use of hand lotions is allowed, only small packets or small bottles of lotion should be allowed on the premises so that they are replaced frequently. The use of hand lotion products should be monitored.

When Must Hands be Washed to Control Hazards?

The following is a list of situations that may lead to hazardous contamination of foods.

1. Touching the body, human contact
   - Anywhere on the head (ears, nose, eyes, mouth, pimples)
   - Shaking hands with people
   - Using a nose tissue, handkerchief
2. Touching selected raw food (particularly raw meat, fish, and poultry products)
3. Touching bottoms of boxes that could be contaminated by meat and poultry juices on the floor of the delivery truck

Situations that do not lead to a hazard, but where hand washing visible to customer's is recommended, because consumers will feel threatened, include:

1. Touching other items
   - Money
   - Soiled apron, soiled uniform / clothes
   - Shoes
   - Items that have fallen on the floor
   - Floor
   - Soiled cleaning tools (mops, brooms)
   - Hair, skin
   - Items such as used tableware before handling ready-to-eat food, particularly wet, ready-to-eat food such as lettuce

Situations that do not lead to a hazard and where hands do not need to be washed after touching the item because consumers will not feel threatened, include:

1. Touching equipment
   - Cash register / scale keys
   - Clean wipe rags, wash water, rinse water
   - Clean slicer / knife handles, serving utensil handles
2. Touching facilities
   - Door handles on refrigerators holding ready-to-eat food
   - Door knobs, faucet handles, fixtures, furniture
3. Touching supplies
   - Sterilized, pasteurized, washed food

However, foodservice and food production personnel should be trained and encouraged to wash their hands at any time if there is any possibility of cross-contamination. Hand washing facilities in food preparation, food production and food service facilities must be accessible and maintained. Whenever possible, foodservice personnel should indicate to customers that they have washed their hands by asking the customer to pardon them for a moment while they wash and dry their hands. Food service personnel should always minimize bare hand and arm contact with ready-to-eat food by preparing and mixing food with clean, sanitized equipment and utensils and by serving food with deli tissues, spatulas, tongs, or other dispensing equipment.

Glove Use

Some states, such as New York *(40)*, and local or city ordinances *(6)* have made glove wearing by food workers mandatory, in spite of the fact that there is no documented evidence that food prepared and served by people wearing gloves is safer than food prepared by people who use effective hand washing procedures. No regulatory agency has been able to force the food industry through regulation and inspection to ensure that all food workers wash their hands because they have no way to measure if hands have been washed. Therefore, some regulatory agencies have chosen to enforce glove use by food workers to contain fecal pathogens on the fingers.

When retail food personnel use gloves to prepare and serve food, they must be trained to realize that microorganisms adhere to the surfaces of gloves and thus gloves can be sources of cross-contamination just as much as unwashed hands. Disposable gloves must be changed frequently.

However, at this time, there are no data or government rules on how long gloves should be worn. The FDA Food Code (34) recommends the following:

> ***§3-304.15 Gloves, Use Limitation.***
> *(A) If used, SINGLE-USE gloves shall be used for only one task such as working with READY-TO-EAT FOOD or with raw animal FOOD, used for no other purpose, and discarded when damaged or soiled, or when interruptions occur in the operation.*

However, considerations for length of time that gloves are worn in addition to type(s) of food being handled, also include material and thickness of gloves, fit, type of work being done, and chemicals coming in contact with gloves. Establishing guidelines for the frequency of changing gloves thus becomes very difficult.

The environment created on the hand covered by a glove is very conducive to the multiplication of pathogenic microorganisms such as *S. aureus* and *E. coli* (82, 83). This is due to the fact that the skin surface on the gloved hand is moist, warm, and protected. Any hole, tear, slit, or puncture of a glove allows the entrance and exit of pathogenic microorganisms. Many inexpensive plastic gloves are porous *(22)*. Korniewicz et al. *(52)* reported tests of procedure gloves from 5 manufacturers as follows:

Vinyl gloves - 4% had defects, 34% allowed the penetration of bacteria, and 53% failed in use.
Latex gloves - 2.7% had defects, 20% allowed the penetration of bacteria, and 3% failed in use.

There is a high probability that pathogenic microorganisms from gloved hands will be transferred to food and other contact surfaces. Paulson *(82, 83)* and Snyder *(93)* have demonstrated that if individuals do not wash their hands before putting on gloves, both the interior and exterior of the gloves become contaminated with surface microorganisms on the hand. This condition has also been recognized by health care professionals *(30, 53)*. It can also be observed that many employees wearing gloves in a foodservice facility have not been trained and do not know when to change gloves, or even wash their gloved hands after touching contaminated objects.

Hands must be washed and dried as soon as gloves are removed, as well as before gloves are put on, to eliminate high levels of microorganisms on the hand surfaces *(37)*. This means that if employees are to use gloves correctly, the government must require that specific procedures be taught by management so that enforcement can be objective.

There have been many inquiries concerning the advisability and feasibility of washing gloved hands. However, at the present time, regulations concerning washing of gloved hands and reuse of gloves by workers in food production and foodservice has not been defined. Doebbling et al. *(25)* and Adams et al. *(1)* have demonstrated that microorganisms adhere to the surface of gloves

and are not easily washed off, despite friction, cleansing agent, and drying. The Occupational Safety and Health Administration (OSHA) Bloodborne Pathogens Standard prohibits the washing and decontamination of disposable gloves for reuse by health care professionals *(78)*.

Pathogenic microorganisms are not as likely to multiply on the skin surface of clean, dry, ungloved hands if the hands are dry, because millions of competitive resident microorganisms inhibit their growth, and the pH of the skin is not optimal for growth.

Wearing gloves to prepare and serve food does not prevent cross-contamination of food and foodborne illness. The reasons for this statement are listed as follows:

1. Glove wearers continue to touch their faces, eyes, environmental surfaces, and contaminated raw food, inoculating the glove surfaces with microorganisms. In many instances, because of inadequate training, personnel wearing gloves assume that because they are wearing gloves, it is unnecessary to wash their gloved hands, or even change gloves.
2. Oils adhere to gloves and promote the subsequent adherence of microorganisms.
3. If people do not wash their hands and fingertips at all or adequately after using the toilet or touching highly contaminated items such as raw meat and poultry products, before putting gloves on, pathogenic microorganisms can contaminate both the inside and outer surface of gloves.
4. Makulowich *(64)* reported that gloves are porous and can allow the entrance of viruses. Hence, it can be concluded that the porosity of gloves will also allow the exit of viruses carried on hands within gloves (e.g., hepatitis viruses, norovirus and others).
5. Korniewicz et al. *(52)* found that when a total of 480 examination gloves were stressed at the highest stress level, 63% of 60 vinyl gloves leaked a selected bacteriophage, compared with 7% of 60 latex gloves. At lower-use level, there was no statistical difference in leakage. Gloves may become punctured during use, and the inside may become wet with perspiration, encouraging an increase in bacteria on the skin surface *(41)*. When gloves are removed, hands must be washed thoroughly to reduce high populations of microorganisms in the moist environment on hands inside of gloves.
6. It must be emphasized that gloved hands touch as many contaminated objects and surfaces as ungloved hands, and must be changed or washed frequently. However, at this time, there are no reliable data on how long gloves should be worn. No government agency has done any studies on glove contamination.
7. Some people develop contact dermatitis when wearing gloves. The causes have been traced to allergic reactions to powders within the gloves and the chemical composition of both latex and synthetic gloves themselves *(100)*.

   The sensitivity of some people to latex is recognized by the medical profession. Latex allergy is a type I reaction to natural rubber latex proteins with clinical manifestations ranging from contact dermatitis to fatal anaplylaxis *(48, 99).* People with a latex sensitivity cannot wear latex gloves without causing extreme skin irritation to both the hands and adjacent skin areas. A recent report *(89)* has also traced adverse allergic reactions in sensitized individuals to consumption of sandwiches and salads prepared by food handlers wearing latex gloves.
8. Persons with infections on their hands should be discouraged from handling ready-to eat food. However, if they continue to work in the retail food industry in the preparation, production, or service of food to the public, an antiseptic should be used on the infected area, which should then be covered with a bandage. A glove should be worn over bandaged area, and only the bandaged hand should be gloved. The gloved hand, in turn, must be washed along with the ungloved hand to keep it clean, or changed each time the

ungloved hand is washed. Another reason for wearing a glove over bandaged hand areas is to keep the bandage(s) from falling into food.

Effective Hand Washing

In 1975, Crisley and Foter *(18)*, stated that the primary goal of hand washing by food workers is the removal of surface soil (oil and debris) on hands and hence, the removal of transient pathogenic microorganisms. This can be accomplished by washing hands with soap or detergent and water. By increasing the friction during hand washing by rubbing the hands together, or by using a nail brush, ordinary soaps and detergents can reduce a high level of transient bacteria, as well as a minor portion of resident bacteria.

Pether and Gilbert *(84)* reported results of research that showed that hand washing with soap and water, followed by drying with paper towels, reduces the risk of transient skin carriage of salmonellas. "Good and simple hygienic practice (correct hand washing and drying) will stop the chain of transmission from feces to fingers to food."

Vesley et al. *(101)* described a method (collection of wash effluent) that compared the removal of transient microorganisms from hands by washing hands in an 8-second cycle of a hand washing machine and by a conventional 15-second Ivory® soap hand wash. There was no statistically significant difference in the percent removal of transient flora by the 2 methods (48.8% from the machine vs. 45.1% from the Ivory® soap wash). When the hand wash machine pressure was set at 32 lb./in.^{2}, the Ivory® soap wash recovered 60.3% of the transient microorganisms, whereas the machine recovered 45.1%. Paulson *(80)* reported similar results when hand washing in Ivory® soap was compared to machine hand washing with 2% chlorhexidine gluconate. These studies indicate that the hand wash machine is no more and sometimes not as effective as a conventional Ivory® soap hand wash.

Thus, the basic microbiological concept that dictates the necessity for hand washing is one of loosening transient microorganisms on the surface of skin with hand soaps or detergents, mechanical action, and removing the microorganisms through dilution and elution with flowing water so they can be reduced from 10^9/gram in feces to a safe number on washed fingertips.

Mandatory use of plastic gloves by food workers is not the solution for protecting the health of the public against contaminated hands. Management training of all employees in the use of effective hand washing procedures, and enforcement of the use of these procedures, is the only solution.

The Hospitality Institute of Technology and Management (HITM) Hand Washing Program

Since the government has not provided any effective program for hand washing, HITM has developed a program. It has been in use for over 25 years by thousands of employees in many food establishments without any indication of a foodborne illness because of unwashed fingertips. Management is responsible for training employees to understand the importance of hand washing, as well as the use of correct hand washing methods, in order to prevent outbreaks of foodborne illness. The following guidelines and tools can be used in the development of a Safe Hands program.

Item	Description
I.	Manager's Information on Safe Hand Washing. *(Can be obtained by reading this article.)*
II.	Employee Safe Hand Washing Policies, Procedures, and Standards. *(To be written by the owner / manager(s). An example is included as Appendix I of this paper.)*
III.	DVD / Video tape: Safe Hand Washing *(Can be obtained from the Hospitality Institute of Technology and Management, St. Paul, Minnesota.)*

Item	Description
IV.	Employee Safe Hand Washing Test and Record and answers *(See Appendix II and Appendix III of this paper.)*
V.	Double Hand Washing with a Fingernail Brush HACCP *(See Appendix IV of this paper.)*
VI.	Safe Hand Washing Checklist *(See Appendix V of this paper.)*
VII.	Safe hand washing poster for above the hand sink *(Can be obtained from the Hospitality Institute of Technology and Management, St. Paul, Minnesota.)*
VIII.	Anchor surgeon's brush: Super Scrub #2000B. *(Can be obtained from the Hospitality Institute of Technology and Management, St. Paul, Minnesota.)*
IX.	Glo-Germ kit: Orange fluorescent powder in mineral oil for hand washing training; white tracking powder to show what people touch and how they transfer germs; fluorescent light to cause the powder to "glow" in a darkened room. (*Can be obtained from the Hospitality Institute of Technology and Management, St. Paul, Minnesota.)*

How to Implement a Hand Wash Program

To institute a hand wash program owners / managers / persons-in-charge can follow the standard management four-step quality assurance cycle.

1. **Plan for Prevention**
   a. Read and utilize the technical information presented in this paper. This information is necessary to answer employee questions after they have seen the video tape, *Safe Hand Washing*. The information is also important to make the safe hand washing program a success.
   b. Watch the video tape, *Safe Hand Washing*. Understand the critical learning objectives.
      1) Every employee could be shedding high levels of pathogens from their bodies, every day, without feeling sick.
      2) Hands carry pathogenic microorganisms on the surface of the skin of the body to food.
      3) Because pathogens are at the highest level on fingertips after using the toilet, the most critical control point is the use of a fingernail brush during hand washing after defecating to assure that fecal pathogens are removed from fingertips.
      4) Employees must also be informed and trained to use good hand washing methods at home in order to prevent transmission of pathogens from other family members and pets to themselves and to work.
      5) Hand washing prevents transmission of pathogenic bacteria. Employees in food production, preparation and service must be trained to use hand soaps / detergents to lather and remove oil and dirt from the hands and fingertips. They must recognize that using a fingernail brush creates friction and removes microorganisms from the fingertips and surface of the hands as "soapy" lather is created and rinsed away with a lot of warm, flowing water (110 to 120°F).
   c. Write a safe hand washing policies, procedures, and standards training and operations manual. (See a model in *Appendix I*.) Include a policy that if at any time the hand wash sink runs out of supplies or is non-functional, the problem will be corrected immediately by the employees, or persons-in-charge will be notified immediately.

      Also include a policy that everyone (this includes both personnel and any other individuals who have permission to visit the facility) must wash their hands using the double wash method with the fingernail brush when coming into the kitchen, food production, food service area, or they will not be allowed entrance. If anyone comes

into the kitchen without using the double hand wash method, persons-in-charge will be notified immediately and corrective action will be taken.

2. Organize and Train for Prevention

a. Set up the hand sink with supplies. Supplies should include: hand soap or detergent (either bars of soap or liquid soaps or detergents are acceptable), fingernail brush, and an adequate supply of paper towels.

b. Set up DVD / video tape. Assemble the employees. Hand out the employee lesson sheets. Let the employees watch the DVD / video. Demonstrate correct hand washing procedures.

c. Test employees (*Appendix II and Appendix III*). Coach them until they know the answers to all of the test questions. Have them demonstrate the double wash procedure. Glo-Germ can be used as a training aid. This is an excellent method of demonstrating thorough hand washing. Participants wash "fluorescent germs" from their hands and observe the effectiveness of their hand washing methods under a long-wave ultraviolet lamp. Kits for this purpose can be obtained from the Hospitality Institute of Technology and Management. Each kit contains a bottle of oil containing fluorescent particles, a bottle of fluorescent powder, and an ultraviolet lamp. The oil with fluorescent particles is put on the tips of the student's fingers. The student then tries to remove the oil using a normal hand washing procedure, and then by using the fingernail brush. Under the ultraviolet lamp the particles glow brightly, revealing the difficulty of complete removal of microorganisms without thorough scrubbing with a nail brush during hand washing. The cost of the kit is under $100.00.

d. Refresher training should be given to all employees twice a year. This consists of watching the video, taking the test, and demonstration of correct hand washing, which is verified by using Glo-Germ.

e. Establish an employee safety assurance committee to gain a total employee commitment of 100% safe hand washing. When employees are involved and understand correct hand washing procedures, they will exercise effective self-control, as has been demonstrated by thousands of trained workers in Minnesota. The employee committee is an important link to ensuring complete communications so that any employee can ask questions about hand washing at any time, or can make suggestions and be heard by persons-in-charge.

f. Perhaps 2 or 3 people in the organization who are highly motivated in terms of hand washing can be designated as hand wash trainers. This will free managers from doing all of the training. The critical control is that: employees must not be allowed to prepare food or serve food until they have been trained to wash their hands according to company rules and have demonstrated correct performance. By using the *Double Hand Washing with a Fingernail Brush HACCP (Appendix IV)* and the *Safe Hand Washing Checklist (Appendix V)*, policies and procedures necessary to ensure safe hand washing in food production and foodservice operations will be utilized and developed.

3. Operate and Control

a. During operations, persons-in-charge should watch employees, catch them washing their hands correctly, and compliment them. It takes constant positive reinforcement to make hand washing a habit.

b. Commitment must be demonstrated. Ensure that all kitchen visitors and management personnel, when entering the kitchen, set the example by washing their hands using the double hand wash procedure.

c. If any employee at any time sees a hazardous act or situation, he/she must have no hesitation in reporting it to his / her supervisor or manager, or saying something to the individual(s) involved.

4. **Measure, Coach, and Feedback**
   a. Regular employee safety assurance committee meetings must be held. Use employee suggestions and improve the safe hand washing process. Keep employees informed about how many days of 100% hand washing have transpired.
   b. Coach employees to constantly improve their safety performance.
   c. Plan and implement improved procedures and goals. Go back to **Plan for Prevention** (the first step in the QA cycle) and improve your operating procedures.

When this simple quality assurance cycle is followed, safe hand washing will be assured.

Summary

Ensuring the removal of transient pathogenic microorganisms from hands requires correct scientific knowledge, management leadership, and employee training. The reason the government has been unsuccessful in getting personnel in the food production and foodservice industry to wash hands is that regulatory authorities have not provided consistent, scientifically correct knowledge, and have not insisted that management have a training program for hand and fingertip washing. When the retail food industry, both management and on-line employees are properly educated and trained, hand washing can be accomplished and food will be safer.

The critical control in hand washing is to reduce high levels of pathogenic microorganisms such as fecal pathogens that get onto fingertips when using toilet paper, to a safe level. This requires a fingernail brush with soft bristles, short fingernails, and a supply of warm, flowing water to wash off the pathogens loosened by the nail brush and soap / detergent. Hand washing is repeated once again, without the fingernail brush, to ensure a low pathogen count. When working with food, the need for reduction is much less because the pathogen count is much lower, and a single hand wash without the fingernail brush is sufficient for hand safety.

While a hand washing sink in the restroom is required by the plumbing code, the kitchen hand sink at the entrance to the kitchen is the critical control area for pathogen removal.

A successful program requires a committed manager. If management is not concerned about hand washing, employees will not be concerned. Recognition should be given to employees who adhere to personal hygiene principles. There must be reprimands for those who ignore or forget hand washing policies. Management must view the problem in the same manner as stealing cash or purposely hurting a customer. If employees continue to disregard hand washing procedures after being trained, they must be dismissed.

Instruction regarding the importance of hand washing, proper methods of hand washing, and management commitment to the hand washing policy must become a part of new employee orientation and continuing employee education. People learn best if their efforts are recognized. Owners / managers should:

1. Compliment employees for using correct hand washing procedures.
2. Provide clean, well-maintained personal hygiene facilities.
3. Share customer and health department compliments with employees.

When management trains employees in food production, foodservice or any retail food industry to know and use the information provided in this paper, the need for the use of plastic gloves to prepare and serve food will disappear, and so will the liability associated with inadequate hand washing.

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APPENDICES I-V FOLLOW

APPENDIX I

POLICIES, PROCEDURES, AND STANDARDS FOR PERSONAL HYGIENE AND HAND WASHING FOR FOOD PRODUCTION, FOODSERVICE PERSONNEL

Employee responsibility. Employees are responsible for using safe food handling methods as trained and instructed, and for practicing good personal hygiene. Employees must be able to describe these procedures and practices.

Personal cleanliness. Every employee must bathe daily and use a deodorant to control body odor. Employees will use only mild perfumes or colognes that will not interfere with the aroma of food. Employees will wear clean, closed-toe shoes, and clean uniforms, or full aprons or smocks over street clothing. Clothing or outer covering will be replaced if it becomes dirty while working.

Individual illness. No employee who is known to have a communicable illness which could be transferred directly by the employee or by employee contact with food will work in the preparation and service of food. PICs and/or supervisors must be notified by employees if their illness symptoms include nausea, diarrhea, and vomiting, or any other illness that is serious enough to be diagnosed by medical personnel. If an employee's illness is not severe and symptoms are not acute, the employee can be assigned to tasks that do not involve food handling, or can be excused from work altogether until he/she is completely well. Illness must not be passed on to customers or other employees.

Fingernails. Fingernails will be neatly trimmed to less than 1/16 inch to make them easier to clean. Employees will not wear fingernail polish or artificial fingernails while working, because this material can flake or fall off into food being prepared or served.

Hand and fingertip washing. All employees who prepare food in the kitchen or production area and who serve food, as well as any authorized visitors who enter these food production and foodservice facilities, will wash fingertips and hands according to the following procedures. Properly washed fingertips and hands will not cause a food safety problem, because transient pathogenic microorganisms will have been reduced to a safe level on the skin surface. The two methods of fingertip / hand washing used in foodservice and food production areas are the double wash method and the single wash method.

The **double wash procedure** utilizes a fingernail brush, hand soap or detergent, and warm, flowing water. The procedure is as follows:

First wash using the nail brush

1. Turn on water so that it runs at 2 gallons per minute with a temperature of 110 to 115°F. Place the hands and fingernail brush under flowing water to thoroughly wet the surface of the fingernail brush, hands, and lower arms.
2. Apply an adequate amount [1/2 to 1 teaspoon (2-1/2 to 5 ml)] of hand soap or detergent to the fingernail brush (enough to ensure a good lather).
3. Brush and lather hand surfaces with the tips of the bristles on the nail brush under the flowing water, particularly fingertips, and around and under fingernails. Build a good lather.
4. Continue to use the fingernail brush under the water until there is no more soapy lather on the hands and the nail brush. Place the nail brush on a holder with the bristles up so that the bristles can dry. [Rinsing the lather off the hands is the critical control. Hazardous microorganisms are in the lather, and these microorganisms are only removed to a safe level when all the soap is rinsed off the hands, arms and fingertips.]

Second wash - without the nail brush

5. Apply a sufficient amount of soap or detergent [1/2 to 1 teaspoon (2-1/2 to 5 ml)] to produce a good lather.
6. While adding water as necessary, rub the hands together to produce a good lather from the wrists to the fingertips, and the up the arms to the tips of the sleeves.
7. In warm, flowing water, thoroughly lather the hands. Then rinse all of the lather from the fingertips, hands, and arms.
8. Thoroughly dry hands and arms using paper towels. Discard paper towels in waste container without touching the container. Drying hands with paper towels removes and reduces the number of microorganisms on hand surfaces another 100 to 1. It is mandatory to **double wash** hands to remove possible fecal pathogens and other pathogenic microorganisms from skin surfaces:
   • Upon beginning a work shift.
   • When entering the kitchen.
   • After using the toilet.
   • After cleaning up vomitus or any fecal material.
   • After touching sores or bandages.

The **single wash** procedure is the same as the second part of the double wash procedure (steps 5, 6, 7, and 8). Hands and lower arms are wet with water. Soap is applied to hand surfaces and a lather is produced by rubbing the skin surfaces together. Lathering must extend from between fingers to up the shirt sleeves. (A fingernail brush is not used for single hand washing.) After lathering, hands are rinsed in flowing water and dried with a disposable paper towel.

It is mandatory to use the **single wash** procedure to wash hands to remove normal low levels of pathogens:

• Before and after coffee, food, or cigarette breaks.
• After handling garbage.
• After handling dirty dishes or utensils.
• Between handling raw and cooked foods.
• After blowing nose.
• After touching skin, hair, beard, or soiled apron.
• As often as necessary to keep hands clean after they become soiled.

Gloves. It is not the policy of the organization for employees to wear gloves to serve and prepare food; however, there are situations when glove use is mandatory. Mandatory use of gloves by employees is required to cover hand cuts or abrasions that have been treated so that they are not severely infected, and also to protect employees when they touch another person's body fluids. Defined conditions for wearing gloves are as follows:

- When gloves are worn, hands must be washed using the single wash method, and dried before gloves are put on, and after they are removed, and before a new glove is applied to the hand.
- If gloved hand(s) are to be used to prepare or serve food, only vinyl gloves will be worn by food preparation and food service employees in order to protect food from the possible contamination of latex gloves.
- Gloves will be worn to cover bandages covering cuts and abrasions that are not infected and do not interfere with an employee's ability to perform tasks. The affected area will be cleaned with soap and water, disinfected, bandaged, and covered with a properly fitting vinyl glove. The purpose of wearing the glove is not to contain the bacteria in the cut, because they have already been reduced to a safe level. The purpose of wearing the glove is to keep the bandage

clean and to prevent the bandage from falling into food. Note, that there is no food safety issue, except to prevent a physical object from falling into the food. There is no need to put a glove on the other hand if it has no injury or infection. When the ungloved hand gets dirty, it will be a signal to change the gloved hand and to wash and dry both hands before applying a clean, vinyl glove to the affected hand. **Gloves to be used when in contact with blood or body fluids from another person**. Before any personnel touch the blood (e.g., if bandaging the wound of another individual) or any other body fluid such as vomitus of another person, he/she will put on properly fitting latex or vinyl gloves that will prevent the body fluid from entering any cuts or breaks in the skin of their own hands. These gloves will be disposed of promptly and properly after removal from hands, and hands will be double washed and dried with clean, disposable paper towels.

Gloves used for cleaning, pot and pan washing. Some employees will need to wear heavy-duty, non-disposable gloves to protect their hands from harsh chemicals, (e.g., personnel who wash pots and pans with strong detergent solutions). These employees should be given their own personal gloves, which will not be shared with any other person in order to prevent skin cross-infection(s). Employees should wash and dry hands thoroughly before putting on these gloves, and again after they are removed.

Gloves used to protect hands from cuts. Some employees will need to wear gloves to protect hands from cuts. These cut-resistant gloves must not be shared with others in order to avoid skin cross-infection(s). Employees should wash and dry hands thoroughly before putting on these gloves, and again after they are removed.

Handling food in front of the customer. Customers prefer to see employees touching or handling food as little as possible. While washed hands are totally safe, employees must indicate to customers that they have washed their hands. Employees who serve food must always wash their hands in the manner described above, and when appropriate, will use utensils or paper sheets to handle and serve food, especially if the customer requests.

APPENDIX II

Name _____ **Date** _____

EMPLOYEE SAFE HAND WASHING TEST AND RECORD

Fill in the blank with the correct answer.

1. The single wash method differs from the double wash method in two ways. The first difference is that the hands are only washed once instead of twice. The second difference is that the _____ _____ is not used.
2. Certain bacteria live in the skin of the hands all of the time. It is difficult and undesirable to eliminate all of these bacteria from the skin. These bacteria are called _____ bacteria.
3. When a person touches high levels of pathogenic microorganisms, he or she should use the _____ hand wash method.
4. A _____ is a microorganism that makes people ill when it gets inside their bodies or when it produces a toxin in food that when eaten makes them ill.
5. After going to the toilet, it is necessary to use the _____ hand wash procedure to clean your hands before handling food again.
6. If you come to work with a cut on your finger, tell your manager, wash and scrub the cut with soap and water until it is clean, and put a clean bandage and a _____ on that hand if you are going to be handling food.

Put T in the blank if the statement is true, F if it is false.

____ 7. Transient bacteria from feces and vomit on the fingertips are a major cause of foodborne illness.

____ 8. It is permissible to keep a nose tissue with you in the kitchen, as long as you keep it in your pocket when you are not using it.

____ 9. Chemicals in the soap destroy the transient bacteria on the skin.

____ 10. Only cooks need to wash their hands.

____ 11. The parts of the hand that are most commonly contaminated with high level pathogens are the fingertips and under the fingernails.

____ 12. Jewelry can harbor low levels of pathogens.

____ 13. Latex gloves can cause skin reaction in some people.

____ 14. While wearing gloves, it is necessary to wash or, better yet, change them often to prevent contamination.

____ 15. If you cough into your hands, there is no food safety problem.

____ 16. Urine can also contain high levels of pathogenic bacteria.

____ 17. All faucet handles carry high levels of pathogens and are a critical problem.

____ 18. The salad preparer is at greater risk for spreading disease than the cook because salads are not further heated after preparation.

____ 19. Water should be at about 110°F to assure the best action from the hand soap.

____ 20. The supervisor, not the employee, is responsible for ensuring safe hands.

_____ _____

Graded By **Date**

I understand the importance of washing my hands and fingertips when working with food. I understand the hand washing rules and how to remove pathogens from my hands and fingertips. I fully intend to comply at all times with these policies, procedures, and standards.

_____ _____

Employee Signature **Date**

APPENDIX III

TEST ANSWERS:

1. fingernail brush
2. resident
3. double
4. pathogen
5. double
6. glove
7. T
8. F
9. F
10. F
11. T
12. T
13. T
14. T
15. F
16. T
17. F
18. T
19. T
20. F

APPENDIX IV

DOUBLE HAND WASHING WITH A FINGERNAIL BRUSH HACCP

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

Process: To double wash fingertips and hands to reduce by 1,000,000 to 1 pathogens from feces and vomit on fingertips and underneath fingernails and to single wash to reduce 1,000 to 1 pathogens on hands from raw ingredients when preparing food in the kitchen.

The Hazard: When employees arrive from home or after using the toilet and toilet paper, they must be assumed to have ≤1,000,000 pathogens on their fingertips and underneath fingernails. This level must be reduced 100,000 to 1 (to ≤10) to assure that the transfer of pathogens to the food that the employees handle is at a safe level. When simply working in the kitchen and touching raw food such as meat and poultry, employees might get ≤1,000 pathogens on their hands. A 100-to-1 reduction is sufficient to assure safety.

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. Water temperature is not a factor, but it must flow at 2 gallons per minute.

The double wash with the nail brush. Turn on the water. Let it flow rapidly at 2 gallons per minute. It is the water that removes the pathogens. Temperature of water has not been shown to be significant.

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 10 seconds). This will give a 1,000-to-1 reduction of pathogens.

Put the nail brush down with bristles up. This allows the water to run off so that the brush dries sufficiently that 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.

Under flowing water, massage the hands. fingertips, and between the fingers. If you are going to be mixing food such as pie dough, where arms could be in contact with food, wash up to the shirtsleeves. Thoroughly rinse all of the lather from the fingertips, hands, and arms in flowing warm water. The step takes about 10 seconds, and when the detergent and lather are gone from the skin, the pathogens are reduced 100 to 1, or ≤10.

The nail brush wash, followed by this second wash, gives a total of >100,000-to-1 reduction of pathogens on fingertips. Used alone, the second wash reduces the ≤1,000 pathogens from raw food to a safe level, or ≤10.

Dry hands using paper towel(s). Use clean, disposable paper towel(s) to thoroughly dry hands (and arms). This reduces the microorganisms an additional 10 to 1 for a total double wash reduction of 1,000,000 to 1, or single wash reduction of 1,000-to-1.

APPENDIX V

SAFE HAND WASHING CHECKLIST

Planning and Pre-control

____ Owner / manager / person-in-charge sets the example.
____ Owner / manager / person-in-charge checks on and reinforces performance.
____ Employees participate in control.
____ Hand sink is maintained and stocked with adequate supplies of soap, fingernail brush and paper towels.
____ Fingernail brush is replaced when worn.
____ There are written hand washing procedures that are kept current and used for training.
____ No one is allowed to handle food until trained and certified in safe hand washing.
____ There is an effective punishment for not washing hands when returning from the toilet.
____ The hand sink produces water at 110 to 120°F in 5 seconds. The water flows at 2 gallons / 8 liters per minute.
____ The soap lathers well, and effectively and speedily removes filth from the hands and fingertips.
____ There are nose tissues by the sink. Handkerchiefs are banned. If a person must sneeze or cough, he or she does so away from the food, into a shoulder, but never into hands.
____ There are good quality vinyl gloves available if an employee needs them.

Organization and Training

____ Responsibility for training and employee safe hand washing certification is clearly defined.
____ All employees have seen the safe hand washing video tape and have been performance certified using Glo-Germ.
____ Every six months, employees receive hand washing refresher training.

Operation and Control

____ The sink is always restocked before any supply gets down to 3/4 empty. There are back-up supplies near the sink, and employees can restock the sink supplies if necessary.
____ Employees check each other and provide team reinforcement in correct fingertip and hand washing.
____ All employees can demonstrate safe hand washing.
____ There is control of cuts on hands.
____ Employees wash gloved hands, if appropriate, when wearing gloves.
____ Fingernails are kept very short and no nail polish is used.

Measuring and Feedback

____ Supplies never run out.
____ Employees participate in improving the system.
____ Safe hand washing is always positively reinforced by management.

Validation of the Program

Names of at least three employees who were asked about hand washing:

	Name	Adequacy of Knowledge
1.	_____	_____
2.	_____	_____
3.	_____	_____