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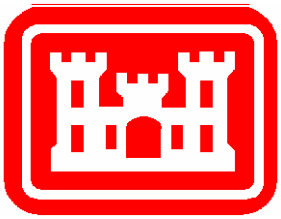

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GUIDANCE TO SELECT DETERGENTS FOR USE AT ARMY WASHRACKS

1. Purpose.

a. This Public Works Technical Bulletin (PWTB) transmits the results of a washrack detergent evaluation study sponsored by the Environmental Division of the Fort Benning, GA, Directorate of Public Works (DPW). The study determined the relative compatibility of several detergents with oil/water separators and biological wastewater treatment systems. This PWTB is intended for use by DPW environmental personnel when deciding which cleaning products will be allowed at washracks and maintenance cleaning facilities on an Army installation.

b. All PWTBs are available electronically (in Adobe® Acrobat® portable document format [PDF]) through the World Wide Web (WWW) at the National Institute of Building Sciences' Whole Building Design Guide web page, which is accessible through URL:

http://www.wbdg.org/ccb/browse_cat.php?o=31&c=215

2. Applicability. This PWTB applies to all U.S. Army facilities engineering, public works, or environmental directorate activities.

3. References.

a. Army Regulation (AR) 420-49, "Utility Services," 28 April 1997.

b. Technical Letter (TL) 1110-3-466, "Selection and Design of Oil/Water Separators at Army Facilities," 26 August 1994.

c. Gerdes, G. L., et al., ERDC/CERL TR-00-04, “Designing Coalescing Oil/Water Separators for Use at Army Washracks,” December 2000.

d. U.S. Army Environmental Center, “Joint Service Oil/Water Separator Guidance Document,” SFIM-AEC-EQ-CR-200010, March 2001.

e. AR 200-1, "Environmental Protection and Enhancement," 21 February 1997.

f. PWTB 420-49-28, “Effect of Quick Release Detergent on Oil/Water Separators”, 2 November 1999.

4. Discussion.

a. AR 420-49, Section 4-8, contains policy for wastewater treatment and surveillance as it pertains to oil/water separators. TL 1110-3-466, Sections 1.2.4 and 1.2.5, discuss cleaning agents and methods. AR 200-1 contains general pollution prevention policies. PWTB 420-49-28 discusses the evaluation of one “quick release” detergent at a Fort Lewis, WA, Tactical Equipment Shop.

b. Most detergents tend to cause stable emulsions of oil in water, thus rendering conventional oil/water separators useless. Emulsified oil will pass through simple gravity or coalescing type gravity separators and flow into the receiving sanitary sewer (or, in some cases, a receiving stream). In locations where a separator discharges to a Publicly Owned Treatment Works (POTW), emulsified oil in the separator effluent may violate pretreatment discharge limits placed on that separator. Emulsified oil discharged to a POTW may cause the treatment works to be in violation of a National Pollutant Discharge Elimination System (NPDES) permit. Because of the potential for Notices of Violation, installation environmental offices have issued policy statements, memoranda, etc. that prohibit or limit the use of detergents at most Army ground vehicle washracks.

c. Use of high-pressure hot-water washers is the recommended alternative to the use of detergents. However, high-pressure hot water often will not effectively clean components heavily soiled with oil and grease. Soldiers will circumvent the ban on detergents and purchase detergents locally in order to clean their tactical vehicles.

d. Recognizing the need for cleaning products that are compatible with wastewater pretreatment systems, detergent manufacturers are now marketing detergents that form unstable emulsions. These detergents, sometimes called “quick release,” “quick splitting,” or “separator friendly,” are said to allow oil to coalesce and separate from wash water after short periods of time. As long as the oil globules are able to rise to the surface of the water in an oil/water separator within the design detention time, then the separator will function properly. The “quick release” detergent could be used without concern for regulatory violations.

e. The study described in Appendix A is an evaluation of 20 detergents, many of which are “quick release” type detergents currently used at Army installations. Each detergent was tested for compatibility with oil/water separators, and with biological treatment systems. A simple gravity separation test was used to determine how much oil separated from a detergent-oil mixture within a 45 minute period (45 minutes being the minimal detention time allowed per oil/water separator design guidance). Microtox toxicity tests were used to determine the relative toxicity of the detergents to microorganisms. The results of the tests are shown in Tables 2 thru 8 in Appendix A.

f. As stated in Appendix A, the results of the laboratory testing should not be interpreted as an endorsement for use of any particular detergent. ERDC/CERL has not field-tested any of these products to verify laboratory findings, nor to determine cleaning effectiveness. The information is intended for use by Army installation environmental personnel as guidance when selecting detergents to be used at washracks on a trial basis.

g. One finding of note was that many of the detergents seemed to negatively affect the results of the oil and grease (O&G) analysis by EPA Method 1664A. Components in the detergents appeared to cause the test results to be higher than the actual concentration of O&G.

5. Points of Contact. HQUSACE is the proponent for this document. The POC at HQUSACE is Mr. Malcolm E. McLeod, CEMP-II, 202-761-0632, or e-mail: Malcolm.E.Mcleod@hq02.usace.army.mil.

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Appendix A: Evaluation of Quick Release Detergents

Introduction

Background

Historically, detergents used to wash vehicles have caused the Army's gravity type oil/water separators to be ineffective. These detergents form stable emulsions of oil in water that prevent the oil from floating to the surface. The emulsified oil passes through the separator and travels to the sewage treatment plant or other discharge point. This can create noncompliance with pretreatment or National Pollutant Discharge Elimination System (NPDES) requirements regarding oil and grease (O&G). Such emulsions can remain stable for long periods of time, unless some type of chemical treatment is used to break the emulsion. The use of chemical treatment at Army motorpool washracks is not practical due to operation and maintenance required. Thus, in an effort to maintain compliance with discharge requirements, the use of detergents has been banned at almost all Army washracks to prevent pass-through of oil. As an alternative, soldiers are encouraged to use hot water, high pressure washers.

Hot water washers are now in use at most motorpools. They are used to clean vehicles prior to inspection, or to wash components prior to repair work. These washers work well for light soiling, but when the surface to be cleaned is exceptionally greasy or oily, the level of cleanliness provided by the washers alone is usually not acceptable. A "Catch 22" had developed between the requirement to clean vehicles and the need to assure acceptable pretreatment of wash water, i.e., it was very difficult to achieve both. Water quality of separator discharges has a lower priority to soldiers because cleaning and maintaining tactical vehicles is linked to readiness, a very high priority. To adequately clean vehicles and parts, soldiers choose to ignore the detergent ban and purchase unauthorized soaps and detergents. It became clear to those responsible for NPDES compliance that it is necessary to find an acceptable method of washing that will not interfere with separator performance.

A simple resolution of the conflict is the use of detergents that do not interfere with the performance of the oil/water separators. Many companies now make "quick release" or

"separator friendly" detergents. These cleaning agents form unstable emulsions of oil and water – after a short time (10 minutes to 1 hour) the emulsion breaks and the oil is free to coalesce and rise to the water surface. In a small study sponsored by the former Army Center for Public Works, the Construction Engineering Research Laboratory evaluated one of those detergents. BG-Clean 402 was selected (somewhat randomly) from a list of several detergents sold as being compatible with oil/water separators. That evaluation consisted of simple laboratory tests to verify the “quick release” characteristic of the detergent, and a demonstration of the detergent at an Army washrack to confirm compatibility with a typical Army oil/water separator. That study concluded that BG-Clean 402 did not interfere with the performance of the oil/water separator. A recommendation from that study was that additional detergents should also be tested.

In 2004, the Environmental Division at Fort Benning funded ERDC-CERL to perform a more extensive study of “quick release” detergents. The objectives of this study were to verify the oil/water separator compatibility claims of several detergent vendors, and to determine the relative toxicity of those detergents on secondary treatments systems at sewage treatment plants. This PWTB discusses the results of that study.

Scope

The study was limited to an evaluation of 20 detergents. The detergents evaluated were selected from lists of detergents that were already authorized for use by specific Army installations. Also selected for study were a few detergents that are commonly used on washracks or are readily available at chain retail stores, but are not sold as “quick-release” or “separator friendly.” It should be noted that many other detergents on the market today claim to be “separator friendly” or “quick-release” type cleaning agents, but not all of these detergents could be tested due to the limited resources of this study. The fact that a detergent was not included in this study does not preclude it from being acceptable for use at Army washracks.

Table 1 shows the detergents chosen for this study.

Table 1. Detergents evaluated for Fort Benning study.

PRODUCT NAME	VENDOR
CBC 4 Citrus Grease Solv	American Cleaning Solutions
Citrikleen	Penetone Corp.
Clean All Purpose	GSA
Clean Split	Certified Laboratories
Dawn	Procter and Gamble
Duo Power	Chemsearch
Envirogard-1	Hotsy
EnviroKlean	Chemifax
Environ	Landa
Gator Wash HD	Product Services
GRRR	Certified Laboratories
Hurrisafe	PCI of America
Krud Kutter	Supreme Chemical
Low Emuls Wash	Knight Marketing Corp.
MA 102	JAD Chemical
Power Cleaner 310L	Penetone Corp.
Simple Green	Sunshine Makers
Split Auto Scrub	Zep
Split Vehicle Wash	Zep
VPW-SC-1000	Orison Marketing

The scope of this study was also limited to determining the compatibility of the detergents selected with pre-treatment oil/water separators, and with biological treatment systems at domestic sewage treatment plants. The detergents were not tested for corrosivity or for cleaning effectiveness – two characteristics that are valuable to the user when choosing a detergent to be used at an Army washrack.

Approach

Each of the 20 detergents was subjected to laboratory-scale testing to determine its oil separation characteristic relative to the other detergents tested. Simple oil separation tests were used to determine how quickly the oil/water emulsions created by the detergents would break and allow the oil to float to the surface. The premise is: the lower the concentration of O&G is in the substrate of a settled detergent/oil/ water

mixture, the more compatible that detergent is with oil/water separators.

Detergents that did well in the separation testing were then tested for relative toxicity using standard Microtox testing. All would have been tested for toxicity had resources been available. Detergents were diluted with tap water per manufacturers' guidance and then tested for toxicity. To determine the effect of chlorine in the tap water, some undiluted detergents were also tested for toxicity.

Test Procedures and Results

Quick-Release Characteristic

The quick-release characteristic of each cleaning agent was determined using a simple gravity separation test. A lubricant was mixed with water containing the cleaning agent and allowed to separate. The quick-release characteristic was determined by how much lubricant remained suspended in the mixture after a 45-minute period for separation. The steps for this test were as follows:

1. The cleaning agent was diluted with tap water according to the manufacturer's instruction on the packaging. If a range of dilutions were recommended (for example: 1:10 to 1:25), then a dilution near the middle of the range was used.

2. A petroleum lubricant was added to the mixture so that the Total Oil and Grease (O&G) concentration was 1000 parts per million (ppm). According to a previous ERDC/CERL characterization study (Gerdes 2000), this is a typical high O&G concentration for wash water influent to Army oil/water separators. For each detergent dilution, three mixtures were made: one with motor oil added, one with hydraulic fluid added, and a third with lubricating grease added.

3. The mixture was shaken in a separatory funnel for several seconds to create a homogeneous mixture, and to allow the detergent to emulsify the lubricant. The separatory funnels containing oil or hydraulic fluid were each upended six times to form a homogenous solution. The separatory funnels containing grease were shaken for 30 seconds, because the semi-solid grease was much more difficult to dissolve.

4. The mixture was set aside for 45 minutes to allow the petroleum to coalesce and separate from the detergent

solution. Current Department of Defense (DOD) guidance (SFIM-AEC-EQ-CR-200010) recommends 45 minutes as the minimum detention time for gravity oil/water separators.

5. Samples of the substrate (liquid below the floating layer of oil and grease) were then analyzed for O&G using U.S. Environmental Protection Agency (EPA) Method 1664A. EPA Method 1664A, while the preferred G&O analysis method, is somewhat inaccurate. Therefore, three samples were taking from each detergent-petroleum mixture, and the results were averaged. Table 2 shows the results of all analyses. EPA Method 1664A measures the total amount of substance in a sample that is extractable by n-hexane — it does not identify specific petroleum products.

Interpretation of Quick-Release Results

The concentration of O&G in the substrate generally indicates the stability of the emulsion formed when mixing the sample. For example, after 45 minutes of separation, the concentration of motor oil left in the Clean Split mixture was only 34 parts per million (ppm). The majority of the oil in the original 1000 ppm mixture had separated, coalesced, and floated to the surface of the separatory vessel. Ideally, this degree of separation will also occur in an oil/water separator.

The results shown in Tables 2 through 5 are only for comparing detergents with each other. The results do not necessarily show which detergents will or will not cause problems with oil/water separator performance. A period of trial usage at Army washracks is necessary to verify the compatibility of any detergent with pre-treatment. This study is intended to help in selecting detergents for further evaluation. Tables 2 through 5 can be used as a tool for predicting the probability of success.

It should again be noted that the detention time used for the laboratory-scale testing was only 45 minutes, the minimum time recommended by DOD guidance. Actual detention times in Army washrack separators are usually much longer than 45 minutes. Most of the detergents tested for separation characteristic are good candidates for further testing at Army washracks.

For most of the detergents, the grease added to the detergent solution did not fully dissolve. Small bits of grease remained in suspension after the mixing period. Therefore, the separation tests involving grease did not accurately represent

the quick release of emulsified grease, and data for the grease–detergent mixtures are not presented in this report.

Table 2. Concentration of O&G Remaining in the Detergent Solution After 45 Minutes of Separation

(Original O&G concentration = 1000 ppm. All values in mg/L)

Detergent	Motor Oil				Hydraulic Fluid			
	A	B	C	Avg	A	B	C	Avg
Clean Split	36	26	41	34	20	23	22	22
Clean All Purpose	25	25	38	29	26	25	25	25
Certified GRRR	38	23	25	29	30	42	22	31
Environ	36	24	23	28	33	23	36	31
Duo Power	26	25	M	26	28	29	28	28
Zep Split Vehicle Wash	32	32	64	43	59	40	35	45
MA 102	71	100	96	89	23	22	29	25
Hurrisafe	100	43	86	76	54	38	62	51
Krud Kutter	40	47	55	47	140	120	94	118
Simple Green	110	160	140	137	49	38	36	41
Envirogard-1	120	100	150	123	68	60	76	68
Dawn	140	65	33	79	160	55	69	95
Low Emuls Wash	140	64	180	128	58	74	85	72
Zep Split Auto Scrub	89	92	80	87	120	60	110	97
Gator Wash HD	140	47	98	95	120	97	98	105
Enviroklean	M	120	170	145	110	M	130	120
Power Cleaner 310L	150	180	150	160	150	180	250	193
CBC 4 Citrus Grease Solv	820	240	750	600	150	90	200	147
Citrikleen	1400	1200	890	1160	210	M	810	510
VPW SC 1000	M	M	2100	2100	110	890	1100	700

Note: M indicates missing data -- sample was lost during shipment.

Substrate samples for the Citrikleen and VPW SC 1000 detergent mixtures had concentrations of O&G that were greater than 1000 ppm, i.e., greater than the original concentration of O&G. The source of that error could not be identified from the original data. Possible sources are: the samples were inadvertently contaminated with excess petroleum product; the original mixture was not thoroughly mixed (though care was taken to maintain good laboratory procedure), or laboratory error occurred during the analysis the procedure. But it was felt the most probable cause for the suspect results is that those two detergents, and perhaps others, contain constituents that interfere with the O&G test procedure.

As mentioned above, EPA Method 1664 is somewhat inaccurate as it does not specifically measure O&G. This is indicated by the long title of the procedure “Method 1664, Revision A: N-Hexane Extractable Material (HEM; Oil and Grease) and Silica gel Treated N-Hexane Extractable Material (SGT-HEM; Non-polar Material) by Extraction and Gravimetry.” In effect, the reportable amount of O&G in a sample is defined by the test, and may not be the actual amount of O&G in the sample. Detergents may interfere with this procedure in two ways. First, if the oil is still emulsified, the emulsion will complicate the n-hexane extraction and gravimetric measurement, and the procedure becomes very dependent on the laboratory analyst’s technique. Second, the detergent may contain chemicals that are extracted by n-hexane and are included in the test results.

To further investigate, additional testing was performed on six detergents. The results of those tests were added to the results shown in Table 2, and are shown in Tables 3, 4, and 5. Table 3 shows the results of testing on the detergent solution mixed with oil; the average of all tests (original and repeat testing); and the standard deviation of the test results. Table 4 is the same as Table 3, but shows the results for detergent solutions mixed with hydraulic fluid. Table 5 shows the results of O&G testing on only the detergent solutions.

Standard deviation is included in Tables 3 and 4 to show how the relative variability of the sample analysis results. The lower the standard deviation in the sample results, the more consistent the sample results are. The standard deviation calculations, along with the results shown in Table 5, seem to indicate that many detergents negatively impact the results of the O&G analysis procedure.

The degree to which detergents affect O&G results varies, as seen in Table 5. It should be pointed out here that the original testing and re-testing were done by different independent laboratories. Comparing the results from the two laboratories in Tables 3, 4, and 5, it is evident that analyst technique had a significant effect on sample results.

Despite the apparently immeasurable impact that a detergent has on test results, some detergents still appear to be acceptable for use at washracks. If the analysis of a sample determines a low concentration of O&G, then there must have been minimal interference with the test procedure as well as a small amount of O&G. It is logical to assume that those detergents that showed good oil separation in Tables 2, 3, and 4 are likely to not significantly affect the O&G analysis results.

When selecting detergents for use on washracks, installation personnel should keep in mind that many detergents interfere with EPA Method 1664A. It is recommended that, prior to widespread installation use, laboratory testing be done on a diluted detergent to determine whether the detergent itself will impact O&G analysis results.

Table 3. Concentration of O&G Remaining in the Detergent Solution After 45 Minutes of Separation

(Original O&G concentration = 1000 ppm. All values in mg/L)

Detergent	Motor Oil - Original Test Results			Motor Oil - Repeat Test Results			Avg	Standard Deviation
	A	B	C	D	E	F		
Environ	36	24	23	27	28	36	29	5.2
Simple Green	110	160	140	96	85	159	125	29.6
Zep Split Auto Scrub	89	92	80	496	325	416	250	170.0
Enviroklean	M	120	170	681	789	767	440	296.9
Citrikleen	1400	1200	890	200			923	455.0
VPW-SC 1000	M	M	2100	129	199	177	809	836.8

Note: M indicates missing data – sample was lost during shipment.

Table 4. Concentration of O&G Remaining in the Detergent Solution After 45 Minutes of Separation

(Original O&G concentration = 1000 ppm. All values in mg/L)

Detergent	Hydraulic Oil - Original Test Results			Hydraulic Oil - Repeat Test Results			Avg	Standard Deviation
	A	B	C	D	E	F		
Environ	33	23	36	37	31	40	33	5.4
Simple Green	49	38	36	84	122	132	77	38.9
Zep Split Auto Scrub	120	60	110	461	383		227	162.6
Enviroklean	M	110	130	536	703	733	370	271.7
VPW-SC 1000	110	890	1100	129	92	125	440	419.9

Note: M indicates missing data – sample was lost during shipment.
Citrikleen was not tested with hydraulic oil.

Table 5. Results of O&G Analysis of Detergent Solutions (No Motor Oil or Hydraulic Oil Added)

Detergent	Test Results		Average	Standard Deviation
	A	B		
Environ	20	7	14	6.5
Simple Green	71	79	75	4.0
Zep Split Auto Scrub	413		413	N/A
Enviroklean	1680	518	1099	581.0
Citrikleen	291		291	N/A
VPW-SC 1000	197	186	192	5.5

Toxicity Characteristic

A few detergents were chosen to be tested for toxicity. Generally, the detergents that had the best oil separation results were selected for toxicity testing. (MA 102 and ZEP Vehicle Wash were not tested due to insufficient quantities of those detergents.) Toxicity was determined using the trademarked Microtox testing procedure.

The Microtox toxicity test consists of subjecting a particular group of microorganisms with successively more dilute aliquots of the sample being tested. The remaining viable microorganism population is recorded for each dilution of the original sample. When reductions of viable microorganisms are at 20 and 50 percent, those dilutions are reported. Table 6 shows the results of the Microtox testing. The EC20 column shows the concentration (as a percentage of the original sample in the dilution) required to reduce the original population of microorganisms by 20 percent (i.e., a 20 percent kill off). The EC50 column shows the concentration required to reduce the population of microorganisms by 50 percent. The EC50 concentration should normally be higher than the EC20 concentration. For example, the EC20 and EC50 for GSA Clean are 2.7% and 5.1%, respectively. That means that a solution of 2.7% GSA Clean wash water and 97.3% distilled water will kill 20% of the test organisms. And a solution of 5.1% GSA Clean wash water and 94.9% distilled water will kill 50% of the test organisms.

Initially, the detergents were diluted according to manufacturers' recommendations using tap water to create the samples for testing. The intent was to determine the toxicity of the wash water as it drained from a washrack. The diluted detergents were submitted for Microtox toxicity testing. Because very low detergent concentrations were being recorded at EC20 and EC50, it was suspected that the chlorinated tap water in the detergent samples may have contributed to the toxicity of the diluted detergents. (Dilutions made during the Microtox procedure are made with sterile de-ionized water.) To determine if this were the case, tap water and six undiluted detergents were then tested for toxicity. Table 7 shows the results of this second phase of toxicity testing, and Table 8 shows a comparison of results with and without dilution with tap water.

Table 6. Results of toxicity testing on samples of diluted detergents.

Sample	Dilution	EC20 (%)	EC50 (%)
GSA Clean	1:10	2.7	5.1
Krud Kutter	1:20	1.1	1.6
ZEP Auto Scrub	1:32	0.88	1.8
Hurrisafe	1:10	0.48	0.90
Environ	1:20	0.46	1.3
GRRR	1:20	0.13	0.22
Clean Split	1:10	0.12	0.42
Duo Power	1:10	0.057	0.10

Table 7. Results of toxicity testing on samples of undiluted detergents.

Sample	EC20 (%)	EC50 (%)
De-ionized Water	>50	>50
Tap Water	8.0	18
GSA Clean	0.20	0.35
Krud Kutter	0.064	0.084
Hurrisafe	0.054	0.084
Environ	0.036	0.077
Simple Green	0.035	0.18
Duo Power	0.0025	0.0080

Table 8. Comparing toxicity of diluted and undiluted samples.

Sample	EC20 (%)		EC50 (%)	
	Undiluted	Diluted with tap water	Undiluted	Diluted with tap water
GSA Clean	0.20	0.25	0.35	0.46
Krud Kutter	0.064	0.052	0.084	0.076
Hurrisafe	0.054	0.044	0.084	0.082
Environ	0.036	0.022	0.077	0.062
Duo Power	0.0025	0.0052	0.0080	0.0091

Values for “Diluted with tap water” are adjusted to include original dilution so all columns show dilution % of original full strength detergent.

Interpretation of Toxicity Results

All detergents tested, as well as the tap water used to dilute them, were fairly toxic to the Microtox microorganisms. This is not surprising. Most detergents include a surfactant in their formulas. Surfactants are generally toxic to microorganisms because they alter the permeability of cell walls. Tap water contains small amounts of chlorine, which is intended to be toxic to microorganisms in water distribution systems. It appears from the data shown in Table 7 that the tap water did not significantly affect the toxicity of the diluted detergents.

This finding raises a legitimate concern regarding toxicity to biological treatment systems, however. The least toxic detergent tested was the GSA cleaner Clean All-Purpose Cleaner, which had an EC20 value of 0.20 percent (Table 7), which is equivalent to 2000 ppm. For a 2 million gallons per day (MGD) flow (1389 gallons per minute [gpm]), the amount of undiluted Clean detergent in that flow would have to be 2.8 gpm to achieve the 0.2 percent concentration. That seems like a large amount of detergent, but that flow is possible for short periods of time during washing at the washracks. If the recommended detergent dilution (1:10) were used, then the wash water flow would have to be only 30.8 gpm. Potentially, this flow could occur if three or four motorpool washracks were using hot water washers at the same time.

There are reasons not to be concerned.

1. It is likely that the microorganisms used for the Microtox test are more sensitive to detergents than the microorganisms growing in secondary treatment processes.

2. Detergents in wash water are routinely discharged to sanitary sewers every day from households and commercial dischargers. Microorganisms in sewage treatment facilities become acclimated to low levels of detergents, and even to slugs of wash water that enter the plant.

3. The duration of the flows from hot water washers is relatively brief. The slug of wash water entering the sanitary sewer should become diluted during the several hours of travel to the sewage treatment plant.

Still, it is possible that the use of highly toxic detergents at washracks could adversely affect biological treatment processes. The example given above for Clean is a best-case scenario. Duo

Power, the most toxic detergent tested, is 50 to 100 times more toxic than Clean. Whenever a new detergent is introduced at an Army installation such as Fort Benning, it is recommended that the number of users of that detergent be increased gradually to allow time for the receiving treatment works to acclimate.

Recommendations

1. Army environmental personnel should use the information in Tables 2 through 8 to select detergents for trial use at washracks. First select detergents that both allow good oil separation and have low toxicity.

2. When selecting detergents for use on Army washracks, installation personnel should keep in mind that many detergents interfere with EPA Method 1664A. It is recommended that prior to widespread installation use, laboratory testing be done on a diluted detergent to determine whether that detergent will impact O&G analysis results.

3. Whenever a new detergent is introduced at an Army installation such as Fort Benning, it is recommended that the number of users of that detergent be increased gradually to allow time for the receiving treatment works to acclimate.