

# Recreation Management

## Tech Tips

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### Do Hand Sanitizers Really Work?

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#### INTRODUCTION

Field crews, such as firefighters, trail crews, back-country rangers, and restoration teams often spike camp (i.e., a remote camp usually near a fireline, and lacking the logistical support of a larger fire camp) in the backcountry. Since water must be packed in to some camps, there might be insufficient quantities of water for personal hygiene needs. Portable hand-washing stations exist but they may not be appropriate for back-country situations. The health risk to field crews is always high when personnel are spiked out for long periods of time and not provided with adequate hand-washing facilities. The supply unit issues firefighters gel hand sanitizers, foam hand sanitizers, or prewetted disposable wipes, but their effectiveness for hand cleaning is unknown.

#### PURPOSE AND SCOPE

The purpose of this project is to evaluate some waterless hand cleaners, plus soap and water. Sometimes water is scarce at spike camps, trail camps, and remote campgrounds and, when water has to be packed in, it often is used for drinking and cooking instead of hygiene.



*Figure 1—An alcohol-based gel sanitizer is the most popular among Forest Service recreation staff.*

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To find out if any of the hand sanitizers are a good substitute for soap and water, staff from the San Dimas, California, campus of the National Technology and Development Center of the Forest Service, U.S. Department of Agriculture, worked informally with scientists at the U.S. Environmental Protection Agency (EPA) to determine if there was a general bacterial reduction on hands cleaned with different hand sanitizers and soap and water. The EPA scientists used an assay medium that grows colonies of a broad range of aerobic (i.e., without oxygen) bacteria of which only a few make people sick. They counted the bacterial colonies, but did not identify bacteria by type because of the immense number of bacteria present.

Scientists did not evaluate virus reduction because there is no broad test for viruses. Viral assays are specific to a particular variety of virus and are very costly and time consuming to conduct.

Products were limited to hand sanitizers currently available to firefighters from the National Incident Support Cache (fire cache), and to those commonly used by recreation staff, which were identified by an informal questionnaire. Figure 2 shows the products chosen for evaluation.



Figure 2—These products were chosen for evaluation.

An informal questionnaire was sent to FS-RECTALK, a Forest Service recreation staff listserv, asking which type of waterless hand cleaners were used. San Dimas staff also distributed a questionnaire to fire personnel during a national logistics workshop. Questionnaire responses indicated that personnel used a variety of brands, including multiple brands of disposable wipes and alcohol-based gels.

Because EPA and Forest Service staffs could not evaluate all brands of similar products, San Dimas staff selected the respondents' most popular hand sanitizer, an alcohol-based gel (Purell®) (figure 1). We also selected two benzethonium-chloride-based prewetted disposable wipes (one readily available—Wet Ones®, and one available in fire caches—Just Clean Skin®); a large disposable towel (Shower Express®); and a benzethonium-chloride-based foam (DepHyze®). We also selected an antibacterial soap (Softsoap®) to use with water.

## PROCEDURE

Working under the terms of the agreement, scientists from the EPA wrote an evaluation protocol and performed the laboratory work; the Forest Service provided the supplies and sampled the dirty hands.

Each cleaner was used by 10 individuals. Samples were taken before the individuals cleaned their hands, and again immediately after they cleaned their hands.

The EPA staff suggested modifying the juicing-glove sampling method (figure 3) by using quart-size plastic bags to create the samples (figure 4). This new size proved easier for removing the hand from the bag without contaminating the sample.



*Figure 3—With the juicing glove sampling method, a hand is placed in a sterile glove, buffer solution is added, and the solution is massaged around the hand for 1 minute.*

*Figure 4—A quart-size bag was used in place of a glove to obtain samples.*



The unwashed hand is placed in a plastic bag and 100 milliliters of sterile buffer solution is poured into the bag. The buffer solution is massaged around the hand for 1 minute. The hand is removed from the bag, and the juice is poured into a labeled sterile specimen container (figure 5).



*Figure 5—The juice is poured into a labeled, sterile cup.*

The volunteer then cleans his/her hands following the directions on the sanitizer. The cleaned hand is placed in a new bag, sterile buffer solution is added, and the liquid is massaged around the hand for 1 minute. The juice is poured into a labeled sterile container. The containers were placed in an ice chest with artificial ice packs. At the end of each day, the ice chest was shipped overnight for early morning delivery. The box arrived at the EPA lab by 8:00 a.m. Artificial ice packs maintained an approximate holding temperature of 4 °C during shipment. San Dimas staff arranged with fire officials to set up a field station before the mobile hand-wash station at the Sayre fire incident command post located at Hanson Dam in California (figure 6). Fire personnel were asked if they wanted to participate in the study while they were waiting in line for dinner.



*Figure 6—Field station set up at the Hanson Dam incident command post.*

## RESULTS

At the EPA lab, dilutions of the samples were made. Scientists analyzed the samples using plates made with tryptic soy agar and counted the number of bacterial colonies that grew. The results are shown in table 1. No definitive statistical difference was found between most of these hand sanitizers. This study was not designed to show a statistical significance. A definitive conclusion can not be drawn because of the relatively low number of participants and the nonstandardized levels of

initial bacterial densities on the participants' hands. Although the hands still contain bacteria after they have been cleaned, there is reduction in bacteria with most of the products. With a 1 to 2- $\log_{10}$  (90 percent to 99 percent) decrease, the hands contain much less bacteria.

Table 1—The average  $\log_{10}$  bacterial count on hands before and after cleaning, and the  $\log_{10}$  decrease for each product.

Product	$\log_{10}$ dirty	$\log_{10}$ clean	$\log_{10}$ decrease	Percent decrease
DepHyze: (Average of 10)	6.89	5.57	1.32	95.2%
Just Clean Skin: (Average of 9)	5.08	2.5	2.58	99.7%
Shower Express: (Average of 10)	7.41	6.97	0.44	63.7%
Purell: (Average of 9)	6.81	5.7	1.11	92.2%
Wet ones: (Average of 10)	6.53	4.96	1.57	97.3%
Soap and Water: (Average of 10)	4.06	3.52	0.54	71.2%
Control samples	4.05	3.89	0.16 (On 11/19/08)**	33.2%
	5.06	4.81	0.35 (On 12/09/08)	39.8%

*\*\*Two control samples were taken to see how much cleaning the buffer solution accomplished. These were before and after samples with no cleaning in between.*

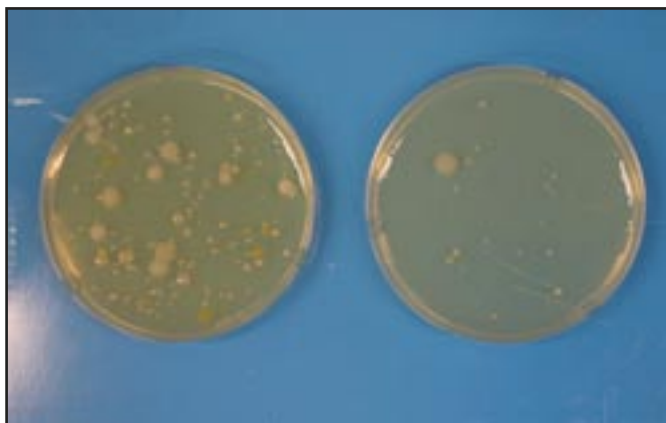
## WHAT THE NUMBERS MEAN

If dirty hands have a count of 5.00  $\log_{10}$ , that is 100,000 bacteria. If clean hands have a count of 3.00  $\log_{10}$  that is 1,000 bacteria (table 2). The 2.00  $\log_{10}$  decrease means that 99 percent of bacteria were eliminated  $[(100,000-1,000)/100,000] \times 100 = 99$  percent.

Table 2— $\log_{10}$  table.

Count	$\log_{10}$
10,000,000	7.00
1,000,000	6.00
100,000	5.00
10,000	4.00
1,000	3.00
100	2.00
10	1.00
1	0.00

Plates were saved, and a random selection of bacteria was chosen for biochemical testing to determine some of the kinds of bacteria found on the firefighters' hands. The bacteria found was typical of those commonly found in soil, air, and water. In the limited selection of bacteria we identified, we did not find any enteric bacteria (i.e., bacteria of fecal origin). Because of the huge number of bacteria found per hand (both before and after cleaning (figure 7)), and the variety of colony colors and morphology, it is impractical to get a good cross section of the organisms and their classifications.



*Figure 7—A before and after set of tryptic soy agar plates.*

## SUMMARY

Most of the products evaluated appear to provide the same or better protection from bacteria as washing with soap and water. Although none of the products or techniques eliminated all bacteria from the hands, the amount of bacteria was reduced by 90 to 99 percent in most cases. Most of these products are suitable to use when soap and water are not available.

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