

Section III: Food Protection and Public Health Services



A US Army Veterinary Services Staff Sergeant, Chief, Food Inspector, 245th Medical Detachment, inspects cans of orange juice for rust that might have occurred during shipment to Vietnam in 1968.

Image: Courtesy of the US Army Medical Department Center of History and Heritage Archival Collection, Joint Base San Antonio-Ft Sam Houston, Texas.

Chapter 9

FOOD SAFETY AND FOOD DEFENSE

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INTRODUCTION

Food-borne illness has often shaped global history. For example, although the exact cause of US President Zachary Taylor's death is still being disputed by some historians, the president may have contracted a fatal food-borne illness from microbes such as *Salmonella* after attending a groundbreaking ceremony for the Washington Monument. Some scholars also believe that the fledgling English settlement at Jamestown, Virginia, was devastated, not by hostile Indians or mosquitoes, but by repeated outbreaks of *Salmonella typhi*. In the Spanish-American War, American soldiers were far more likely to succumb to typhoid than to enemy fire. More than 20,000 recruits contracted the disease, and thousands died, many while training in southern states. Similarly, during the South African War of 1899 to 1902, the British lost 13,000 troops to typhoid—far more than the number of troops lost in battle.¹

Tracing the Roots of Food Preservation

At the close of the 18th century, France was at war, and Napoleon's armies were faring poorly on inadequate rations that frequently included spoiled meat and other unwholesome or unpalatable items. Navy and merchant shipping personnel faced similar wholesomeness problems, including the inability to maintain enough consumable vitamin C-rich foods onboard to prevent scurvy while sailing for long periods of time.

To encourage development of food preservation methods, countries such as France began offering their researchers prizes. In 1809, Nicolas Appert was honored and awarded 12,000 francs for introducing the world to the art of food canning. (Appert discovered that if food was sufficiently heated in a sealed container, and the container was not opened, the food would be preserved.) Although Appert used glass jars in his studies, Peter Durand, an English merchant, later substituted durable tin cans for the breakable jars. Some 50 years later, Louis Pasteur, another Frenchman, proved that microorganism growth is a major cause of food spoilage. Pasteur experimented with heat as a method of preventing microbial growth in milk and wines, eventually developing "pasteurization," a technique that supported and better explained Appert's method of food preservation.²

Developing Food Regulations in Industrial America and Today's Global Society

Despite advances in food preservation worldwide, at the turn of the 20th century, regulations to govern either US food processing or retail establishments were virtually nonexistent, resulting in filthy and dangerous

conditions at American food industry factories. The dangers inherent in US meat processing plants were uncovered when journalist Upton Sinclair conducted an investigation at a Chicago plant. Sinclair's published exposé, which was later published as a novel (ie, *The Jungle*), helped secure the passage of both the Pure Food and Drug Act and the Meat Inspection Act of 1906—acts, which, in turn, initiated a series of regulations that the United States still uses to control most foods consumed by Americans today.

Although US food regulations can greatly reduce the chances for people to contract food-borne illnesses from American products, the globalization of the food industry has created potentially new risks for consumers. Some foods now available in US markets or restaurants may have arrived only days earlier from distant countries where regulatory requirements are not as stringent as those enforced in the United States. In many countries, effective food safety is undermined by fragmented legislation, multiple jurisdictions, and weaknesses in surveillance, monitoring, and enforcement.³

Weighing the Consequences of Civilian Food-borne Illnesses

The US food safety mission requires numerous regulatory institutions, thousands of trained personnel, supporting diagnostic laboratories, and many other resources to attain and sustain the current level of food safety in the United States. Although this mission involves substantial financial investments, the absence of a comprehensive food safety system could create even more costly expenditures because, despite current US efforts to keep food safe, illness from contaminated food is still a serious, expensive US public health threat. The Centers for Disease Control and Prevention (CDC) estimate that over 48 million Americans become ill from food each year; this figure includes the 3,000 who die from food-borne illness and the 128,000 who require hospitalization. When tallied, the consequences of food-borne illness, including doctor visits, medication, lost work days, and pain and suffering, cost the United States an estimated \$152 billion annually.⁴

Reviewing the Impact of Food-borne Illnesses on the Military

In addition to being a risk to civilians, food contamination presents an asymmetric threat to US forces because a conventionally outmatched force can strike fear in American troops by undermining confidence in their food sources. Historically, food has been used as an effective and covert vehicle to intentionally

poison troops, with food poisoning being recognized as a threat as early as when Hippocrates conducted toxicology studies in Greece (circa 400 BCE).⁵ More recent military intelligence, such as that gleaned during Afghanistan operations, reinforces the harsh reality that resourceful adversaries leverage food to harm US service members.

Emerging food safety risks also must be continuously evaluated to prevent disease and, ultimately, conserve combat power. A common counterinsurgency strategy used in Iraq and Afghanistan, which involves US personnel sharing meals prepared by local nationals, is one example of a monitored food safety risk. Although mission success often hinges on the ability of US service members to build relationships and bridge cultures with local populations, the lack of local food sanitation practices places US service members who eat meals prepared by non-US military sources at a higher risk of contracting food-borne illnesses than those who eat only US military-provided rations. The potential for the loss of troop readiness should be weighed carefully against the strategic advantages gained by sharing meals prepared by local nationals. (See also this chapter's section about food safety in counterinsurgency [COIN] operations.)

To better understand the military's current food-borne risks, the Army Public Health Center (APHC) disease epidemiology program reviewed the statistics of gastrointestinal (GI) illnesses reported by Army medical treatment facilities (MTFs) from 1996 to 2011. Overall, 2,268 cases of GI illnesses in active duty service members were reported to the APHC through either the Reportable Medical Events System (RMES) or Disease Reporting System-Internet (DRSI) from 1996 to 2011. Of these cases, *Campylobacter* was the most frequently reported causative agent for illness, followed by *Salmonella*, *Giardia*, and *Shigella*. This pattern of frequency is similar to trends seen throughout the United States. The least commonly reported agents were *Escherichia coli* (Shiga-toxin producing) and norovirus. (Note, however, that reported cases of norovirus are not a good estimate of the disease burden in the active duty population because norovirus only became reportable in 2010, and laboratory testing is infrequent. Note also that although the true burden of all food-borne illness is likely greater than Department of Defense [DoD] disease-reporting systems currently estimate, evolving detection and reporting technolo-

gies and methods will provide increasing clarity about the impact of food-borne illness on future active duty service populations.⁶)

Transitioning to a Broader Military Mission

In concert with DoD guidance, Army Veterinary Services (VS) leaders have responded to the rising costs of food-borne illnesses and the increasing threats of intentional food contamination by transitioning from a focus on food safety and quality assurance to food protection, which encompasses food safety, quality assurance, and food defense. Current food protection programs are designed and integrated to protect personnel, especially warfighters; prevent food-borne illness; prevent monetary loss to the government; and provide food protection support throughout the DoD.

The shift to food protection has greatly increased mission scope, and, consequently, resource requirements. Although estimates indicate that the Food and Drug Administration (FDA) inspects only 2.3% of the subsistence being imported into the United States, hundreds of trained US Army inspectors stationed worldwide work around the clock to protect the military's global food supply.⁷

The DoD food protection program encompasses a gamut of food safety and defense activities, including food inspections, commercial establishment audits, special event assessments, and installation food vulnerability assessments (IFVAs). These diverse activities shield service members and their families from intentional and nonintentional disease threats throughout the food chain—from the harvest or slaughter of raw products—to product processing—to service and consumption.

The food protection mission executed by the VS is not only immense in scope, this mission also uniquely involves other service branches and addresses individual needs. For example, the US Army VS provides support to the US Navy, such as inspecting subsistence that goes on board submarines or Nimitz-class aircraft carriers; works with Army Special Forces units; and offers services to the National Science Foundation in the Antarctic. To provide a more detailed view of the broad VS mission, all of the major food protection programs required to ensure safe food for warfighters are described in this chapter, beginning with the installation support plan (ISP) program.

FOOD SAFETY PROGRAMS

Installation Support Plans

The ISP program was developed as a way to more efficiently and effectively manage personnel, monitor activities, and support installation customers. First im-

plemented to quantify and depict the level of support provided to an installation (for both food protection and animal medicine), ISPs now “assist the installation veterinary officer-in-charge [OIC] make risk-based assessments of veterinary public health requirements”

and “wisely match resources against the entire spectrum of food safety, food defense, animal programs, and customer needs for a given installation.”^{8(p8)}

The ISP program includes active duty Army, Reserves, National Guard, Marine Corps, Coast Guard, and Navy missions and limited Air Force missions. Personnel in the military occupational specialty (MOS) of 68T, animal care specialist, report animal health-related functions within this system, including bite and scratch reports, animal facility checks, and government-owned animal care. Veterinary food inspection specialists (MOS 68R) conduct visits at every installation food facility, including temporary and mobile facilities serving ready-to-eat food.⁸

There are three types of ISP reports: (1) agency contact, (2) facility contact, and (3) customer visit. The agency contact report details the initial face-to-face meeting between the veterinary OIC or a senior veterinary representative and a senior food agency manager (ie, from the Defense Commissary Agency [DeCA], Army and Air Force Exchange Service [AAFES], and Morale, Welfare, and Recreation [MWR] programs). The purpose of this initial meeting is to discuss all of the services to be provided for the particular agency and the frequency at which these services will be conducted. The meeting’s end product is an agreement that is validated annually.⁸

A facility contact report is produced for every facility on the installation. Both the agency contact report and facility contact report focus on the people using the services and establish a standardized approach to the services supplied. Both reports are also created according to the individual need, manpower, and mission requirements of each agency or facility and implement standing operating procedures specifically designed for each agency or facility.⁸

The final ISP program report is the customer visit report, which is completed for every visit by a 68R veterinary food inspector (VFI), regardless of the services provided by the facility. During these site visits, VFIs conduct product inspections on all food within storage areas, perform receipt inspections of deliveries that have arrived at that time, and verify that the foods delivered are safe (ie, confirming that food is wholesome and originates from approved sources).⁸

Food recalls are another focus of the VFIs’ site visits; inspectors ensure that recalled subsistence does not enter or remain in the military food supply. Since VFIs are the first to examine vendor-provided subsistence, they serve as the first line of defense for food safety, food defense, and quality assurance. VFI reports describe the inspection in detail, including any deficiencies observed, and all nonconformances are posted on a database. For ISP inspections on facilities

that fall under preventive medicine jurisdiction, VFIs do not conduct “formal” sanitation inspections unless agreed upon in writing.^{8,9}

The ISP program, designed to provide prompt feedback, increased accuracy, efficiency, and standardization of all reports, also serves as an organizational platform for many food programs presented in this chapter. For example, customers can find summaries of their contractual nonconformances in the ISP-distributed summary reports. In essence, the ISP program is the framework that the VS implements at the branch level to achieve mission goals while promoting customer-focused execution of services.

Commercial Food Protection Audits and Certification Program

A critical first step in ensuring that the DoD receives safe food is purchasing products only from reliable sources that demonstrate excellent food protection practices. In order to be sold to the US government, food products are required to originate from a sanitarily approved source, as listed in a federal directory, or be “exempt” from such listing. (“Exempt” means the product can be bought and sold without restrictions or audits imposed by the military.¹⁰)

Products can be exempt for a number of reasons: namely, they are inspected either by a federal agency (eg, the FDA, US Department of Agriculture [USDA], or US Department of Commerce) or by a state agency with a federal-equivalent program in place. Regardless of the type of listing, the subsistence must be evaluated by a recognized food safety or public health agency, or the product and process to produce the subsistence must be deemed of sufficiently low risk to consider it safe without a military audit.¹⁰

If a commercial producer is not exempt, the subsistence must pass a food protection audit performed by professionally trained, certified VS personnel, usually a Veterinary Corps officer (VCO). A commercial producer that fails to meet standards could be denied an initial approved source listing, or, if it is already listed as approved, the producer’s contract with the government could be canceled.

In 2000, *Military Standard 3006, Sanitation Requirements for Food Establishment* (MIL-STD-3006) and *Military Handbook 3006, Guidelines for Auditing Food Establishments* were published. These two companion documents transformed the VS mission of assessing commercial food establishments from facility sanitation inspections to systems-focused sanitation audits. While sanitation inspections observe and count defects and symptoms, sanitation audits observe cause and effect, consider objective evidence, and determine the

root causes of problems. (See the Food Defense Initiatives section of this chapter for more recent, notable revisions of MIL-STD-3006.¹¹)

Sanitation inspections and sanitation audits also use different checklists. Sanitation inspections use an observation-based checklist whereas sanitation audits use a process-based checklist, which focus on each process relative to the system. Regardless of the checklist used, all scored food protection requirements are tied to Title 21 of the Code of Federal Regulations, Part 110 (21 CFR 110), current Good Manufacturing Practices.^{11,12}

Only qualified auditors may perform sanitation audits. Based on their rank, education, experience, and technical ability, qualified auditors are certified to perform commercial sanitation audits as well as formal military inspections. The auditor certification program ensures that VS auditors have the knowledge and ability with which to perform these audits.

The auditor certification program applies to audits conducted in the continental United States (CONUS) and outside the continental United States (OCONUS) and to military active component, reserve component, and civilian VS personnel whose career track includes performing commercial sanitary audits or military inspections. The prerequisite training is provided by the Army Medical Department Center and School, Health Readiness Center of Excellence (AMEDDC&S, HRCoE), at the Department of Veterinary Science Warrant Officer Basic Course (for newly appointed warrant officers), the Basic Officer Leader Course (for Army veterinarians), and several other functional courses (for officers and reservists).

The need for, and amount of, prerequisite training that civilians must complete prior to performing audit or inspection work is based on the civilians' previous experiences. For example, Department of the Army civilians with little or no commercial audit or military sanitation inspection experience are required to attend training at the AMEDDC&S, HRCoE. However, former VCOs and noncommissioned officers (NCOs) are given credit for relevant training received on active duty.

The auditor certification program is implemented in two phases. Phase I, the instructional stage, is comprised of didactic, hands-on, and practical exercises, focusing on required knowledge such as food microbiology, food chemistry, hazard analysis critical control point, food deterioration, food processing, and preservation. Instruction is also given on the auditor's roles and responsibilities, conducting an audit, and using the field database system. Reserve personnel can receive Phase I training either in their VS courses or from an adjunct trainer who has been certified by the AMEDDC&S, HRCoE.

Phase II consists of the field experience trainees (staff auditors) receive by shadowing experienced auditors (lead auditors). After participating in a few audits as staff auditors, trainees advance to the position of lead auditors. With their trainers close by, the trainees conduct additional audits of a variety of food commodities, gaining exposure to as many different manufacturing systems as possible. After completing these additional audits, trainees are evaluated by lead auditors to determine if the trainees are ready to perform audits independently or if additional training is appropriate. If deemed proficient, trainees are then considered certified auditors and are authorized to conduct audits independently.

In addition to any required initial training, certified auditors must participate in continuous self-study to keep their knowledge-base current. Numerous additional regulatory and industry training courses are available, and all auditors are encouraged and expected to take advantage of any opportunity to attend such courses.

Destination Monitoring Program

The destination monitoring program (DMP) was established to provide surveillance capability, which allows military personnel and scientists to target higher-risk food items through product laboratory sampling. Using DMP guidelines, qualified personnel first identify high-risk items, then make recommendations about which products to sample. In CONUS, the program is tracked via the US VS application portal of the VS information management system. Using this portal, applicable personnel can view the status of all products that must be sampled.¹⁰

All the APHC regions receive a tasking that lists the type of samples required for the quarterly submission to the DoD Food Analysis and Diagnostic Laboratory. After the regions receive the quarterly tasking, the district food safety officers (FSOs) direct that samples be taken from government food-producing and retail agencies at each military establishment within their area of responsibility. Since the DMP is executed at the installation level, food inspectors collect samples in accordance with the *DoD Food Analysis and Diagnostic Laboratory Submission Guide*.¹³ In addition to specific command directives, the DMP also allows inspectors the flexibility to collect other potentially hazardous foods (eg, foods identified in local customer complaints).

One of the most valuable benefits of the DMP is that it triggered VS to develop an infrastructure of personnel, equipment, and procedures to properly collect and transport food samples to supporting laboratories,

including developing guidelines for handling perishable items. Collecting and shipping perishable items requires extensive training because there are many control points within the overall process that require attention to detail (eg, collecting the right number of products to sample, aseptically packing these samples so that the collection process does not damage or contaminate the product, preparing sample containers, and ensuring the containers' proper transportation to the laboratory). When samples are prepared for transportation, great care must be taken to ensure that the proper refrigerant is used and all necessary documentation is complete and accurate. When an emergency situation such as a natural disaster or increased force protection condition level necessitates a surge in sample collection, the DMP also outlines the equipment, trained personnel, and processes necessary for seamlessly shifting the mission priorities and supporting the ground situation.

Military Sanitation Inspections

The military sanitation inspection program is designed to ensure that food safety and food defense programs and procedures comply with their applicable governing regulations and standards. The objective of this inspection program is to protect the health of service members and their families while acting as a good steward of resources. The program's sanitation inspections are implemented at the branch level by means of the ISP program and are conducted at all military facilities that either store or display subsistence,¹⁰ including military food facility establishments, retail food sale stores (ie, DeCA commissaries), AAFES mini-marts, storage facilities such as Troop Issue Subsistence Activities, and warehouses.⁸

Military sanitation inspections include walk-through (cursory or partial); routine (normal, comprehensive inspection); and follow-up (required after unsatisfactory routine inspections). VFIs perform walk-through inspections daily. These daily inspections, which are not as comprehensive as monthly inspections, usually cover specific areas of a store, focusing on high-risk operations (eg, the deli department) and inspecting any food processing operations (eg, making salads and sandwiches and slicing different types of deli products). Special attention is paid to any cooking processes such as preparing rotisserie chicken.⁸

Although these daily walk-through inspections can cover the entire store, they are generally focused on common findings such as products that exceed their shelf-life, unapproved sources, improperly executed pest control programs, and items that are susceptible to infestations. By conducting such continual inspec-

tions, VFIs are not only able to maintain a higher level of safety, but are also able to identify potential trends and problems more immediately. Typically, walk-through inspections provide the stores with a less formal means of internally adjusting their operations without the concern of higher-level supervisors becoming involved. However, VCOs and senior enlisted food inspectors also jointly review the results of these daily efforts in preparation for the more formal, comprehensive monthly inspections.

The routine inspections performed at facilities run by AAFES and DeCA are more comprehensive than those performed at other facilities (eg, nonfood-preparation facilities such as food warehouses), culminating in a rating that indicates the facilities' ability to comply with food sanitation and food defense requirements. The APHC regions and districts ensure that standing operating procedures providing guidance on conducting sanitation inspections of the military facilities, including the establishment of qualified inspection and training criteria, are in place and that the inspections are completed in a timely, efficient manner. Any inspection that results in an unsatisfactory rating triggers a required follow-up inspection limited to the violations causing the failure. Since facility supervisors review the sanitation inspection reports, report ratings create an incentive for store sanitation compliance (ie, nonfailure).⁸

The application portal, previously mentioned as a means of tracking DMP results, is also the primary means of entering military sanitation inspection results and the most efficient way to externally oversee APHC branch-level activities. The branch, the tactical arm of the military sanitary inspection program, is where standard operating procedures are finalized and executed according to guidance from the regions and districts. Branch-level warrant officers and VCOs ensure that the inspectors who conduct military sanitary inspections are properly trained in accordance with all appropriate inspection documents and procedures.¹⁰

Salvage Operations for Subsistence

The VS has developed programs to "inspect" and "salvage" ("survey" in the Navy) distressed foods. Specifically, these programs are designed to identify and inspect any food product that has been damaged or stressed and to enable informed, science-based decisions regarding the disposition of inspected products. These programs have proven to be extremely beneficial in reducing the threat of food-borne illness and increasing cost savings.

The two programs involving salvage operations are (1) salvage and distressed foods at government retail and storage facilities and (2) inspection of perishable

foods exposed to refrigeration failure. The former program covers the salvage of physically damaged, overaged, or otherwise distressed military-owned semi-perishable subsistence, and the latter program deals specifically with perishable products that have been exposed to temperature-stress. Both programs are designed to address compromised food products, thus protecting service members and their beneficiaries from consuming higher-risk food products.⁸

The first military salvage operation, the salvage and distressed foods at government retail and storage facilities, is primarily performed at DeCA stores. When executing this program, the VFIs follow military regulations and DeCA directives to ensure food safety and food defense standards are maintained. Additionally, VFIs train DeCA employees (salvage coordinators) to perform routine salvage operations in an effort to increase in-store salvage capabilities. The salvage coordinators cull, consolidate, and make salvage determinations. More specifically, these employees segregate food products from nonfood products and further segregate those food products with minor damage that is easily identifiable (ie, products that exhibit moderate to severe damage). The VFIs then make disposition decisions on the more severely damaged products, eventually ensuring all salvaged items have been inspected prior to being offered for sale.¹⁴

Although DeCA stores present their own food salvage risks, troop issue subsistence activities, dining facilities, depots, and warehouses pose other unique risks such as extended storage of subsistence and subsistence returned from the field. In these situations, food quality and safety issues may trigger the reclassification, segregation, and tracking of degraded food products. For example, any products returned from the field must be reinspected before they are returned to inventory.¹⁰

The second salvage operation, the inspection of perishable foods exposed to refrigeration failure, mainly governs refrigerated and frozen perishable products. Although this program is primarily designed to support DeCA facilities, AAFES food stores, dining facilities, and subsistence storage warehouses, program guidelines can be applied to any perishable, temperature-stressed product.

When military-owned perishable foods are compromised by refrigeration failure or by improper storage, VS personnel must inspect the affected food and determine if an unacceptable risk exists. An elevated threat of food-borne illness exists when food is exposed to the temperature danger zone (ie, temperatures above 41°F and below 135°F); prolonged or repeated exposures to these higher temperatures accelerate the growth of bacteria (eg, spoilage or pathogens). Whether the re-

frigeration failure is affected by power outages, refrigeration breakdowns, or human error, the requirement to salvage temperature-stressed foods remains: safety first. When determining risk levels for temperature-abused foods, qualified VFIs may have to make the very costly decision to throw away potentially edible government-purchased rations to spare troops the even costlier risk of eating potentially spoiled foods.⁸

To help with the sometimes difficult decision-making process when inspecting distressed foods, VFIs are trained to use scientific-based guidelines developed by the US Army Natick Soldier Research, Development, and Engineering Center (NSRDEC). Additionally, VFIs and VCOs undergo extensive training in microbiology, chemistry, food deterioration, food technology, and package defects in the AMEDDC&S, HRCoE, courses.

Since time and temperature abuse greatly reduce the shelf-life of food products and increase the potential of food-borne illnesses, a quick response to a refrigeration failure is critical to promoting military food safety, preventing significant illness, and saving government resources. For example, in 1995, a power outage at a Lackland Air Force Base facility in San Antonio, Texas, caused the potential loss of over \$40,000 worth of product. After an inspection in which NSRDEC's *Guide to the Salvage of Temperature-Abused Food Products in Military Commissaries*¹⁵ was applied to the situation, the loss was reduced to approximately \$20,000. These savings were passed on, in turn, to DeCA patrons, when these patrons were able to purchase the food items that were deemed wholesome at discount prices (Chief Warrant Officer 5 [Retired] Joseph Goldsmith, chapter author, unpublished data, April 1995). Salvage reviews of foods compromised during emergency conditions (such as the Lackland example), or of potentially distressed foods culled during routine daily inspections, limit DeCA losses and frequently provide consumer discounts on items found safe for consumption.

Army Food Management Information System

The Army Food Management Information System (AFMIS) provides automated support to control the management and operation of the US Army's worldwide food service program, enabling military personnel to order, inventory, and invoice subsistence supplies, including field rations. For example, to assist the Army G4 (supply and logistics) in tracking the condemnations of Army-owned subsistence, VS personnel record condemnations in AFMIS. (This practice is logical because VFIs are able to determine the proper disposition of stressed products and act as a neutral third party for product accountability.) The G4 then uses the AFMIS information to track the quantity of a

condemned food item and the reason for its condemnation (eg, overaged products, product adulteration, pest infestation, or temperature abuse).

Access to the veterinary condemnation section of AFMIS, which is granted to VFIs by installation food program managers, enables food service personnel at all levels to better manage their food supplies.¹⁶ AFMIS also supports dining facilities' menu planning, automated head-counts, labor scheduling, cash collection, and equipment replacement.

Operational Rations Programs

The Defense Logistics Agency (DLA) Troop Support, Directorate of Subsistence, Operational Rations Division manages all operational rations programs and employs a comprehensive strategy for integrating the nation's industrial base in supplying these rations. The DLA responds to military ration requirements by implementing and providing operational rations programs and items and the logistical infrastructures necessary to support their use. Modern battlefield requirements demand subsistence support that not only meets the needs of service members in extremely intense and mobile combat situations, but also adapts quickly to humanitarian assistance operations.¹⁷ Only the US Air Force Public Health Service or the US Army VS are authorized to provide inspection services for operational rations, as appropriate.¹⁸

Types of Operational Rations

Currently, the 14 types of "go-to-war" operational rations used by the US military are divided into three main categories: (1) individual rations, (2) group rations, and (3) survival rations. The characteristic common to all operational rations is the extensive research and development involved in the formulations, processing, packaging, and packing materials required to enable the rations to withstand extreme environmental conditions and the ongoing challenges of logistical support. Each ration, regardless of type, is developed to be palatable and to have a reasonable shelf-life (18 months–3 years at 80°F), and each is produced in sufficient quantities to support military requirements.¹⁷

Individual Rations. The first category of rations is the individual ration, which is designed for various missions and specific individuals. This chapter highlights a few of the module options from the DLA website, the first being meals ready to eat (MREs).

MREs are designed to sustain an individual engaged in vigorous activity such as military training or actual military operations that preclude the warfighter from eating at usual food service facilities. Each MRE is a



Figure 9-1. Typical packaging for Meals Ready to Eat. Reproduced from a photograph taken by Air Force First Lieutenant Kay M. Nissen. <https://www.troopsupport.dla.mil/events/news140401.asp>. Accessed March 9, 2016.

complete meal packed in a flexible meal bag (Figure 9-1) that is lightweight even when full and fits easily into military field clothing pockets. Each meal bag contains an entree and a variety of other components such as cookies, desserts, dried fruit, candy, powdered drink mixes, coffee packets, sugar, and salt. The contents of one MRE meal bag provide approximately 1,250 kilocalories (13% protein, 36% fat, and 51% carbohydrate), which equals about one third of the military recommended daily allowance of vitamins and minerals as determined by The Surgeon General of the United States.¹⁹

Another individual ration is the first strike ration (FSR), an eat-on-the-move assault ration. Designed for consumption by individual warfighters during short durations of highly mobile, high-intensity combat operations (ie, the first 72 hours of a conflict), the FSR is more compact than the MRE. However, even though the FSR is substantially reduced in weight and volume to increase a service member's combat mobility, this ration is packed with nutrition. The FSR is equivalent to one full day of food for one person and contains approximately 2,850 kilocalories. One FSR is consumed in lieu of three MREs.²⁰

The last example of an individual ration is the meal, religious, Kosher or Halal, issued to individual service members who maintain a strict diet based on Jewish or Islamic laws. Each meal consists of one Kosher- or Halal-certified entree and religiously certified and acceptable complementary items sufficient to provide the service member with the recommended daily nutritional intake.²¹

Group Rations. The next category of rations is the group ration, which includes unitized group ration-heat and serve (UGR-H&S), unitized group ration-A

option (UGR-A), B-rations, and unitized group ration express (UGR-E). Group rations are used when ample time and equipment are available for heating and serving specially processed and packaged meals designed to feed more than one service member at a time (eg, during operations that allow for organized food service facilities). Almost everything needed for a complete 50-person meal, including necessary disposable items (eg, trash bags and paper cups), is provided, and all of the pre-prepared meals are packaged in sealed containers that serve as heating pans and serving trays.^{22,23}

Both UGR-H&S and UGR-A provide 1,450-calorie meals and maximize use of commercial items to more easily provide high-quality food service to troops in a field environment. However, mandatory supplements such as milk and cold cereal and optional enhancements such as bread, fresh fruits, and vegetables are not included in all the group meal options. For example, B-ration meal options use only canned or preserved ingredients that can be served without adequate refrigeration or freezer facilities. The UGR-H&S module provides the usual group tray-pack entrees plus starches and desserts, but the UGR-A module also may include some perishable, fresh, and frozen entrees, commonly known as A-rations. A-ration meals may be served in field kitchens and in more fixed military dining facilities.^{24,25}

Unitized group ration-express (UGR-Es) are compact, self-contained modules that provide complete, hot meals with necessary disposable items for 18 warfighters without the necessity of equipment, cooks, fuel, or power. Similar to UGR-H&S tray packs, UGR-E precooked meals are served in trays and take only 30 to 45 minutes to warm via provided heater modules. Since UGR-Es are an alternative to individual MREs as the sole source of subsistence in austere, remote locations, certain small combat groups (eg, special operations forces, military police, and military transition teams) benefit the most from UGR-Es.^{22,23}

Survival Rations. The last of the three operational ration categories is the survival ration, which includes the survival, general purpose, improved; survival, abandon ship; and survival, aircraft, life raft rations. All survival rations are uniquely designed and packaged to withstand their intended environment and are calorically dense. For example, the survival, aircraft, life raft ration is a small food packet used to provide short-term sustenance to survivors of air crashes at sea. The small packets, along with other essential equipment, are stowed in the emergency kits carried aboard naval aircraft; each packet supplies approximately 300 calories.²⁴⁻²⁶

Types of US Army Veterinary Services' Operational Rations Support

According to an old adage attributed to both Napoleon and Frederick the Great, an army "marches" on its stomach. In other words, throughout history, armies have relied on good and plentiful food to preserve full fighting strength and mobility. The current US Army travels with food inspectors and officers who not only ensure fit rations are maintained, but who also consult commanders on the courses of action they can take to maximize the life and safety of those rations.

The VS bears the overall responsibility for the operational rations food protection mission, and the extensive infrastructure support system for this mission includes the DLA-Troop Support (TS); NSRDEC; AMEDDC&S, HRCoE; and APHC districts, regions, and headquarters. In the forefront are the US Army VFIs who maintain and inspect operational rations throughout the US armed forces' areas of operation.¹⁴

To ensure the welfare of the fighting forces and the financial interest of the government, VFIs first perform a variety of onsite inspections, checks, and controls at assembly plants to ensure that the rations being produced are ready for either war or humanitarian support. The various types of inspections conducted for depot assembly operations require VFIs to receive specific technical training, use mandated guidelines, and implement a responsive inspection process to determine the rations' usability and, if conditions permit, extend their shelf-life. From the time operational rations are initially collated at the ration assembly plant throughout the government storage, time of issue, and potential return of residual stocks, VFIs perform these inspections in a variety of locations under divergent constraints (eg, from a climate-controlled Army warehouse in Japan where rations display longevity to a nonair-conditioned shipping container in Iraq or Afghanistan where heat impacts shelf-life).

These rations present unique challenges for inspectors and supervisors alike because of mandatory nutritional requirements and the method by which some rations are packed. For example, MREs include smaller, component packages of food in a larger plastic pouch. Each packed component contributes a certain amount of the protein, carbohydrates, and fat required for a balanced meal and, within those components, sufficient calories to sustain troops serving in demanding conditions. As the meal ages or is exposed to harsh conditions, it slowly deteriorates. In the case of an MRE containing multiple products, the components degrade at different rates, thus presenting a host of questions as to whether an item should be replaced, removed, issued with instructions, or condemned. To

make decisions about such rations, inspectors leverage their experience, training, education, standard operating procedures, regulations, and officer oversight to maintain both food safety and fiscal stewardship.

Prime Vendor Destination Audits

The prime vendor destination audit program is a VS feedback mechanism that verifies the quality, condition, and wholesomeness of subsistence procured for feeding US military troops and provides all military services with targeted data on specific products. Prior to this program's inception, inspectors at all duty sites were required to perform cursory, routine, and special product compliance evaluations. These earlier program guidelines emphasized completing as many routine evaluations as was possible but with the accuracy equivalent to that of USDA commodity graders. Initially, the inspectors, who originated from all ranks and experience levels, tended to routinely examine high-dollar, high-use food items.²⁷

Over time, program designers decided the sheer volume of reports generated by the program's emphasis, coupled with the wide-ranging variability of the reports produced by the diverse graders, was not fulfilling the program's intended purpose of value-added commodity surveillance and reporting. A new direction for the program was initiated in the mid-2000s and remains the standard today. The current program streamlines the reporting system; limits audit personnel to those with increased rank and experience; dramatically reduces the number of product audits required; adds the skilled, technical review of reports to the program; and increases the knowledge and capabilities of product auditors.²⁷

The current prime vendor destination audit program also trains qualified personnel to comprehensively audit food products for all terms of the contract. If any nonconformances are found, monetary reimbursement may be sought, and future contractual requirements or catalog modifications may be implemented. VFIs are certified as prime vendor destination auditors during a 40-hour course emphasizing the advanced contractual requirements associated with four commodities: (1) red meats, (2) poultry, (3) processed fresh fruits and vegetables, and (4) seafood. Each attendee is assigned a particular commodity to master but also may be responsible for auditing any or all other commodities if required.²⁷

To most accurately determine the safety and quality of these products before their imminent consumption, audits focus on food products that are ready to be purchased. All audits are performed in accordance with comprehensive audit data packets created by formally trained civilian destination audit coordina-

tors within the VS, and generated product data is used to validate and improve the quality of food served to the US military.²⁸

Support to the Navy and Marine Corps Food Management Teams

Navy Food Management Team

The VS has maintained a long-standing working relationship with the US Navy, providing food safety and food inspection support for the Navy's troop feeding operations. In 1997, the Navy Supply Systems Command prepared for the roll-out of the subsistence prime vendor program by the DLA to provide support to its fleet and shore facilities. To ensure a smooth transition with minimal disruptions, the Supply Systems Command collaborated with the US Army Veterinary Command (VETCOM) (later replaced by USAPHC, now APHC) to establish a memorandum of agreement (MOA), mandating that seven senior enlisted (specifically in the rank of E-7 or E-8) VFIs (military occupational specialty 91R) serve on the existing Navy food management teams (NFMTs). These soldiers, who replaced Navy corpsmen on the existing NFMTs, are referred to as Army veterinary food safety instructors (AVFSIs) (Colonel Jerrod Killian, chapter author, personal knowledge).

The seven initial AVFSIs were "hand-picked" by their respective chains of command. Per the MOA, only senior enlisted can be selected in order to equip the teams with the legitimate authority they need to enforce the applicable requirements and regulations. Although these senior AVFSIs have extensive and beneficial experience in food hygiene, safety, inspection, quality assurance, and contractual compliance, they receive additional training hosted by the AMEDDC&S, HRCoE, Department of Veterinary Science prior to reporting to their team assignments at various Navy installation locations, including Norfolk, Virginia; New London, Connecticut; Mayport, Florida; San Diego, California; Pearl Harbor, Hawaii; Yokosuka, Japan; and the Puget Sound Naval Shipyard in Washington (Colonel Jerrod Killian, chapter author, personal knowledge).

An NFMT's primary responsibility is solving major problems that may be experienced by food service operations on ships, submarines, and shore facilities throughout the team's region of responsibility. The team's ultimate goal is excellence in food service, which is accomplished by improving the quality and raising the standards of food service in all Navy troop feeding operations to boost the health and morale of personnel as well as the Navy's overall operational readiness.

Each NFMT provides a variety of seminars and training in addition to onsite assessments. The assessments, which include periods of observation as well as hands-on training, can be tailored to meet the specific needs and schedules of the particular food service operation. Initially, a full-spectrum assessment is conducted to identify any weak areas that need to be addressed. Next, the team members work side-by-side with the operation's personnel and provide hands-on training on all required food service operation processes. To ensure each process is fully understood and is being executed properly, another period of observation follows completion of the hands-on training.

Marine Corps Food Management Team

The VS has also maintained a lengthy working relationship with the US Marine Corps via a standing MOA to support the Marine Corps food management teams (MCFMTs). This agreement stipulates that VETCOM (replaced by USAPHC, now APHC) will provide three senior 91R VFIs (E-6 or E-7) to support teams at three global locations: (1) Camp Lejeune, North Carolina; (2) Camp Pendleton, California; and (3) Marine Corps Base Okinawa, Japan. The Marine Corps refers to the VFI team members as Army veterinary technicians (AVTs) (Colonel Jerrod Killian, chapter author, personal knowledge).

The mission of the AVTs on the MCFMTs is similar to that of the AVFSIs on the NFMTs: training personnel on food hygiene, safety, inspection, quality assurance,

and contract compliance. The goal of the MCFMT is to enhance troop feeding operations so that they function with maximum efficiency while minimizing costs at all points of the process. Throughout the year, the AVTs provide training by means of various seminars and classes, participate in formal staff assistance visits, and provide technical expertise regarding the combat operational rations used by the Marine Corps. Team members attend DLA operational ration symposiums and provide input and briefings based on the Marine Corps' current needs. They also assist with field feeding operations during training missions and at locations such as the Marine Corps Mountain Warfare Center near Bridgeport, California.

Ship-Rider Program

The VS supports the Military Sealift Command combat stores ships by providing VFIs who serve as ship-riders (Figure 9-2) during scheduled deployments. The basic food protection duties and responsibilities of ship-riders are executed in accordance with Army and Navy guidance documents.²⁹ Supported combat logistic force ships are government-owned, run by civil service mariners, and may have a small contingent of Navy personnel aboard for operational, supply coordination, and helicopter operation support.

Ship-riders perform receipt inspections OCONUS (ie, foreign ports); execute surveillance inspections and shelf-life extensions on subsistence in storage; conduct pest management evaluations; and issue certificates



Figure 9-2. Cruiser USS *Normandy*, oiler USNS *Leroy Grumman*, aircraft carrier *George Washington*, fast combat support ship USNS *Supply*, and combat stores ship USNS *Saturn* sail together. US Army veterinary service personnel participate in the Ship-Rider program, providing food protection support to naval resupply ships. Reproduced from a photograph taken by Petty Officer Third Class Summer M. Anderson, US Navy. <http://www.msc.navy.mil/annualreport/2002/organization.htm>. Accessed February 16, 2016.

of unfitness when required. Ship-riders also conduct training classes on food sanitation, personal hygiene, salvage (survey) operations, subsistence condition monitoring, time and temperature effects on potentially hazardous foods, and proper packaging and staging of subsistence for at-sea replenishment operations.

In addition to routine inspection and training duties, ship-riders participate in activities not normally experienced at traditional duty sites such as deploying aboard Navy vessels, fire-response training, and “abandon ship” drills. Ship-riders are afforded these unique work experiences by authority of an MOA between the Military Sealift Command and the APHC.²⁹

When deployed onboard, ship-riders are required to have the appropriate equipment and all documents and regulations necessary to perform their mission. A key food safety duty that ship-riders perform in support of Navy operations is coordinating and overseeing the DoD Hazardous Food and Nonprescription Drug Recall Program, known in the field as the All Food Activities Program or ALFOODACT. ALFOODACT is a worldwide notification system for placing food products that may pose legal or health concerns on medical hold, thus preventing their sale or consumption. Affected products remain segregated on medical hold until a final disposition message is disseminated.²⁹ (More detailed information about the ALFOODACT system and its procedural process for non-naval activities is found in the Defense Logistics Agency-Troop Support section of this chapter.)

During deployment, ship-riders maintain contact with their respective veterinary units and liaison with the US Army Veterinary senior quality assurance specialist assigned to the Naval Supply Command, Fleet Logistic Center, in the geographical area or areas where the naval vessels are deployed. (Senior quality assurance specialists monitor the ALFOODACT communications and provide current ALFOODACT information to the ship-riders.) Contact is primarily electronic while the ship-riders are at sea and in person when the ship-riders arrive at their ports of debarkation. Once deployment contact is initiated by the ship-rider (VFI), specific local information regarding approved food sources and important food safety concerns is disseminated to the VFI’s home duty station, the ship’s supply officer, and the food service officer for inclusion into APHC’s ISP food recall database.²⁹

After completing a tour of duty, the ship-rider participates in a structured lessons-learned process that includes after-action reports highlighting aspects of the deployment that went well, areas that need improvement, and special challenges such as a lack of appropriate mission support and resources. Meeting DoD food protection challenges requires the VS to forge

relationships with the DoD and other governmental organizations by means of MOAs. Specifically, the VS’s relationship with the Military Sealift Command exemplifies how a previously unmet need for safe foods for military personnel serving onboard naval vessels created a VS program that strives to provide monitored foods from approved sources.

Surveillance Food Laboratory Program

The surveillance food laboratory program was initiated to develop different field tests that could provide military personnel with quicker results than those furnished by fixed reference laboratories. More immediate results are often needed for several interrelated reasons: (a) many food products are perishable items; (b) primarily fixed reference laboratories are widely dispersed; (c) lengthy transportation times often cause samples to be nontestable upon delivery; and (d) difficulties in shipping food from one country to another may delay or even prevent needed laboratory testing.

Other times, more immediate results are necessary because of operational considerations. For example, smaller forward operating bases and many expeditionary units have limited food supplies and must quickly ascertain the safety of their food using surveillance food laboratories to ensure continuous operations.

Two food testing sets specifically designed for use on the battlefield, as well as in food production plants and storage facilities, were fielded in the mid-2000s: the unit assemblage 913A veterinary equipment set (VES) field microbiology kit and the 914A VES food testing kit. Initially, the 913A VES kit was to be used for rapid screening of food and water samples as a means of ensuring food safety and supporting food defense initiatives. This VES kit had the capability to perform indicator microorganism screening of foods and was designed to provide flexibility in lab testing, regardless of whether the entire kit was set up in a tent or select components were used to perform limited testing in a hotel room.³⁰

In 2009, the 913A VES kit was revised to include animal testing capabilities, thus changing the focus from surveillance food laboratory testing to veterinary surveillance laboratory testing. Some of the animal testing included *Giardia*, heartworm, Lyme disease, *Anaplasma phagocytophilum*, and *Ehrlichia canis*. The revised kit was also designed to make the laboratory more rugged (ie, better protecting the equipment in the battlefield environment).³⁰

The kit currently in use features a handheld instrument that detects luminescence for adenosine triphosphate, which is associated with microorganisms, food and organic residues, and pesticides. The kit also is

capable of indicator microorganism screening using Petrifilm (3M Corporation, Maplewood, Minnesota). VS support teams of Medical Detachment VS are authorized to use revised 913A VES kits, which are fielded to each team (squad) in a table of organization and equipment unit.³⁰

The 914A VES food testing kit also provides rapid screening of indicator microorganisms but with expanded chemistry capabilities. This kit features a small bench-top analyzer that uses a liquid scintillation counter to test for aflatoxin and antibiotics and a bioluminescence counter for testing pesticides. Food procurement teams of the Medical Detachment VS are authorized to use the 914A VES kit.³⁰

While the purpose of surveillance laboratories is to support commanders' missions, these labs were not designed with the capability to recover and identify pathogens. Rather, they have served to more quickly identify potential problems (based on indicator testing) or to refer testing samples to a reference laboratory (eg, the Veterinary Laboratory Europe or the DoD Food Analysis and Diagnostic Laboratory) for confirmation. Components of these labs have been used at offsite special events in real-world food defense missions, for OCONUS food and water risk assessments, and on the battlefields of Iraq and Afghanistan. The surveillance food laboratory program has expanded greatly over the years, evolving as equipment has been modified or updated. Continuing efforts are underway to develop new equipment and methods to meet ever-changing battlefield needs by means of expanded testing capability, quicker turn-around times, and more definitive identifications of certain food-borne microorganisms.³⁰

National Science Foundation Programs

The Antarctic Treaty, entered in 1961, sets aside Antarctica as a scientific preserve, establishes freedom of scientific investigation, and bans military activity on the continent. This joint treaty originally involved 12 nations but now involves over 50. The United States continues to conduct research and collaborate with foreign nations on this frontier continent.³¹

The polar regions are unique natural laboratories in which a wide range of research is carried out, including discerning the effects of climate change, understanding the region and its ecosystems, and studying the upper atmosphere and space. However, since Antarctica's remoteness and extreme climate result in field science that is more expensive to conduct than in most locations, research is performed in the Antarctic only when it cannot be performed in more convenient, less expensive locations.

US polar science research is coordinated through the National Science Foundation (NSF), which maintains three research stations in Antarctica: (1) Palmer Station, (2) McMurdo Station, and (3) South Pole. Because these three stations are so remote and have only minimal medical capabilities, food safety is of the utmost importance to the programs and all personnel involved in them. A food-borne illness outbreak in this austere environment would not only hinder the NSF's global scientific mission but could also result in serious human consequences, including casualties. To prevent such a potential outcome, the NSF entered into a memorandum of understanding with the APHC that enables the APHC to perform sanitation audits and inspections of NSF food and facilities.³²

The facilities audited and inspected are located worldwide and include the three remote stations, manufacturing and distribution facilities, transportation and resupply vessels, and supply and depot sites. The NSF utilizes the APHC's audits and inspections to ensure contracted companies fulfill food quality and food safety obligations.

VS personnel from APHC are selected to support NSF based on their locations and skill sets. CONUS support consists of depot facility inspections and is generally provided by 68R VFI noncommissioned officers stationed geographically near the inspection site. A VCO (either a veterinarian or warrant officer) assigned to APHC Region-Pacific typically provides OCONUS support, which is divided into two areas:



Figure 9-3. The *Lawrence M. Gould* research vessel resupplies Palmer Station, Antarctica. US Army veterinary service personnel conduct pier receipt inspections prior to loading the vessel.

Photograph courtesy of Captain Emily M. Corbin, chapter author.



Figure 9-4. A C-17 Globemaster III drops pallets of cargo during the first C-17 airdrop to the South Pole, December 20, 2006. Airdrops such as this one offer flexible support to the National Science Foundation mission, delivering high volumes of supplies in emergencies and when landings are not possible (eg, during blizzards). US Veterinary Services personnel deploy via a ship to provide food safety checks of the delivered supplies.

Reproduced from a photograph taken by Lieutenant Colonel James McGann, US Air Force. <http://www.af.mil/News/ArticleDisplay/tabid/223/Article/128633/c-17-makes-1st-ever-airdrop-to-antarctica.aspx>. Accessed February 16, 2016.

(1) McMurdo Station and South Pole, both of which are located south of New Zealand; and (2) Palmer Station, located south of Chile.³²

A Veterinary Corps food safety warrant officer provides support to McMurdo Station and South Pole typically by means of quarterly deployments. The NSF provides administrative support, including office space, to the warrant officer assigned at the International Antarctic Centre located in Christchurch, New Zealand. A VCO assigned to APHC District-Central Pacific in Hawaii typically provides annual support to Palmer Station, the smallest of the three stations. This officer travels to Punta Arenas, Chile, near the southern tip of South America, then travels by ship, the *Lawrence M. Gould* research vessel (Figure 9-3), for 4 days across the Drake Passage to Palmer Station. The officer remains on-station until the ship departs again for Chile, typically 7 to 9 days later.³²

The support the NSF requests from APHC varies from mission to mission and may include subsistence procurement inspection; verifying approved sources; observing the contractor’s food receipt and inspection process; providing technical guidance; observing all aspects of food storage procedures (ie, segregation of raw and ready-to-eat items, removal of distressed or compromised food products, and



Figure 9-5. The Army’s 331st Transportation Company built the steel pier (pictured) when the ice pier used at McMurdo Station, Antarctica, failed. Supplies from the USNS *Green Wave* are being received on this pier.

Reproduced from a photograph taken by Captain Christina Shelton, US Army. <http://archive.defense.gov/news/newsarticle.aspx?ID=67819>. Accessed February 16, 2016.

proper stock rotation); observing food handling and food preparation within dining facilities and kitchens; observing vessel offload operations; and reviewing temperature logs.³³

Unlike the majority of the APHC’s deployed locations, in Antarctica, temperature stress is usually not an issue—the exception being food products damaged by freezing. However, the stations’ remoteness presents issues typical of end-of-supply-chain dynamics: expired products and poor quality perishable foods such as fresh fruits and vegetables (Captain Emily M. Corbin, chapter author, personal knowledge).

The severe and unpredictable weather also impacts the food supply and personnel transport via aircrafts (Figure 9-4). Planes supply food and personnel to the South Pole station and transport personnel and some foodstuffs to McMurdo Station; however, when the arctic weather is too cold, aircrafts may not be able to fly. Other changes in weather can affect the Antarctic supply operation as well. In 2012, for example, the ice pier at McMurdo Station was not stable enough to support the annual delivery load (warm weather caused it to melt), so the NSF enlisted the support of a US Army Transportation Corps unit to install and later remove a modular causeway system to facilitate the annual resupply vessel offload (Figure 9-5). In 2012, spring flooding in Punta Arenas, Chile, caused an abrupt halt in the supply chain to Palmer Station (Captain Emily M. Corbin, chapter author, personal knowledge).

FOOD SAFETY SUPPORT TO OTHER AGENCIES AND ACTIVITIES

Defense Commissary Agency

Although supplying quality groceries to US service members worldwide is no easy task, ensuring that these large quantities of groceries are wholesome and safe for consumption is equally as daunting. To meet this challenge, the US Army provides food safety, food quality, and food defense programs at US Army, Navy, and Marine Corps military commissaries across the globe. The Air Force utilizes its public health inspectors at Air Force bases for DeCA support.

Additional oversight of food safety operations is provided by DeCA regional FSOs (military or civilian) and DeCA headquarters military and civilian personnel, one of whom is an Army staff veterinarian. Unlike civilian establishments that are inspected by local and state regulatory agencies on a limited basis, DoD commissaries have military food inspectors on-site and on-call at all hours. These inspectors conduct constant surveillance to ensure food safety and enhance the confidence of service members and DoD beneficiaries. Key surveillance activities include food delivery inspections, pest surveillance, food vulnerability assessments, sanitation inspections, refrigeration failure salvage operations, food item recalls, and approved source verifications.

Those departments within a commissary that process potentially hazardous foods such as sushi bars and delicatessens are monitored carefully to ensure sanitation programs are meticulously followed. VFIs perform preoperational inspections as well as bioluminescence testing to ensure the food processing equipment in these areas has been adequately sanitized. Hazard analysis and critical control point plans are also monitored and verified to ensure product safety.

When commissaries experience a power outage, VFIs are on-site to perform salvage operations, ensure food safety, and, where applicable, to prevent the total loss of thousands of dollars' worth of food products that are stressed but are still safe for consumption. The final disposition authority rests with the VCOs, who sign food condemnation certificates when necessary.

VFIs also conduct preliminary investigations of customer concerns ranging from quality issues related to the product and its production to storage along the supply chain. In the event of product adulteration, these investigators attempt to locate the root source and determine whether the issue is an isolated case or a systemic problem. If the latter is the case, or if the isolated incident is critical in nature, other agencies

and the manufacturer are notified, and the product may be recalled. During a product recall, commissaries and VFIs receive an ALFOODACT alert and take immediate action by coordinating with commissary management to remove the affected products from distribution, thus preventing their consumption.

As noted previously in this chapter, all products sold in commissaries must originate from an approved source, so VFIs must vigilantly screen all products available for sale. When a nonapproved product is found on commissary shelves, the local veterinary inspection unit conducts a risk assessment to determine the product's use or removal. The approved source program also ensures that the facilities where the products originated have been inspected by a federal agency or a VCO.⁸

To ensure contract compliance, VFIs must understand myriad food protection provisions within the various types of contracts in use at DeCA commissaries. Suppliers' contracts with DeCA stipulate provisions and requirements that maximize food quality, safety, and cost savings. Copies of all contracts are available at the commissaries for VFIs to review as needed to ensure delivered products meet food protection requirements.

VFIs also provide needed food safety and defense training to commissary employees, either by commissary request or as deemed necessary by the inspectors. Commissary employees who are aware of food defense risks are extremely valuable in identifying food defense threats (eg, products that have been tampered with).

Army and Air Force Exchange Service

The APHC plays a vital role in ensuring food safety and defense in the over 2,400 AAFES facilities worldwide, including shoppettes, main exchanges, exchange gas stations, and fast food restaurants. Deployed service members can go to AAFES restaurants for a taste of home and to escape the stress of deployment, if only for the duration of a meal. Exchanges and shoppettes also supply deployed troops a taste of home by stocking foods shipped from the United States.³⁴

VS food safety and defense support to AAFES facilities, similar to that provided to DeCA, is described within the ISP, is executed by VFIs daily, and includes performing the following duties: food delivery inspections, food recall actions, shelf-life extensions, refrigeration failure support, approved source verifications, sanitation inspections, and food defense activities.⁹

Food defense concerns are heightened in deployed environments where food may be left unattended and vulnerable to intentional contamination. For example, food destined for the small exchanges located on forward operating bases throughout Afghanistan can be trucked for long distances by local nationals or third-country nationals without oversight by US forces. Aggressors may seek to target these food establishments' products because creating a food-borne illness inexpensively reduces the effectiveness of US or allied personnel. Army VFIs lower such food defense risks by performing food vulnerability assessments and providing food defense training to exchange employees.

Defense Logistics Agency-Troop Support

History

Defense Logistics Agency-Troop Support (DLA-TS) is a joint service activity with member support from all five uniformed services as well as the civilian sector. The agency's roots trace back to the 1800s, with the construction of the Schuylkill Arsenal in Philadelphia, Pennsylvania. Initially, the arsenal was erected as a warehouse for ammunition and other military supplies such as the uniforms that local seamstresses were contracted to make by hand at home. The first opportunity for the arsenal to serve the nation in wartime came during the War of 1812 when the arsenal supplied guns and ammunition, as well as clothing and textile materials, to American troops. The Schuylkill Arsenal relinquished its ammunition and arms mission in 1819 and became fully dedicated to the manufacture, storage, and distribution of clothing and textile materials.³⁵

In ensuing years, the Schuylkill Arsenal grew, relocated, and was renamed the Philadelphia Quartermaster Depot. In 1965, the Defense Personnel Support Center was officially established on the site, and the facility's mission expanded to include providing food, medicines, and medical supplies, as well as its essential clothing and textile supply responsibilities. In addition, both the Defense Subsistence Supply Center in Chicago, Illinois, and the Defense Medical Supply Center in Brooklyn, New York, moved to the Philadelphia location. Concentrating all three directorates in one space provided a level of efficiency that was immediately tested by the Vietnam War.³⁵

The Defense Personnel Support Center was renamed the Defense Supply Center Philadelphia (DSCP) on January 13, 1998. Effective July 3, 1999, materiel management responsibilities for the Defense Industrial Supply Center's assigned commodities—general and industrial items—were absorbed by the DSCP. In 2010, the DSCP was officially renamed the

DLA-TS. The organization's many functions are vital to the military, and the VS is an essential partner in DLA-TS's efforts.³⁵

Mission

The mission of the subsistence section within DLA-TS is to serve as the focal point for issues pertaining to food quality, food safety, and customer complaints. In essence, DLA-TS serves as a liaison between military and other government agencies in support of the subsistence acquisition process. The following key sites³⁶⁻⁴¹ ensure that the acquisition process flows smoothly from beginning to end:

(1) Defense Logistics Agency-Troop Support-Philadelphia-Consumer Safety. DLA-TS Philadelphia-Consumer Safety (P-CS) serves as the focal point of the DoD Hazardous Food and Nonprescription Drug Recall System. VS personnel serve here in a joint service capacity within DLA-TS Philadelphia's Subsistence Directorate. Product recalls pertaining to subsistence as well as those of nonprescription drugs are managed from DLA-TS Philadelphia. Regardless of whether a manufacturer failed to declare an allergen, found a pathogen, or mislabeled its product packaging, an effective mechanism with which to stop the distribution or sale of these identified items must be in place. In fact, manufacturers often recall food products because of public health concerns or for reasons that concern the manufacturer.³⁹

In addition to providing advice on matters related to nonprescription drugs, the DLA-TS-Philadelphia consults with the US Food and Drug Administration (FDA), USDA, US Department of Commerce, and other entities on all matters pertaining to recalls. Continuous coordination with the FDA and USDA is necessary for determining the classes of hazardous recalls and evaluating suspected hazardous foods and nonprescription drugs.

ALFOODACT messages serve as a means to quickly and effectively disseminate information pertaining to both food and nonprescription drug recalls. Such messages are generated by the DLA-TS-P-CS based on information received through coordination with other government agencies. The DLA-TS-P-CS generates an ALFOODACT message when and if a suspect product is likely to be found in DoD supply channels. A message concerning the specific product or products is then disseminated DoD-wide to veterinary food safety representatives, accountable officers, prime vendors, and the general public. The DLA-TS-P-CS officer's responsibilities include receiving the initial notification from the recalling authority and interpreting, researching, drafting, and sending the official ALFOODACT

message. However, the activities that occur in reaction to such a message determine the effectiveness of the recall system overall.³⁹

The VCO, FSO (MOS 640A), and food inspector (MOS 68R) are responsible for ensuring compliance with ALFOODACT messages. Although many organizations receive these messages and take initial action to respond appropriately, VS personnel contact the organizations, assist them, and confirm that the recall was properly executed and completed.³⁹

In addition to working with the FDA, USDA, and the US Department of Commerce, the DLA-TS-P-CS's work has also fostered and strengthened partnerships with NSRDEC and APHC. Continual communication and coordination between DLA-TS-P-CS and military and government agencies is essential and enhances food safety and security.

Other functions of the DLA-TS-P-CS include reviewing and submitting initial audit requests; establishing requirements for unapproved sources, source verifications, and prime vendor nonconformances; serving on technical panels; managing significant quality issues; and updating internal regulations and policies. The DLA's Food Safety Office monitors prime vendor programs, produce inspection programs, and significant trends in the DLA-TS Subsistence Directorate's worldwide mission.

(2) Defense Logistics Agency-Troop Support-Philadelphia-Quality Assurance. DLA-TS Philadelphia-Quality Assurance (P-QA) performs duty on a joint staff subsistence inventory control point, providing quality assurance and technical support to the subsistence supplier operations directorate for its subsistence quality audits. These audits are conducted at vendor as well as government facilities to evaluate product conformance and DLA contractual requirements. Subsistence quality audits may also be conducted to investigate facilities and verify compliance of contractual requirements and operational rations quality systems.

Data received from inspection agencies (ie, the USDA and FDA), the Defense Contract Management Agency, and VFIs are collected and analyzed for later use. Government source inspections at vendor facilities located worldwide are also analyzed, and the data is compiled into a quality history. This information can then be used during contract awards, option quantity reviews, and pre-award actions and evaluations of DLA contracts.

In addition to providing technical guidance in the fields of statistical sampling, analytical testing, food safety, pest management, sanitation, food defense, and aspects of food quality, DLA-TS-P-QA reviews and evaluates the quality system plans, hazard analysis and critical control point plans, and food defense plans of

government contractors. Routine vulnerability assessments are performed using the CARVER plus Shock Method (Exhibit 9-1). DLA-TS-P-QA also provides the quality assurance and food protection regulations, manuals, handbooks, and directives to ensure the safe, regulated procurement of wholesome, quality subsistence.⁴⁰

(3) Defense Logistics Agency-Troop Support-Pacific. DLA-TS Pacific spans 16 time zones in the US Pacific Command. With over \$150 million in sales each year, DLA-TS Pacific supports more than 670 DoD customers.³⁸ DLA-TS Pacific monitors the quality and wholesomeness of all subsistence that is procured, stored, and distributed within the region and maintains close communication with all veterinary field inspection elements.

To sustain sanitation and quality requirements, DLA-TS Pacific conducts routine visits (surveys) of its region's vendor processing facilities. Technical evaluation panels are conducted routinely for long-term produce contracts awarded by the Hawaii Procurement Office. DLA-TS Pacific also ensures the availability of up-to-date technical recommendations on quality assurance topics for use by contracting officers and field logistics specialists.

(4) Defense Logistics Agency-Troop Support-Europe & Africa. DLA-TS Europe & Africa provides support for Europe and Africa and performs many of the same duties in the European theater of operations as DLA-TS Pacific does in the Pacific theater, including providing technical recommendations, overseeing quality assurance, and ensuring wholesomeness. Additionally, DLA-TS Europe & Africa provides support to the DLA-TS Europe and Africa Food Service and Operational Rations Unit, which in turn provides subsistence prime vendor and operational rations support. Full-line commercial distributors provide customers with one-stop shopping and back-door delivery to military dining facilities and ships.³⁷

The DLA-TS Europe and Africa Produce and Local Market Ready Unit provides fresh fruits and vegetables, dairy products, water, beverages, fruit juices, specialty items, and bakery products to US forces dining facilities throughout the United Kingdom, the Netherlands, Spain, Germany, Belgium, Italy, Greece, Turkey, Egypt, Saudi Arabia, and Africa, as well as to ships calling on ports in the Atlantic Ocean, Baltic Sea, Mediterranean Sea, and Black Sea.³⁷

Joint Culinary Center of Excellence

The Joint Culinary Center of Excellence (JCCoE) is the "corporate headquarters" for Army food service worldwide. Located at the US Army Quartermaster

EXHIBIT 9-1

CARVER PLUS SHOCK METHOD FOR FOOD SECTOR VULNERABILITY ASSESSMENTS

The CARVER plus Shock method is an offensive targeting prioritization tool that has been adapted for use in the food sector. This tool can be used to assess the vulnerabilities to an attack within a system or infrastructure by identifying the most attractive targets for an attack from the perpetrator's point-of-view. By conducting such a vulnerability assessment and determining the most vulnerable points in the system or infrastructure, resources can be focused on protecting the most vulnerable points. CARVER is an acronym for the following six attributes used to evaluate the attractiveness of a target for attack:

- **Criticality** - measure of public health and economic impacts of an attack
- **Accessibility** – ability to physically access and egress from target
- **Recuperability** – ability of system to recover from an attack
- **Vulnerability** – ease of accomplishing attack
- **Effect** – amount of direct loss from an attack as measured by loss in production
- **Recognizability** – ease of identifying target

In addition, the modified CARVER tool evaluates a seventh attribute, the combined health, economic, and psychological impacts of an attack, or the SHOCK attributes of a target.

The attractiveness of a target can then be ranked on a scale from one to ten on the basis of scales that have been developed for each of the seven attributes. Conditions that are associated with lower attractiveness (or lower vulnerability) are assigned lower values (eg, 1 or 2), whereas, conditions associated with higher attractiveness as a target (or higher vulnerability) are assigned higher values (eg, 9 or 10). Evaluating or scoring the various elements of the food sector infrastructure of interest for each of the CARVER-Shock attributes can help identify where within that infrastructure an attack is most likely to occur. Federal agencies, including the Food Safety and Inspection Service and Food and Drug Administration, have used this method to evaluate the potential vulnerabilities of farm-to-table supply chains of various food commodities. The method can also be used to assess the potential vulnerabilities of individual facilities or processes.

Adapted from: Catlin M, Kautter D. *An Overview of the Carver Plus Shock Method for Food Sector Vulnerability Assessments*. <http://www.fsis.usda.gov/wps/wcm/connect/483f86d5-a566-44f8-90d5-05a16dbe3f78/CARVER.pdf?MOD=AJPERES>. Accessed December 2, 2015.

School at Ft Lee, Virginia, the JCCoE provides joint proponent food preparations training and serves as the executive agent providing direction for the Army's food program. The JCCoE is also the focal point for joint services basic and advanced food service skills training.

DoD VS supports the JCCoE with an FSO currently assigned to the Quality Assurance Division within the Operations Directorate. The directorate provides the central direction, management, and oversight of the Army's worldwide food service program for the Quartermaster General and Department of the Army G4. The FSO serves as technical advisor for the development and enhancement of food safety and food defense strategies, procedures, and standards and serves as a critical source of evaluation for new product development within the Quality Assurance Division.

Duties of the FSO include not only technical and scientific evaluations and recommendations, but also a significant liaison function in concert with the JC-CoE executive agency functions for the Army G4. The position requires recurring interaction with joint com-

mittees and organizations such as the NSRDEC, Food Risk Evaluation Committee, Combat Rations Network, North Atlantic Treaty Organization Support Agency, and various DoD and Army committees and organizations that provide input on the safety of food consumed within the purview of military field or garrison feeding systems. The FSO's additional duties include teaching food safety concepts and policy to joint services active duty and reserve personnel enrolled in advanced food service professional development courses.

United States Army Natick Soldier Research, Development, and Engineer Center

As part of the Army Materiel Command's Research, Development, and Engineering Command, NSRDEC's Combat Feeding Directorate (CFD) provides the DoD with a joint service program responsible for the research, development, integration, testing, and engineering of combat rations, food service equipment technology, and combat feeding systems. The Combat Feeding Research and Engineering Board oversees



Figure 9-6. Water reticulation is an example of the Combat Feeding Directorate leveraging advanced technologies in Kandahar, Afghanistan. Photograph courtesy of Chief Warrant Officer 5 Sean Lonacker, chapter author.

CFD activities and includes joint technical staff representatives from the Army G-4, Marine Corps, Air Force, Navy, and DLA.

Eleven primary facilities comprise NSRDEC's CFD: the (1) Advanced Food Processing Laboratory; (2) Analytical Chemistry Laboratory; (3) Food Microbiology Laboratories (BSL2+); (4) Food Safety Testing Laboratory; (5) Flexible Food Packaging Laboratory; (6) Food Analysis Laboratory; (7) Sensory and Consumer Testing Laboratory; (8) Refrigeration Calorimeter Test Chamber; (9) Polymer Film Center of Excellence; (10) Navy Equipment Laboratory; and (11) Burner Test Facility.⁴¹

The CFD also actively leverages leading-edge technologies (Figure 9-6) to ensure the warfighter is provided the decisive advantage in all aspects of combat feeding (Figure 9-7). The use of integrated products teams involving the DLA, joint services, combat feeding program teams, academia, industry, and other government agencies consistently optimizes costs, scheduling, and performance. These teams' combined efforts provide the science and technology base, as well as engineering support, to fulfill the unique feeding requirements of each service.⁴¹

Currently, nine teams work to develop innovative combat feeding technologies for warfighters in coordination with the CFD and across the following disciplines: (1) advanced materials engineering; (2) food processing, engineering, and technology; (3) performance optimization research; (4) combat rations; (5) equipment and energy technology; (6) systems equipment and engineering; (7) food engineering services; (8) food service and equipment; and (9) food protection.



Figure 9-7. Military food service professionals from Alaska prepare a three-course meal inside an Army mobile kitchen trailer at Joint Base Elmendorf-Richardson, Alaska. The mobile kitchen trailer enhances combat feeding operations, significantly reducing food safety risks in austere environments. Reproduced from a US Army photograph (released) taken by Staff Sergeant Jeffrey Smith. http://www.usarak.army.mil/main/stories_Archives/Mar_3-7_2014/140305_FS1.asp. Accessed March 9, 2016.

The food protection team's primary mission is supporting food safety and defense for the VS. The VS collaborates with the CFD on various forums and issues, including occasional joint research projects with the food safety warrant officers who attend the Long-Term Health Education and Training program. The VS also has one dedicated chief warrant officer (VS technician) who holds a minimum of a Master of Science degree in food science or technology. This individual is an organic member of the CFD, serving as a project manager in the food protection team and the veterinary liaison who coordinates activities between NSRDEC laboratories, the DoD VS Activity, and the APHC.⁴¹

Counterinsurgency Operations

US service members often assume that the food they eat during deployments is safe, especially when it is consumed on a military base. This assumption may put service members at increased risk for food-borne illness when they deploy to less-developed countries, including Afghanistan, where the risk of food-borne illness is higher than it is in the United States. For various reasons, including jurisdictional constraints, the local foods that are available on- or off-base during deployment are not necessarily subjected to the same scrutiny by preventive medicine and veterinary personnel as military-provided foods. Thus, service members who consume local foods, especially those who are not

acclimated to eating regional cuisines, could be at an increased risk for food-borne illness. Furthermore, although service members need to better understand the risks of eating locally during deployment and learn to recognize the differences between high- and low-risk foods, consistent access to local food consumption guidance is difficult, mainly because service members are deployed across a broad geographic area.⁴² The next section of this chapter examines the impact of local food consumption during COIN operations, the difficulty of quantifying the burden of food-borne illness on military missions, and the challenges of communicating food safety in deployed settings. This section also provides an indepth look at a successful collaborative food safety communication effort that targets deployed personnel.

Studying the Impact of Local Food Consumption on Service Member Health During Counterinsurgency Operations

During COIN operations, service members must work to bridge various cultural, linguistic, and often generational differences (eg, when young service members engage with Afghan elders). A significant culture-bridging activity, which helps to build trust and morale, involves sharing meals and beverages with local populations (Figure 9-8 and Figure 9-9). Because this sharing primarily occurs off-base, these dining experiences increase service members' exposure to local foods, which are rarely



Figure 9-8. Ninewa provincial reconstruction team members share a meal at a command-initiated small business site in Bashika, Iraq, October 3, 2010. Reproduced from a US Army photograph (released) taken by Staff Sergeant Edward Reagan. https://www.dvidshub.net/image/331315/prt-bashika#.VsX__XnVy70. Accessed February 18, 2016.



Figure 9-9. An Afghan teenager from the Satara III orphanage offers tea to Navy personnel in Kabul, Afghanistan, after service members distributed boxes of supplies to the orphanage on December 5, 2010.

Reproduced from a US Navy photograph (released) taken by Mass Communication Chief Jason Carter. <https://www.dvidshub.net/image/346668/haven-afghan-children#.VsYAQHnVy70>. Accessed February 18, 2016.

acquired from approved sources, are less likely to be handled properly, and, thus, pose a higher risk for food-borne illness.^{42,43}

As noted in a VS-authored risk communication campaign journal article, gastrointestinal illness, which includes various food-borne illnesses stemming from the consumption of local food products, is a common problem when US service members are deployed.⁴² This article highlights several military studies of deployed US personnel in which gastrointestinal illness and other food-borne threats were either prevalent, underreported, or both; this article also features subsequent studies focusing on specific prevalent infectious agents and risk associations:

- “Between 1990 and 2005, infectious gastrointestinal illness was listed as the fourth most commonly reported diagnosis during US military deployments, following noncombat orthopedic injuries, respiratory infections, and skin diseases.”^{42(p51)}
- According to a 2003 survey of self-reported diarrhea in operations Iraqi Freedom and Enduring Freedom, “diarrhea” is defined as “three or more loose stools in 24 hours, or two or more loose stools associated with other gastrointestinal symptoms.”^{42(p61)} A survey of the impact of illness and noncombat injuries

on military personnel deployed to Afghanistan during 2003-2004 found that “[while] 54.4% of respondents reported experiencing [such] diarrhea while deployed, the number of diarrhea cases in theater [was] likely underreported.”^{42(p51)}

- A 2006 study of US military personnel deployed to the Middle East also noted a high prevalence of diarrhea but low treatment numbers in theater. While 60% of survey respondents reported an episode of diarrhea or vomiting or both during their deployment, only 30% reported seeking care.⁴²
- In a summary of pathogen prevalence and diarrhea incidence among US military and similar populations by region, the most common infectious agents identified in the Middle East and northern Africa were enterotoxigenic *Escherichia coli* (28.3%), enteroaggregative *Escherichia coli* (16.8%), norovirus (7.1%), and *Shigella* (7.1%). Infection with multiple pathogens (9.3%) was more common than infection with some single agents such as norovirus and *Shigella*.⁴²
- In a survey published in 2006, time spent off base and the consumption of local food were identified as the most important risk factors for diarrhea, and consumption of local food was strongly associated with reports of multiple episodes of diarrhea. This survey of US military personnel deployed to Afghanistan found that 52.8% of survey respondents reported eating local food at least monthly while deployed, and 8.8% reported eating local food daily. The consumption of local food from unapproved sources remains a risk behavior for contracting diarrheal illness in Afghanistan.⁴²
- A round-table discussion on emerging infectious diseases that affect US service members deployed to the Middle East, which was published in 2010, revealed that “a number of infectious agents commonly associated with diarrhea and certain food-borne illnesses, such as brucellosis, hepatitis E, and typhoid fever, are present in Afghanistan and can pose a potential threat to US forces stationed there.”^{42(p51)}

After consideration of prevailing research, on September 29, 2010, the US Department of Veterans Affairs published a final rule that recognized the existence of an association between the risk of certain food-borne illnesses and deployment to Southwest Asia. This rule also outlined a positive association between service

in Southwest Asia during certain periods and the subsequent development of nine infectious diseases, including brucellosis, *Campylobacter jejuni*, nontyphoid *Salmonella*, Q fever, and *Shigella*.⁴⁴ (See also this chapter’s section on food defense for more information about food-borne illnesses that affect US troops who are deployed.)

Research also shows that there is an increased risk of illness after consuming local foods among deployed service members in South and Central America. In 2012, a diarrhea outbreak occurred during a US military training and humanitarian assistance mission in El Salvador. Although service members frequently report suffering from diarrhea during similar short deployments, indepth investigations, such as the one performed by the Naval Medical Research Unit No. 6 after the El Salvador outbreak, usually are not conducted. This naval investigation, which used epidemiological surveys, microscopy, and polymerase chain reaction analysis of stool samples, “concluded that the consumption of food from on-base local vendors (RR = 4.01; 95% CI, 1.53–10.5; and $P < .001$) and arriving on base within the previous 2 weeks (RR = 2.79; 95% CI, 1.35–5.76; and $P < .001$) were associated with increased risk of developing diarrheal disease.”^{43(p64)}

Challenges in Quantifying the Food-borne Illness Burden on Military Missions

In addition to special studies of reported food-borne illnesses, daily and weekly rates of infectious gastrointestinal illness are recorded in the Joint Chiefs of Staff disease nonbattle injury reports submitted through the Joint Medical Work Station. Notifiable infectious gastrointestinal illness can also be reported through service-specific reporting systems. Another means of quantifying the potential disease burden is the review of medical diagnoses entered in applications such as AHLTA-T and TC2 (also known as TMIP-J Composite HealthCare System [CHCS] Cache’ [TC2] [InterSystems Corporation, Cambridge, Massachusetts]), which capture outpatient and inpatient care, respectively.

However, barriers to reporting and system utilization are common, and laboratory diagnostics are limited; therefore, it is difficult to surmise how complete the data are. Disease nonbattle injury reporting often has been shown to underestimate rates of illness and injury and, accordingly, their impact on military missions.⁴⁵ For example, a 2006 systematic review discussing the impact of diarrhea among US military and similar populations showed that diarrhea incidence based on self-reporting was much higher than incidence based on passive surveillance data such as that recorded in the Joint Medical Work Station.⁴⁶

Furthermore, deciphering the true extent to which gastrointestinal symptoms are related to food or water versus noninfectious causes (eg, stress, side effects of certain medications, and changes in eating habits) is challenging. These factors illustrate the limitations of deployment health surveillance as well as those of food-borne illness detection in general, all of which result in an incomplete understanding of diarrheal incidence and its impact on military operations.

While infection from acute food-borne illness can significantly impact military operations, that impact can be magnified by postinfectious sequelae that may not be immediately apparent. For instance, postinfectious irritable bowel syndrome has been identified as a sequela of infectious gastroenteritis in a number of studies.⁴⁷ Given the increased emphasis on COIN operations in Afghanistan and other areas of the world and the potential for long-term sequelae resulting from infectious gastroenteritis, the acute and chronic impacts of food-borne illnesses will probably increase across populations of veterans in the coming years.

The inability of current data systems to demonstrate the true burden of food-borne illness on military missions may cause medical leaders to incorrectly assume that the impact of food-borne illness is limited. To mitigate this threat to service members' health and to operational success, increased focus and resources should be directed to preventing service members' exposure to food-borne illnesses and ultimately to reducing the incidence of food-borne illness (eg, both infectious gastroenteritis and its sequela may be preventable).⁴⁷

Using a Food Risk Communication Campaign to Empower Deployed Service Members

As noted earlier in this chapter, successful COIN operations often hinge on building trusting relationships between military members and local nationals. Sharing endemic foods can play a large role in bridging different cultures and forging good relationships, including those built among leaders (Figure 9-10). However, two key problems stemming from the consumption of local foods should make US commanders wary of extending command approval to this commonly accepted trust-building practice: (1) the higher potential for US service member illness and (2) diminished US troop readiness. In addition to the findings already cited in this chapter,⁴² studies from various Middle East deployments offer more proof in point:

- Of the US personnel deployed to Iraq and Afghanistan between 2003 and 2004, "78.6% of troops in Iraq experienced diarrhea, with

80% seeking care from their unit medics," and eating local foods from non-US sources was associated with an increased risk of their illness.^{43(p64)}

- A study of acute diarrhea in US military personnel deployed to Sinai, Egypt, conducted between May 2004 and January 2005, revealed that one of every five individuals who became ill with diarrhea while deployed to Egypt reported not being able to work because of this food-related illness (missing an average of 2 days); two out of five reported that their work performance decreased because of their illness.⁴³

The Egypt study also noted that "multiple episodes of diarrhea during deployment equate to a large number of lost and diminished duty days for warfighters and [should constitute] a cause of concern for their leaders,"^{43(p64)} especially when preparing troops for deployments. Historically, predeployment training focused on instructing service members to consume only those foods approved by veterinary personnel to decrease the risk of food-borne illness. Service members were not given information about how to make informed local food choices during deployments.

To address this information gap, the APHC, VS, and AMEDDC&S formed a multidisciplinary food safety communication team (FSCT) comprised of health



Figure 9-10. Ninewa provincial reconstruction team members and key leaders for the district of Quarakosh eat lunch after conducting a meeting at the Women's Development Center, near Mosul, Iraq, December 5, 2009.

Reproduced from a US Army photograph (released) taken by Private First Class Ali Hargis.

https://www.dvidshub.net/image/229375/iraqi-farmers-receive-greenhouse-equipment#.VsX_rHnVy70. Accessed February 18, 2016.

information analysts, epidemiologists, food safety and environmental health specialists, and recently deployed preventive medicine and veterinary personnel. The goal of this collaboration was to craft and evaluate a comprehensive health communication package to empower service members to make informed food choices during deployment. The team leveraged a broad range of expertise among its members to develop, disseminate, and evaluate a risk communication campaign to prevent disease among US service members.

Research shows that tailored and targeted communication strategies and messages have been associated with changes in various health-related behaviors.⁴⁸⁻⁵² The FSCT focused its communication strategies on changing deployed service members' local food consumption behaviors as a means of mitigating food-borne illness and used Rogers' innovation-diffusion theory as a framework to develop its targeted health communication package messages and products.⁵² (Rogers' innovation-diffusion theory has been examined in a variety of studies, has contributed to a greater understanding of behavioral change, and has been found to have numerous applications in public health.⁵⁰⁻⁵²)

The communication package designed for service members provides information on how to identify the risk level of common local food items and the importance of avoiding high-risk food items when possible. This package includes the following five products: the (1) *Predeployment Local Food Choices* briefing, which generates awareness of the risks of eating local foods, provides information on choosing lower-risk local foods, and emphasizes the importance of making smarter local food choices; (2) *Food Risk* smart card, (3) *Avoid Higher Risk Foods* sticker; (4) *Be Smart When You Eat Local* poster, which outlines lower-risk and higher-risk local food choices and is formatted for use throughout a deployment; and (5) *Be Smart When You Eat Local* electronic card, which is intended for distribution midway into deployment and reaffirms the benefits of making smart local food choices.⁴²

In addition to the five aforementioned products targeted at service members, two communication package products were developed especially for leaders: the (1) leader smart card (provides leaders with information about the risks of eating local foods and ways to communicate with their personnel about making smarter local food choices); and (2) toolkit for leaders (provides information on how leaders can communicate with their personnel about the risks of eating local foods, the benefits of choosing lower-risk local foods, and the importance of making smarter local food choices). Tools contained in the leader toolkit include messages and talking points, frequently asked questions, and

guidance for effectively disseminating available communication products to service members.⁴²

The entire communication package was designed for use during deployment to any area of responsibility where service members may encounter local foods. Care was taken to ensure that no communication product compromised the mission or superseded command guidance or policy regarding service member interactions with local populations. Most of the package's products are available online from the APHC Health Information Products eCatalog.⁴²

Evaluating Food Risk Communication Campaign Results

A pre- and post-test design was used to evaluate the effectiveness of the *Predeployment Local Food Choices* briefing and three of the communication package products: (1) the *Food Risk* smart card, (2) *Avoid Higher Risk Foods* sticker, and (3) *Be Smart When You Eat Local* poster. In May 2012, a group of more than 100 service members completed a prebriefing survey to evaluate their baseline knowledge and perceptions about local food safety when deployed. Following the pretest, a preventive medicine physician presented the briefing and the three aforementioned communication package products to the group. A post-test was then administered to determine whether the participants gained any new knowledge from the material and gauge their perceptions of the communication products.⁴²

Results showed that, overall, the food safety briefing was effective in educating service members about the risk level of 12 of 13 categories of local foods and beverages. The categories included bread; raw, leafy vegetables; fully cooked vegetables, beans, and rice (kept and served hot); milk and other dairy products; hot tea; meats (boiled or well done and eaten within 2 hours of cooking); bottled water or canned carbonated drinks; and hard-skin fruit (peeled before eating).

Following the briefing, over 85% of all 106 respondents, regardless of their starting knowledge, were able to correctly identify the risk level of each category. Across all of the categories, an average of 44% of respondents moved from answering incorrectly on the prebriefing survey to answering correctly on the postbriefing survey. The specific knowledge gain for the individual categories ranged from 6.7% to 80%, depending on the category.⁴²

Furthermore, most respondents viewed each of the four products (briefing, smart card, sticker, and poster) positively. Virtually all respondents agreed, and approximately 60% strongly agreed, that the purpose of the four products was clear and that they were easy to understand, provided enough

information about risks, and enabled smart local food choices. The same proportions of respondents would recommend these communication products to other deploying service members. About 86% of respondents agreed that the products grabbed their attention and were easy to read (50% of the 86% in agreement strongly agreed). More than 80% of respondents indicated they would refer to the products during deployment.

Evaluation of the communication products yielded insights about the service members' overall perceptions of the materials as well as the efficacy of their messaging. The evaluation also revealed information gaps and improvements that needed to be addressed when designing future communications about the risks of consuming local foods and beverages during deployments, especially concerning certain locally prepared or provided meats and beverages, canned and packaged foods, and hard-skinned fruits peeled by the service member.⁴²

Continuing Efforts to Limit Food-borne Illness Risks in Deployed Environments

Since COIN operations will likely continue in Afghanistan and in other areas of the world, service members' interactions with local populations and exposure to local foods will remain a public health focus for years to come. To protect service members' health, medical leaders, including VS personnel, must understand and communicate the limitations of the food-borne illness data collected in theater and focus on reducing service members' exposure to food-borne illness in deployed settings and, ultimately, its incidence. The FSCT project is an example of what can be achieved when public health professionals and communication experts from varied organizations and disciplines collaborate to protect the health of service members. (See also this chapter's sections on food defense, including the food and water risk assessments [FWRAs], a decision-making tool often used by commanders during COIN operations.)

Emergency Response Activities

The Army's VS engages in a wide variety of emergency response activities worldwide. Whenever service members, their families, and their pets are threatened by emergency events (eg, natural disasters such as earthquakes and hurricanes), the VS responds (eg, noncombatant evacuation operations). A recent example of the VS's capabilities and contributions during disasters is the 2011 earthquake in Japan and its aftermath.

On March 11, 2011, the eastern seaboard of Japan was struck with a devastating 9.0 magnitude earthquake that resulted in two more destructive side effects: (1) a massive tsunami and (2) the subsequent devastation at the Fukushima I Nuclear Power Plant. US Army–Japan and its subordinate units were tasked to support the US military's recovery efforts through Operation Tomodachi (トモダチ作戦) or Operation Friends ("Tomodachi" means "friends" in Japanese). The soldiers of the Japan District Veterinary Command (JDVC), later known as the US Army Public Health District–Japan, provided food and water safety monitoring, animal health care, and public health support during Operation Tomodachi.^{53,54}

A VCO stationed in Japan prior to and during the emergency response efforts offers the following account of initial events: On Friday, March 11, 2011, at 2:46 PM (local), the ground began to shake uncontrollably. JDVC is located at Camp Zama, in the city of Sagami-hara and the prefecture of Kanagawa, 24 miles southwest of Tokyo and almost 250 miles from the earthquake's epicenter. The JDVC headquarters personnel reported that they had to evacuate because the building was shaking violently, and pictures and books were falling from the walls. Outside, the staff was joined by workers from neighboring buildings. This group watched as nearby trees and telephone poles swayed and cars in the parking lot shook back and forth on their suspension systems. Many onlookers reported that the ground beneath their feet felt as if it would open and swallow them (Colonel Margery Hanfelt, US Army Veterinary Corps, former JDVC Commander, personal knowledge).

Because of the power outages at many of the bases occupied by US forces, food and water safety became an immediate concern. Additionally, because of reports in the news media, service members, DoD civilians, and their families became increasingly concerned about the safety of their food and water supplies. The JDVC used public service announcements, interviews with news media, and participation in town hall meetings to address most of these fears (Colonel Margery Hanfelt, US Army Veterinary Corps, former JDVC Commander, personal knowledge).

Other immediate responses included implementing the following general safety measures: the frequency of ISP visits was increased; special emphasis was placed on warehouses, retail sales, and troop feeding; the recently completed Surveillance Food Laboratory was fully staffed with JDVC soldiers and augmentees; and rapid sampling techniques were used to increase the monitoring of food preparation areas and food products (Colonel Margery Hanfelt, US Army Veterinary Corps, former JDVC Commander, personal knowledge).

More specific actions also were quickly undertaken, especially regarding radiation risk control and local food procurement. For example, specially trained and credentialed teams of VFIs were swiftly dispatched with radiation monitoring equipment. Health Physics specialists at APHC–Pacific assisted with training and the selection of sampling points and then monitored the results of all readings daily. Over the next several months, thousands of radiological readings of food (surfaces), food packaging, and warehouse storage areas were taken. No significant threat to human health was ever detected, and no US forces reported illness attributed to radiation poisoning (Colonel Margery Hanfelt, US Army Veterinary Corps, former JDVC Commander, personal knowledge).

On April 1, 2011, ALFOODACT 04-2011, “Suspension of Food Procurement from Specified Regions and Prefectures of Japan,” was coordinated and published to officially announce that most of the locally procured food supplied to US forces from north and west of Tokyo was suspended. Since the area near the Fukushima nuclear power plant is largely agricultural, the suspension of this locally procured produce for a few months following the disaster had a significant effect on the availability of fresh produce for troops stationed in Japan.⁵⁵

In early April 2011, the unit FSOs and their interpreter also began surveying commercial food plants in the region to determine the overall effect on food procurement as a result of the “triple” disaster. Many

of the commercial plants suffered from a lack of power and limited fuel for back-up generation systems as well as raw material supply chain interruptions. A few plants sustained direct physical damage from either the earthquake or tsunami (Colonel Margery Hanfelt, US Army Veterinary Corps, former JDVC Commander, personal knowledge).

The commercial audit program was adjusted to ensure that comprehensive audits of all suspended and suspect plants were performed in the areas of greatest concern, primarily the Tohoku, Chubu, and Kanto regions. The usual predisaster audit team of one veterinarian, one FSO, and an interpreter was augmented by two VFI noncommissioned officers when radiation surveillance and extensive sample selection became the new standing operating procedure. Since the initial March 11, 2011, earthquake, the people of Japan and the soldiers of US Forces Japan have made significant adjustments to ensure food safety. However, inspection frequencies will remain at heightened levels until new reports of contaminated food and food products diminish further. The Fukushima I Nuclear Power Plant disaster, the second-worst nuclear accident ever behind Chernobyl (the 1986 nuclear accident in Pripyat, Ukraine), remains the most complex catastrophe, given the residual effects of both natural and nuclear disasters (Colonel Margery Hanfelt, US Army Veterinary Corps, former JDVC Commander, personal knowledge).

FOOD DEFENSE

The US Army VS food protection program executes food defense activities to prevent the intentional contamination of food, bottled water, and ice from chemical, biological, radiological, nuclear, or physical agents. Protection of the nation’s food supply has economic, social, political, and psychological significance that is magnified by the DoD’s growing role in preventing terrorism. The threat of intentional contamination is further amplified in deployed settings, creating a real and present danger not only in terms of possible casualties, but also in terms of potential mission failures.

Prevention against bioterrorism is an ambitious goal, given the quantity of food destined for DoD personnel and the complexity of food production and delivery systems. As noted earlier in this chapter, myriad food items, which are grown on countless farms, are sometimes transported over long distances through hostile territory before reaching the site where they are finally consumed. This complexity creates opportunities (eg, during transportation, storage, and

preparation) for aggressors to intentionally contaminate food. An integrated effort between key experts (eg, intelligence, antiterrorism and force protection, police force, and public health personnel) is critical to systematically evaluate and deliberately mitigate vulnerabilities.

For example, the bulk of food delivered to US forces in an operational environment is harvested, processed, and packaged in the United States, then transported to a stateside port and loaded onto a ship that is bound for another country. At a foreign port, food shipments are off-loaded onto contracted trucks with contracted drivers and transported (often through several countries) before eventually arriving at multiple, geographically dispersed forward operating bases. This example clearly outlines numerous opportunities for those who seek to intentionally contaminate the food supply destined for DoD personnel abroad. However, the threat of intentional contamination is not limited to deployed combat operations; it also applies to stateside DoD assets.

Terrorists know that a successful agroterrorism incident threatens America's economic welfare and its standing as a leading exporter of agriculture products to the world. Agriculture-related products comprise nearly 10% of all US exports, which amounted to nearly \$68 billion in 2006.⁵⁷ Although there are numerous US targets that would provide terrorists with high-profile results, these targets are often well protected. Consequently, terrorists now seek softer targets such as US agricultural resources, the destruction of which would still produce crippling economic and psychological effects. The cost-versus-reward ratio of targeting agricultural production is also attractive to terrorists because many methods of implementing this tactic are low tech and low cost. The VS employs a proactive approach to food defense programs to confront these threats by working closely with the USDA, FDA, and local agricultural groups; identifying potential vulnerabilities in food systems; and developing simple, low-cost mitigation strategies to reduce or eliminate such threats from various aggressors.

Aggressors can be divided into four categories: (1) disgruntled employees, (2) criminals, (3) protestors, and (4) terrorists. Terrorists are usually politically or ideologically motivated and often work in small, organized groups. Although terrorists pose a threat to DoD food supplies, other types of aggressors, such as those mentioned in the examples below, pose a greater national risk and must be addressed when a risk mitigation strategy is being developed. Understanding what motivates aggressors is critical to crafting effective risk mitigation strategies to stop them at home and abroad.⁵⁶

While numerous examples of intentional poisoning of fellow citizens exist worldwide, "home-grown threats" have also been noted in the United States. In 1984, members of a cult headed by Bhagwan Shree Rajneesh used cultivated *Salmonella* bacteria to contaminate restaurant salad bars in Wasco County, Oregon; their intent was to sway a local election's outcome. More than 750 people were infected. The motivations for poisoning can be varied, but this cult was politically motivated.⁵⁷

A high-profile incident of an insider threat occurred in Dallas, Texas, in 1996, when a former laboratory employee pled guilty to contaminating a tray of doughnuts and muffins with the food-borne pathogen *Shigella* and inviting 45 other laboratory workers to enjoy these pastries in a break room. Only 12 of the 45 employees consumed the contaminated pastries, but these employees suffered severe gastrointestinal illness as a result. An investigation later revealed that the perpetrator was a disgruntled employee who had also poisoned her boyfriend with the contaminated

food. It is clear from these examples that knowledge of aggressors' possible motivations can be an important tool for shaping effective prevention and mitigation programs.⁵⁷

The authority to execute food defense activities stemmed from the Bioterrorism Act of 2002. This act authorized the Secretary of Health and Human Services, acting through the US Food and Drug Administration, to issue regulations to protect the nation's food and drug supplies against bioterrorism. Additionally, DoD Directive 6400.04E designated the responsibilities of the Secretary of the Army as the DoD executive agent for DoD Veterinary Public and Animal Health Services and provided the VS the authority to plan and deliver food. The DoD now implements several food protection programs in which food defense requirements have been embedded, including food protection audits, installation food vulnerability assessments, special events assessments, higher headquarters assessments, and FWRA protection (Colonel Scott Severin, US Army Veterinary Corps [Retired], personal knowledge of the effects of the Bioterrorism Act of 2002's effects on veterinary food defense activities).

Food Defense Initiatives

The Need for Revised Food Audit Programs and Other New Assessment Programs

The attack on the World Trade Center on September 11, 2001, exposed homeland vulnerabilities that stimulated the United States and its military to change its mindset about food defense. US leaders immediately recognized that if terrorists could target symbolic American buildings and kill nearly 3,000 people, they could also contaminate US food production facilities; the resulting food injuries and food-borne illnesses could severely impact DoD personnel worldwide.

Consequently, multiple food defense initiatives were systematically undertaken, and food defense was immediately combined with preexisting food safety programs. For example, one initiative stipulates that the commercial food facilities currently listed in *US-APHC Circular 40-1, Worldwide Directory of Sanitarily Approved Food Establishments for Armed Forces Procurement* (better known by its shortened title, *Worldwide Directory*) should have their food defense programs evaluated. One of the many benefits of adding food defense to the food protection audit program is the increased ability using new guidance to safeguard those plants that produce critical food supplies such as MREs. *Military Standard 3006C* (MIL-STD-3006C) is the current standard under which food protection

audits are performed (supersedes *Military Standard 3006A*, 2002, and *Military Standard 3006B*, 2008). MIL-STD 3006C expands the philosophy and scope of force protection audits to include food defense findings.^{10,11}

A food defense finding is defined as “any condition, practice, step or procedure noted (during a food protection audit) relating to the risk of intentional food tampering or increased food vulnerability.”^{11(p2)} Food defense findings can occur at any stage of subsistence procurement, including receipt, storage, processing, packaging, packing, warehousing, and distribution.¹¹

The adoption of other food defense initiatives (eg, the IFVA program) provides a broader level of protection for the food supplies destined for military installations.⁵⁸ In 2002, the US Army Center for Health Promotion and Preventive Medicine, in coordination with the DoD VS Activity, created *Technical Guide 188, US Army Food and Water Vulnerability Assessment Guide* (TG 188).⁵⁹ TG 188 establishes the guidance and framework to reduce the vulnerability of food and water supplies to terrorist attacks by identifying soft targets and providing commanders with recommendations to prevent or mitigate such attacks.

The current food defense reference is *USAPHC Technical Guide 355, IFVA Program Handbook* (TG 355), released in November 2012.⁶⁰ This handbook was published to complement TG 188 and provides further policy, procedures, and guidance for the implementation and management of the IFVA program at the installation level, including clearly outlining how IFVAs are conducted to standardize the process across all DoD installations.

The IFVA is a critical tool in shaping an installation’s food defense programs, which are further nested within installations’ antiterrorism and force protection programs. The annual IFVA evaluates the vulnerabilities of all food-related activities (ie, receipt, storage, preparation, and distribution) on DoD installations. The results of this evaluation become part of an overall installation risk assessment, which is consolidated by the installation antiterrorism and force protection officer and compiled into a briefing for the installation commander.⁶⁰

Recommendations for the mitigation of identified vulnerabilities are also incorporated into an installation’s force protection condition program and are used to develop the food VS annex to the installation’s emergency response plan. These plans help personnel who are involved in the installation food defense program to better understand their defined roles during an emergency situation.⁶⁰

Special events assessments, conducted by food and water defense (FAWD) teams, are a collaborative effort designed to reduce the vulnerability of food

and beverage service to intentional contamination or disruption by terrorists or criminals at events where DoD personnel present an attractive target. Unique risks associated with special events may include the following factors: (a) most are at off-installation locations with potentially varying levels of security; (b) these types of events are well publicized and may be open to the general public; and (c) when off-installation special events are held, facilities may not be required to meet DoD public health standards, and contractors may not meet federal security or training criteria. A FAWD team must view potential targets from the terrorist’s perspective and accurately communicate identified risks to the special event security manager.⁶⁰

The VS currently collaborates with DoD security teams to execute FAWD assessments at special events to mitigate risk and safeguard DoD personnel. This collaboration is initiated when a security team supporting a special event requests a FAWD assessment. A FAWD team generally consists of veterinary and preventive medicine officers who generate a joint report for the security team lead for inclusion in the overall facility risk assessment. Based on the FAWD team’s recommendations, the security team lead determines whether a food defense team is needed on-site during the special event to provide further food protection. FAWD team personnel may need to be present well before the event begins to ensure that food supplies are properly received and stored prior to being prepared and served. Another key aspect of supporting any special event is the collection of food samples for submission to a diagnostic laboratory should a food-borne outbreak occur.⁶⁰

Higher headquarters assessments are an evaluation of an installation’s ability to protect its personnel from terrorist attacks. Installations are inspected at various frequencies by two higher headquarters levels: (1) the Defense Threat Reduction Agency and (2) higher headquarters assessment (HHA) teams. The Defense Threat Reduction Agency executes a joint staff integrated vulnerability assessment (JSIVA) program conducted at the DoD level. The HHAs are conducted on a more frequent basis by major commands such as the Army Materiel Command and the Installation Management Command. An important aspect of both the JSIVA and HHA is the evaluation of the DoD food vulnerability assessment benchmarks, including a review of the annual IFVA conducted by local VS food defense personnel. Findings made during the JSIVA and HHA are reported to the respective team leaders and the installation’s command group for the elimination or mitigation of all identified vulnerabilities and concerns.⁶⁰

The Emergence of Food and Water Risk Assessments for Use During Deployments

The purchase and consumption of subsistence procured in some overseas locations can be risky because, in many countries, endemic food-borne diseases are exacerbated by poor hygienic practices in restaurants and other commercial catering establishments. Sanitation risks include the “lack of potable water and sanitizing supplies, improper sanitizing procedures, poor sanitary standards, questionable health standards among workers, a poorly trained workforce, and the use of manual or hands-on food processing techniques.”^{43(p63)} Risks unique to particular countries or regions include “lack of food sanitation hygiene laws; insufficient oversight by the local civilian government (regulators); lack of animal herd health monitoring programs and associated controls for endemic diseases; inadequate health care systems; improper use of pesticides and chemicals; and the lack of food vendor accountability in the event of food-borne illnesses.”^{43(p63)}

To address these risks, OCONUS commercial food establishments that sell to the DoD are audited by VS VCOs, thus ensuring compliance with regulatory, industry, and DoD requirements. As noted earlier in this chapter, when a food production facility passes a food protection audit in accordance with military standards, the facility is listed in the *Worldwide Directory*. A facility’s placement on this global list assures that it has achieved the established food protection (food safety and defense) benchmarks, thus reducing the risk of food-borne disease to service members and their families worldwide.⁴³

Unfortunately, when growing numbers of service members were deployed to various remote locations such as Beyond the Horizon exercises in Panama and foreign humanitarian assistance operations in Pakistan, purchasing food from listed, DoD-approved food sources became increasingly difficult. Although most major exercises are usually conducted near larger cities where DoD-approved food sources are more readily available and logistically feasible, the main thrust of remote exercises and operations is to serve the most in-need populations, which are often located in rural areas where DoD-approved food sources may be unavailable or impracticable.⁴³

Problems also surfaced when military standards were used to assess developing countries’ food operations, especially in more rural areas where local food safety practices were less stringent and often did not meet audit requirements. VCOs had to assign failing ratings to the majority of audited facilities in develop-

ing countries, leaving commanders without realistic feeding options, which, in turn, affected the VC’s ability to support the worldwide missions the DoD considered essential.⁴³

Over time, VC leaders recognized that a new evaluation system had to be developed to support commanders and their missions while still preventing food-borne disease. A collective new system, the food and water risk assessment (FWRA) program, was developed so that trained assessors could “identify, assess, and communicate food-borne illness risks associated with food preparation operations such as hotel kitchens, restaurants, caterers, and military feeding operations, including facilities used during exercises and host nation dining facilities.”^{43(p63)} The actual document created to assess such food operations is called *Military Standard 3041, Requirements for FWRA*s (MIL-STD-3041).⁶¹

Both MIL-STD-3006C and MIL-STD-3041 are based on the same US federal food safety laws. However, while MIL-STD-3006C is coupled with a form of a “pass” or “fail” audit of a food establishment, MIL-STD-3041 mandates use of an FWRA to identify associated risks and assign an overall level of risk. Commanders then can determine their acceptable level of risk based on VC risk mitigation recommendations.⁴³

Currently, the FWRA program is transitioning to MIL-STD-3041, new handbook guidelines, and checklist improvements, which were released in 2013. The consolidated and updated checklist allows assessors to systematically evaluate food operations for exercise feeding plans and provides assessors with tools to recommend exclusion of higher-risk food items (eg, unpasteurized dairy products that pose a threat of brucellosis) from food operations.⁴³

Integrating Department of Defense-Approved Food Sources and Food and Water Risk Assessments During Military Exercises. Military exercise planners who support service members in deployed areas must construct the safest feeding plan possible within the mission requirements. Although there is usually no single solution that will prevent an outbreak of food-borne illness, using an integrated risk-based intervention approach to food protection is the most efficient and effective means of reducing service member morbidity rates. The goal is to prevent service members from consuming higher-risk local foods from sources whose employees’ food service training is questionable and whose sanitation conditions are poor (Figure 9-11).⁴³

DoD-approved food sources are the foundation of food protection for US troops stationed anywhere in the world and, thus, should be the first choice for feeding small groups during military exercises.

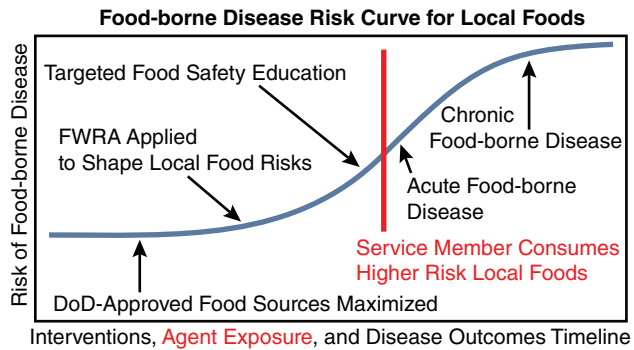


Figure 9-11. Food-borne disease risk curve for local foods. DoD: Department of Defense
FWRA: food and water risk assessment

Operational rations are the next preferred food safety option—above higher-risk local food sources—when DoD-approved sources are not available.

If planners cannot rely on either DoD-approved food sources or operational rations when feeding small groups of deployed troops, they may need to request an FWRA, the first step toward local food procurement. FWRAs are not required when deployed service members are reimbursed on a per diem basis because their purchased meals are not US government-contracted meals. (Troops usually choose which local establishments they would like to eat at when they are provided daily allowances for expenses.) However, planners who implement the per diem feeding option should still consider using FWRAs, particularly to evaluate those local food operations that military members frequent most, as a means of lowering the risk of troops incurring food-borne illnesses from these popular establishments.

Another feeding option for small groups who are deployed is to contract meals from local restaurants or caterers. Because this option mandates that service members eat local foods provided by US-government contracted local food operations, an FWRA is required to ensure that any food protection risks are understood and mitigated and only the safest local food operations are selected for the contracted meals.

FWRAs can be loosely divided into two groups: (1) those evaluations performed on upscale hotels (often large hotel chains) that host DoD-sponsored conferences in major cities and (2) those evaluations conducted in support of military exercises, often outside urban areas, where impoverished rural populations are generally located. Currently, the majority of FWRAs are group one evaluations. A case in point is the US Southern Command's area of focus; here, upscale hotels are routinely assessed every 6 months.⁴³

Generally, upscale hotel assessments are facility-based evaluations of individual urban hotel kitchens, which maintain food protection practices that are comparable to those in use at similar hotels in the United States. Although upscale hotel assessments are usually not performed to support military exercises, they do establish current risk assessments for hotels that are highly frequented by US service members.⁴³

Unlike urban assessments, FWRAs conducted in support of exercises in less-developed areas often require assessors (usually VS personnel) to evaluate higher-risk, moderate-scale hotel kitchens and consider the complete (beyond-the-hotel) exercise feeding plan. For example, heightened water quality concerns in rural areas (often stemming from inferior water distribution systems and increased agricultural use) create a need for safer bottled water sources. Fresh fruits and vegetables and, as previously mentioned, local restaurants and caterers must also be assessed for their potential inclusion in feeding plans. A case in point, during Operation Martillo (Spanish for “hammer”) in Guatemala in August 2012, multiple food options were leveraged in the exercise feeding plan. Bottled water was procured from a DoD-approved source in Guatemala City. Fresh fruits and vegetables were delivered from a local supermarket. UGRs and MREs were served at operation sites, and, occasionally, meals were catered by a local hotel restaurant.⁴³

Of these various food and water sources, the highest risk of food-borne illness usually stems from local restaurants (ie, stand-alone establishments or those in hotels). Common risks include unapproved raw materials, inadequate refrigerator or freezer space, unsanitary food preparation surfaces, and improper handling of potentially hazardous foods such as ice. Food service personnel often fail to recognize ice as a ready-to-eat food that is easily contaminated by improper handling. Examples include restaurants in developing countries that, in an attempt to save money, may make their own ice or serve the same ice used to keep foodstuffs cold (ie, as a refrigerant) to customers ordering drinks in beverage glasses.⁴³

Assessors also advise contractors and commanders on less obvious risks. For example, a hotel kitchen with a moderate risk of food-borne illness when serving below its maximum capacity may present an extremely high food-borne illness risk if required to double the number of meals served.⁴³

Understanding the Process and Challenges of Providing Effective Food and Water Risk Assessment Risk Communication. Providing ongoing risk communications to commanders and service members who may encounter higher-risk local foods can significantly reduce the incidence and impact of food-borne diseases. Other key stakeholders in the risk communication

process include the assessor and the contractor. “The assessor evaluates food operation risks and assists the contractor in embedding food safety requirements into a contractor’s statement of work. This relationship with contractors is crucial to affect the most change within the food operation.”^{43(p65-66)} A statement of work may direct a food establishment to replace excessively worn cutting boards, purchase additional freezers to ensure ample cold storage, or make kitchen and building improvements. This statement could even direct the use of thermometers to enable the food establishment to provide foods or food services to US service members.⁴³

The assessor communicates risk using the risk assessment matrix (Figure 9-12) similar to the one found in Field Manual (FM) 5-19, *Composite Risk Management*.⁶² Because commanders are accustomed to this type of risk communication, they can place food-borne illness threats in the same context as other operational risks and assign an appropriate weight to this information in comparison with other risks present on the battlefield. Use of this matrix system must remain central to the command’s planning process if all threats are to be communicated to leaders as transparently as possible.^{43,63}

In fact, effective risk communication presents, possibly, the greatest challenge within the FWRA program. Although VCOs do an outstanding job of identifying threats and assessing food protection risks, those threats and risks must be communicated properly to the commanders and service members who will use the particular food operations. As commands improve and expand their use of FWRAs, great care should be taken to develop processes that do not substitute effective risk communication with convenient contracting. Specifically, food operations should not receive a “Pass” or “Fail” designation based on the FWRA. Rather, informed commanders must weigh the FWRA risk level assigned against mission requirements and either accept or reject the risk. Contracts should only be formed after risks have been accepted by supported commanders, and those risks should be fully reevaluated prior to any contract renewal.

Despite the risks that exist within the FWRA program, it presents several means by which food safety can be improved, including the food operations recommendations and onsite training. Such training creates an opportunity for skilled assessors to impart their expertise. The program’s capability to directly engage

HAZARD SEVERITY	HAZARD PROBABILITY				
	Frequent (A)	Likely (B)	Occasional (C)	Seldom (D)	Unlikely (E)
Catastrophic (I)	Extremely High	Extremely High	High	High	Moderate
Critical (II)	Extremely High	High	High	Moderate	Low
Marginal (III)	High	Moderate	Moderate	Low	Low
Negligible (IV)	Moderate	Low	Low	Low	Low
	RISK ESTIMATE				

Figure 9-12. Risk management matrix for measuring operational risks, including food-borne illness threats. Hazard Probability: (A) **Frequent**: occurs very often and continuously experienced; (B) **Likely**: occurs several times; (C) **Occasional**: occurs sporadically; (D) **Seldom**: remotely possible, but could occur at some time; and (E) **Unlikely**: can assume hazard will not occur, but is not impossible Hazard Severity: (I) **Catastrophic**: loss of ability to accomplish the mission or mission failure (example indicators include death or widespread illness); (II) **Critical**: significantly or severely degraded mission capability or unit readiness (example indicators include multiple food-borne illness incidences); (III) **Marginal**: degraded mission capability or unite readiness (example indicators include sporadic food-borne illness and loss of confidence in food supply safety); and (IV) **Negligible**: little or no adverse impact on mission capability
Adapted from Figure 4 in Killian JW, Burke RL, Westover JE. Food and water risk assessments: empowering commanders and protecting service members. *US Army Med Dep J*. 2013 Jan-Mar: 66.

partner nations and deliver simple and sustainable food protection training that impacts host nation health may also open the door to exercise-related training engagements apart from the FWRA program.

Even when DoD-approved food sources or operational rations are maximized, FWRAs are leveraged, and onsite training is conducted, service members still encounter higher-risk local foods, often by choice. When such encounters occur, troops also must be armed with sufficient food protection knowledge to enable them to make safer local food choices. Online educational materials provided by government websites provide realistic guidance on reducing the incidence of food-borne diseases associated with local food consumption. For example, information on diseases ranging from acute bouts of diarrhea from *Campylobacter* to life-long spondylodiscitis and sacroilitis from diseases such as brucellosis (contracted by consuming unpasteurized milk) is located on the APHC's page, "Local Food Choices During Deployment."⁶⁴

The FWRA program has experienced rapid growth because of its tremendous value to supported commanders: it empowers them to make confident decisions, meshes with COIN operations, and is more applicable to developing countries. Overall, the FWRA program allows higher-risk food operations to be considered for use during deployments but requires an increased focus on food-borne disease mitigation. Commanders should not assume that food operations contracted under the FWRA program are as safe as DoD-approved sources or naively form contracts based on convenience rather than accepted food safety risks and mission requirements.⁴³

The Emergence of Food and Water Risk Assessments During Foreign Humanitarian Assistance Operations

Foreign Humanitarian Assistance (FHA) operations generally require quick responses to counter the immediate human suffering caused by natural disasters and other humanitarian crises. However, because these incidents often occur in regions of the world where DoD-approved sources often are not present in the first place, establishing a formal supply system (ie, securing DoD-approved sources or operational rations) may be impossible. Conducting the sanitary food protection audits necessary to secure approved suppliers in a timely manner may not be practical for two other key reasons: (1) those that were available are often severely crippled (and sometimes even wiped away) by the disaster; and (2) the transient nature of the FHAs limits the long-term value of the audits as the operation may conclude before final approval is granted. Consequently, commanders leading FHA

operations often rely on FWRAs as a valuable alternative for providing sustenance to US service members while continuing to ensure force health protection.⁴³

A case in point is the DoD flood relief effort in Pakistan in 2010. During these FHA operations, FWRAs were conducted at three US base camps in Pakistan, where the initial overall risk assessment for all three locations was "high," primarily because microbial contamination threatened both food and water. By implementing recommended FWRA control measures, the overall risk was reduced to "moderate."⁴³

The key recommendations included the following safeguards: (a) the removal of all ruminant meat and meat products from the menu (because of the potential risk of bovine spongiform encephalopathy or "mad cow disease"); (b) increasing the cooking times and temperatures to US-required levels; (c) using bottled water (from an approved source) for cooking; (d) substituting high-risk food items on the menu with lower-risk food items that were exempt from requiring approval (eg, replacing locally manufactured products with products imported from Europe); (e) chlorinating bulk water tanks used for washing dishes and cookware and testing them monthly for residual chlorine; and (f) establishing mess trailers for food preparation and dining. Implementing these recommendations did not completely eliminate the risk of food-borne illness, but they did reduce the overall risk to a level that was acceptable to the commander without negatively impacting FHA operations in Pakistan.^{43(p67)}

Food Defense Training

The emergence of a robust food defense program required the legacy VETCOM to create a food defense training cell to instruct NCOs and VCOs on the performance of food defense initiatives. Increasing the number of trained food defense personnel was critical in building a food defense expertise base. Upon VETCOM's deactivation, the AMEDDC&S, located at Joint Base San Antonio-Ft Sam Houston, Texas, assumed full responsibility for food defense training, which includes embedding and updating food defense training materials in all its active duty and reserve courses.

In February 2015, the AMEDDC&S was designated as the Army's HRCoE, and the food defense mission of the DoD is now fully embedded in the daily duties of veterinary and preventive medicine personnel who provide technical support and guidance for food and water vulnerability assessments and food defense at the installation level. This service also has been elevated to the forefront of food defense NCOs' daily mission priority. Additionally, the AMEDDC&S, HRCoE, delivers worldwide food defense training via

veterinary training and assistance teams. These teams are in high demand and have traveled to DoD installations in Japan, Germany, and Kuwait (Colonel Jerrod Killian, chapter author, personal knowledge).

As the food defense mission expands and budgets decrease, it is critical that financial resources be care-

fully aligned with personnel assets to obtain the most effective food defense posture possible. This targeted approach must anticipate risks, match the enemy's resourcefulness, and remain sufficiently flexible to adjust rapidly when new intelligence is provided or old intelligence changes.

CONCLUSION

The VS is a key DoD food protection agent. Prior to the terrorist attacks on September 11, 2001, the VS's mission was monitoring security concerns and protecting food from intentional contamination; however, these attacks catalyzed the US military's new multifaceted, integrated food defense posture. The VS's current mission is twofold: to protect service members and their families from intentional and unintentional food-borne illness while also protecting the financial interests of the government. This dual mission is commonly referred to, respectively, as "conserve the fighting strength" and "financial stewardship."

Regardless of the mission title, prevention—both of illness and monetary loss—is the VS's primary goal. The VS remains adaptive and committed to excellence when investing in personnel, prioritizing training, and ensuring mission execution. This proactive and adaptive posture was the cornerstone when valuable contributions were made during Operation Tomodachi in Japan and continues to guide the VS when food risks are encountered during COIN operations, when FWRAs are instituted, and when critical food defense missions are launched.

The VS could not accomplish such missions without the integration of various federal, state, and local agencies; commercial industry; and academia and continues to forge new relationships to better integrate its food defense efforts. For example, the VS mission on military installations is deliberately embedded within tailored ISPs that are developed to prevent the intentional and unintentional contamination of food. However, food defense and food safety must be developed individually—as well as jointly—to eliminate any gaps that could create weaknesses if these missions were only approached separately.

While the food safety mission has increased in priority, quality assurance remains an important aspect of the VS mission, and financial stewardship, the second tenet of the mission, is becoming increasingly critical in today's era of fiscal responsibility. The cost savings to the government is not one-dimensional. Achieving the most savings possible is the result of careful planning and the implementation of programs designed with an emphasis on saving money.

In some instances, a more expensive product, package, or process will yield the most savings. A case in point is the Cook Chill system (Plascon Group, Traverse City, Michigan) installed at the US Military Academy at West Point, New York. The academy kitchen used to cook what soups and gravies were needed for service and then continue using what was left over for the next day or two. This conventional production process seemed—on the surface—to be the best way to make and use these food items. Conversely—at the outset—the new Cook Chill system was more expensive to use, including the packaging material it required; however, this initially large investment ultimately saved thousands of dollars a year and improved operations. Since the packages were sealed in sizes that allowed more control of how much was used and an ice bath was utilized to rapidly cool down the heat-vacuumed bags, the end results were substantially favorable: less waste; a safer, more consistent, higher-quality product with a much longer shelf-life; the capability to ship products to other facilities for consumption; and overall cost savings (Colonel Jerrod Killian, chapter author, personal knowledge).

Other areas in which VS programs and procedures have saved defense dollars include the shelf-life extension program (OCONUS), contract procurement, salvage operations, management and control programs, organizational inspection program visits, and consultations and corrections in food storage and shipping operations.

Although the food protection goals of safeguarding warfighters and saving government resources remain constant, the methods to achieve these goals must deliberately evolve to address emerging threats. Attempts to improve every aspect of food protection include a constant search for better processes, equipment, and training. To that end, efforts are underway to increase the readiness and capabilities of VS personnel by placing personnel more precisely, promoting quality advanced schooling, and leveraging modern technology. The VC is challenged to identify, evaluate, and incorporate any system or product that will improve job performance, cost savings, and safety.

Finally, the interconnected global food market has created additional challenges in implementing food protection for US personnel serving at home and

abroad. Although food supply-chain logistics—purchasing, storing, shipping, preparing, and serving safe food—have always been important command considerations, the VS must continue to help commanders realize that

food-borne illness, an inherent risk that is intensified in deployed locations, is preventable, especially when FWRAs are implemented and service members are empowered with knowledge about local food safety risks.

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