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Final Toxic Release Inventory (TRI) Chemical Quantification at Fort Lewis, WA

by
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This research quantified the Emergency Planning Community Right-to-Know Act (EPCRA), Section 313, Toxic Release Inventory (TRI) chemicals used on a representative Forces Command (FORSCOM) installation (Fort Lewis, WA), and identified the processes that generated those chemicals. Data from calendar year 1994 (CY94), CY95, and CY96 were collected from several existing installation data base sources. This typical FORSCOM installation uses a diverse set of

TRI chemicals and chemical categories. The current law allows chemicals used in various processes to fall under exclusions from the requirement to report.

The study found that Fort Lewis used 500 lb or more of 58 different TRI chemicals and 12 different TRI chemical categories in 1996. If certain EPCRA exemptions are repealed, the data suggest that installations like Fort Lewis use quantities of TRI chemicals that, in the future, may become reportable.

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This research quantified the Emergency Planning Community Right-to-Know Act (EPCRA), Section 313, Toxic Release Inventory (TRI) chemicals used on a representative Forces Command (FORSCOM) installation (Fort Lewis, WA), and identified the processes that generated those chemicals. Data from calendar year 1994 (CY94), CY95, and CY96 were collected from several existing installation data base sources. This typical FORSCOM installation uses a diverse set of TRI chemicals and chemical categories. The current law allows chemicals used in various processes to fall under exclusions from the requirement to report. The study found that Fort Lewis used 500 lb or more of 58 different TRI chemicals and 12 different TRI chemical categories in 1996. If certain EPCRA exemptions are repealed, the data suggest that installations like Fort Lewis use quantities of TRI chemicals that, in the future, may become reportable.

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Foreword

This study was conducted for the Directorate of Military Programs, Headquarters, U.S. Army Corps of Engineers (HQUSACE), under Military Interdepartmental Purchase Request (MIPR) 3487; Work Unit W27, "Hazardous Waste Quantification at a Representative FORSCOM Installation." The technical monitor was Mitchell Cohen, AFPI-ENE.

The work was performed by the Troop Installation Operation Division (UL-T) of the Utilities and Industrial Operations Laboratory (UL), U.S. Army Construction Engineering Research Laboratories (USACERL). The USACERL principal investigator was Deborah R. Curtin. Walter Mikucki is Division Chief, CECER-UL-T; John T. Bandy is Operations Chief, CECER-UL; and Gary W. Schanche is the responsible Technical Director, CECER-TD. The USACERL technical editor was William J. Wolfe, Technical Resources.

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1 Introduction

Background

The Emergency Planning Community Right-to-Know Act (EPCRA) of 1986 was enacted to provide the public with information on toxic and hazardous chemicals processed by industrial facilities in their communities. EPCRA requires the creation of emergency planning and notification requirements to protect the public in the event of releases of extremely hazardous substances. Section 313 of EPCRA, The Toxic Release Inventory (TRI) was expanded under the Pollution Prevention Act of 1990. Presidential Executive Order (EO) 12856, *Federal Compliance with Right-to-Know Law and Pollution Prevention Requirements*, was issued in 1993 and directs all Federal facilities to comply with reporting requirements and established calendar year (CY) 1994 as the baseline with CY 1995 as the first reporting year for most Federal agencies.

Although Federal facilities are complying with EO 12856, there are currently no legal or regulatory drivers in place that require Federal facility compliance. The "Right-to-Know-More and Pollution Prevention Act of 1997" is a bill currently under consideration by Congress that will require all Federal facilities to comply with EPCRA. Although the Right-to-Know-More Bill has not yet passed, it seems likely that there will be significant changes in the future. A spokesman from the office of U.S. Senator Lautenberg (the bill's sponsor) has said that "although this bill has not yet received support of the Democratic majority, it is expected that it will pass in the future." In addition, Senator Lautenberg's office indicated that there are other bills introduced that will likely impact the scope of EPCRA. In addition to pending legislation, the Environmental Protection Agency has already proposed to lower the TRI reporting thresholds for persistent and bioaccumulative chemicals. It seems reasonable to conclude that it is only a matter of time before the scope of EPCRA changes and military installations will be required, by law, to extend their continually shrinking resources to comply with the full intent of EPCRA.

To comply with EO 12856, those Federal facilities that exceed the manufacturing, processing, or otherwise use-activity thresholds are required to submit TRI reports to the USEPA and resident State EPAs. Thresholds are set

at 25,000 lb* for manufacturing and processing activities, and 10,000 lb for "otherwise use" activities. The thresholds are chemical specific and do not apply to the aggregate of all chemicals manufactured or used at a facility. Once a facility meets or exceeds a threshold for individual toxic chemicals, the facility must submit a TRI "Form R" Report that details the amount of the particular toxic chemical released into the environment. Facilities report the amount released into the air, water, and to the land, as well as the amounts associated with waste management activities. As of December 1996, the TRI chemical list included approximately 620 chemicals and 27 chemical categories. Although the TRI chemical list is subject to change, according to the USEPA and the EPCRA hotline, the December 1996 list is current. No chemical deletions/additions are pending.

Troop type installations are generally not engaged in large-scale manufacturing or processing. Hence they are not likely to generate reportable TRI chemicals under these two activities. However, they do use TRI reportable chemicals under the "otherwise use" category. The data contained in this report will give a snapshot of what the impacts may be to troop type installations in the event that the exemptions in EPCRA, Section 313 are repealed, or reporting thresholds are lowered.

Under EO 12856 and EPCRA, Section 313, six exemptions may preclude Federal facilities from reporting under TRI:

1. *Structural Component of a Facility.* This refers to stationary physical components of the facility, such as copper pipes installed in walls and paint applied to building interiors and exteriors. The USEPA extended this exemption to solvents that evaporate during painting of facility structures and that are used to clean equipment after such painting. Welding on structures and fixed equipment that are part of the facility is exempt. Department of Defense (DOD) EO 12856 guidance of March 1995 specifies that this exemption applies to structures such as roads, buildings, runways, fence lines, and utilities.
2. *Routine Janitorial and Facility Grounds Maintenance.* Included are normal cleaners, disinfectants, herbicides, and pesticides used to maintain the facility.
3. *Motor Vehicle Maintenance.* This includes chemicals in products used to operate and maintain motor vehicles operated by the facility, for examples: chemicals in

* 1 lb = 0.453 kg.

gasoline, diesel fuel, brake and transmission fluids, oils and lubricants, antifreeze, batteries, cleaning solutions, and solvents in paint used for touch-up.

"Motor vehicles" include cars, trucks, cranes, forklifts, tow motors, locomotive engines, and aircraft. "Exempt motor vehicle maintenance" includes: maintaining staff cars, facility maintenance and support vehicles, and privately owned vehicles.

DOD EO 12856 guidance of March 1995 states that the following activities are exempt: aircraft de-icing; field maintenance and support; fuels while in transit, during transfer, and in storage; and emissions from motor vehicles. Organizational level, or routine maintenance of tactical vehicles, aircraft, and ships includes lubricant or fluid changes and is exempt. However, intermediate and depot-level maintenance of tactical vehicles, aircraft, and ships is not exempt. Intermediate and depot level maintenance includes major repairs, rebuilds, or overhauls.

4. *Employee Personal Use.* Included are: food, drugs, cosmetics, and dispensary contents. Within DOD facilities, this exemption applies to: on-site housing, on-site cafeterias, sewage treatment plants, commissaries, post exchanges, morale, welfare, and recreation (MWR) activities, and medical facilities, as well as the chemicals used to treat on-site swimming pools that are for employee recreational use. DOD EO 12856 guidance of March 1995 extends this exemption to all activities associated with hospitals.
5. *Intake Water and Air.* Amounts of chemicals contained in the water and air received at the site are considered neither processed nor otherwise used, nor are they considered to be releases to the environment.
6. *Laboratory Activity Under Direction of a Technically Qualified Individual.* A "technically qualified individual" is defined as someone capable of understanding health and environmental risks of chemicals used under his or her supervision because of education, training, or experience. Laboratory bench scale activities may be exempt, while specialty chemical production and pilot plant activities are not exempt. This exemption requires careful evaluation and may not apply to an entire facility, and should not be based solely on the word "laboratory" in the name.

Due to the nature of the exemptions allowable under EPCRA, Section 313, U.S. Army Forces Command (FORSCOM) installations are able to take advantage of a number of TRI reporting exemptions. The USEPA is already questioning whether Federal facilities are meeting the full intent of EPCRA. In fact, the USEPA has formed a subcommittee to provide input on the exemptions; it seems

logical to expect some change in the future. Expanding the scope of EPCRA related activities would place a tremendous burden on all military facilities, not only FORSOCM installations.

EPCRA, Section 313 (TRI) Form R Report is sometimes used as a benchmark to determine the extent of environmental challenges a DOD entity may face. Reporting under section 313 is done by a "facility," which has been defined as "all contiguous property owned or operated by a single entity." If reporting were required collectively (i.e., all troop type installations or all troop type installation activities) with no exemptions, the data may show that troop type installations as a whole would face an environmental challenge just as large, if not larger, than that faced by production facilities. Troop type installations typically engage in processes that may use hazardous materials, but which are not reportable due to the exemptions allowed under Section 313. Although a reporting threshold of 10,000 lb may be met or exceeded, the various exemptions that troop type installations can take advantage of often precludes the reporting requirement. Identifying and quantifying TRI chemicals at a typical FORSCOM installation can help to prepare such installations to maintain compliance should EPCRA exemptions be repealed, or should reporting thresholds be lowered.

Objective

The objective of this study was to determine the total amount of TRI chemicals used on-site at Fort Lewis (a representative FORSCOM installation) and to determine the processes in which those chemicals are generated.

Approach

1. USACERL researchers made a site visit to Fort Lewis to assist the installation with populating its hazardous waste bar code tracking system.
2. The researchers returned to USACERL with a copy of the EPCRA data base on a removable drive medium, for later analysis.
3. Data base queries were constructed to extract needed information from the raw data.
4. Results of the queries were analyzed and conclusions were drawn.

2 Site Data – Fort Lewis, WA

Site Description

Fort Lewis, WA, is a military reservation of 86,176 acres, and the winner of the 1997 Department of Defense Environmental Security, Non-Industrial Pollution Prevention Award. Fort Lewis serves as a major military training facility for both weapons qualification and field training. This installation was chosen as the award recipient for successfully “reaching out” to all installation organizations. Based on input from the various installation organizations, Fort Lewis prioritized projects by analyzing installation processes, reduced waste streams through high quality technical solutions, and used evaluation and feedback as key aspects of its success. Although Fort Lewis’ success in pollution prevention is not yet mirrored by all nonindustrial installations, the activities and processes are typical (and therefore representative) of troop type installations. The following demographic data may help other nonindustrial installations to extrapolate the data contained in this report.

According to Fort Lewis’ 1995 Annual Progress Report, the force structure at Fort Lewis includes I Corps Headquarters, which commands all FORSCOM units at Fort Lewis. The installation also hosts 1st BDE, 25th ID; 35th Air Defense Artillery Brigade; 201st Field Artillery Brigade; 1st Personnel Group, 62nd Medical Group; 1st Special Forces Group (Airborne); 2nd Battalion (Ranger) 75th Infantry; Law Enforcement Command; 4th Reserve Officer Training Corps (ROTC) Region; and the 3rd Brigade, 2nd Infantry Division. Fort Lewis serves occasional users from other U.S. armed services and units from allied nations. The average active duty soldier population for Fort Lewis and subcommands (Yakima) was 18,418 in 1996 and 19,250 in 1997. The civilian population was 5,348 in 1997. The civilian population includes Madigan Army Medical Center (MAMC) and remains fairly constant. In addition to these various military organizations, nonmilitary organizations perform services and functions that use hazardous substances and generate hazardous waste. Services performed include the maintenance of over 5,000 buildings and infrastructure such as roads and utilities; maintenance of over 3,000 vehicles and nearly 1,500 pieces of equipment that includes aircraft, weapons systems, power generators, and communications equipment. A major hospital, several medical and dental

clinics, printing and graphics facilities, materials storage warehouses, and crafts shops also operate of Fort Lewis.

Fort Lewis was chosen as the installation for this study because it is representative of FORSCOM installations in general and because of its existing environmental databases. In addition, Fort Lewis' personnel have developed databases of hazardous chemical usage and hazardous waste disposal. Both these databases were extremely valuable sources of information for this report.

Data Sources

Only existing data from Fort Lewis were used for this report. Sources of the data were the EPCRA Reporting Database, the Hazardous Waste Bar Code Tracking System, the Firing Information and Range Execution (FIRE) Noise Prediction System, Madigan Army Medical Center's Section 313 Chemicals 1996 Consumption Amounts report, the 1996 Fort Lewis Air Emission Inventory, and the 1995 Annual Progress Report for Fort Lewis.

Although the reporting threshold for TRI chemicals under Section 313 is 10,000 lb, this report contains information on all TRI chemicals with usage at 500 lb or above. The reason for reporting data on such low usage rates was: (1) to determine the impact to troop type installations in the event that reporting thresholds are lowered, (2) to show which TRI chemicals and chemical categories are threatening the reporting threshold, and which are not, and to show the diversity of TRI chemicals and chemical categories used at troop installations.

The Hazardous Waste Bar Code Tracking System

The Hazardous Waste Bar Code Tracking System predates the EPCRA Reporting Database and is still used for cradle-to-grave tracking of all hazardous waste generated on post. The database was developed to document hazardous waste chain-of-custody from the point of generation to final disposition. The Hazardous Waste Bar Code Tracking System was used to gather information related to the disposal of TRI chemicals. The information extracted from this system included the waste disposal quantities and the chemical composition of the waste streams.

Fort Lewis EPCRA Reporting Database

The EPCRA Reporting Database is a relational database developed by Fort Lewis in response to DOD EO 12856 guidance. The database tracks information for most hazardous materials that come on post. Installation personnel provide hazardous material inventory information to Fort Lewis' environmental office. Environmental personnel then populate the EPCRA Reporting Database with inventory records that specify the hazardous material, its exact location, the current quarter, and the material's quarterly usage and storage. If a particular unit does not report, information is extrapolated from previous quarters. The EPCRA Reporting database also includes a library of Material Safety Data Sheet (MSDS) information for all known hazardous materials in use at Fort Lewis, and a library of chemical compositions for each of these hazardous materials. Each inventory record is associated with a record in the MSDS data library. This association provided the means to calculate the usage rates of TRI chemicals found in this report.

The database contains information for the 1994 baseline year as well as reporting year 1995 and 1996. Capturing all hazardous substances coming on post through voluntary reporting is not an easy task. Data for each consecutive year from the baseline year become more complete than the previous year's data—as data collection processes improve. The database is considered dynamic; new data is entered throughout the calendar year. Fort Lewis used the EPCRA Reporting Database to provide information for its 1996 TRI reporting. Since that time, the database has been improved. (The information in this report reflects these improvements.) The EPCRA Reporting Database in 1996 does not include information about fuel usage, munitions usage, and some hazardous material usage at MAMC. In these cases, alternative information sources (described below) were used to supplement the EPCRA Reporting Database.

Data base queries were developed to select the applicable data to display in this report. Each query allowed for data from more than one data table to be included, and for query criteria to narrow the scope of the data retrieved. For example, queries were developed to retrieve TRI chemicals and chemical categories with usage exceeding 500 lb during 1996.

1996 TRI Report, Fort Lewis

Fort Lewis' 1996 TRI report was used to provide comparison values for the usage estimates developed in this report. Fort Lewis' worksheets for the 1996 TRI

report provided information on the exemptions taken by Fort Lewis for the chemicals triggering TRI reporting.

1996 Air Emission Inventory Report

The 1996 Air Emission Inventory Report provided fuel usage information for this report. This information is collected for the air emission inventory to allow the calculation of volatile organic compound emissions from fuel usage and storage.

Madigan Army Medical Center's Section 313 Chemicals 1996 Consumption Amounts

TRI chemical usage information from MAMC is provided to Fort Lewis environmental personnel in the form of a report. Information from the 1996 report was included as part of the overall estimates of chemical usage shown in this report.

FIRE Noise Prediction System

The FIRE noise prediction system provided information about munitions usage. Munitions usage information is regularly provided to FIRE to develop noise contour estimates for troop training exercises. Munitions usage during 1996 was extracted from this system for this report.

1995 Annual Progress Report, Fort Lewis

The Fort Lewis Progress Report provided information such as: installation information, baseline information, and the identification of various processes that use hazardous materials and generate hazardous waste at Fort Lewis.

3 Data Queries and Reports

Individual TRI Chemicals Used During CY1996 at Fort Lewis > 500 lb (Appendix A)

This query was designed to retrieve all individual TRI chemicals used in quantities exceeding 500 lb during 1996. The query includes details on the products containing these chemicals. Of the 57 chemicals retrieved, there were 11 chemicals used in quantities in excess of 10,000 lb. Table 1 shows the estimated usage of TRI chemicals during 1996. Table 2 shows the usage quantities estimated by Fort Lewis as part of its 1996 TRI reporting.

There are several differences between the tables. The slight differences for chlorine, CFC-12, ethylene glycol, isopropyl alcohol, and sulfuric acid are the result of improvements made to the EPCRA Reporting Database since Fort Lewis generated its TRI report. The large values shown in Table 1 for benzene, ethyl benzene, n-hexane, toluene, and xylene result from the practice of including fuel usage as part of the estimate. Fort Lewis used approximately 10 million gal* of fuel in 1996.

Table 1. Estimated usage of individual TRI chemicals (1996).

Chemical Name	Quantity Used (lb)
Benzene	1,404,207
Chlorine	65,625
Dichlorodifluoromethane (CFC-12)	14,828
Ethylbenzene	1,404,949
Ethylene glycol	124,124
Isopropyl alcohol (mfg – strong acid Process)	14,287
Methanol	10,145
n-Hexane	1,407,499
Sulfuric acid (aqueous form)	28,596
Toluene	3,521,907
Xylene (mixed isomers)	7,031,524

* 1 gal = 3.78 L.

Table 2. Estimate of individual TRI chemicals greater than 10,000 lb (1996).

Chemical Name	Total Quantity (lb)	Quantity Exempt (lb)	Reportable (lb)	Exemption(s) Taken
Chlorine	66,611	66,611	0	Personal use exemption
Dichlorodifluoromethane	13,865	13,493	0	Motor vehicle maintenance, structural component use, personal use, routine janitorial/grounds maintenance exemptions
Ethylene Glycol	94,617	59864	34,753	Motor vehicle maintenance, personal use, structural component exemptions
Isopropyl Alcohol	12,821	12,821	0	Not in specified form exemption
Sulfuric Acid	28,896	28,896	0	Not in specified form exemption
Toluene	10,051	0	10,051	None
Xylene	11,824	0	11,824	None

For this report, USACERL modified the chemical composition description for unleaded gasoline to include the organic constituents mentioned above. This information was gathered from oil company MSDSs for unleaded gasoline. Methanol occurs in Table 1 and not Table 2 because of the inclusion of a formaldehyde solution containing methanol as part of the estimate in this report. The formaldehyde solution was used by MAMC. Because of exemptions of the 11 TRI chemicals shown in Table 1, only 3 were actually reportable under EPCRA, Section 313: ethylene glycol, toluene, and xylene (see Table 2).

In both tables, sulfuric acid and isopropyl alcohol are listed under Section 313 "Reportable Chemicals." However, they are listed with a qualifier. Sulfuric acid is only reportable in aerosol or other airborne forms, and is not reportable in aqueous form. Isopropyl alcohol is only reportable if manufactured by the strong acid process. The EPCRA Reporting Database quantifies sulfuric acid and isopropyl alcohol in all forms, hence the "not in specified form" exemption shown in Table 2. Some other TRI chemicals with qualifiers have usage estimates reported in Appendix A. These values also reflect usage regardless of form and are therefore overestimates of usage. The same is also true of the remaining data in this report. Any estimate of a TRI chemical with a qualifier should be considered an overestimate. In most of these cases, Fort Lewis actually had no usage of the qualified chemicals.

Individual TRI Chemicals Disposed of as Hazardous Waste > 500 lb in 1996 (Appendix B)

This query was designed to retrieve all individual TRI chemicals disposed of as a hazardous waste in 1996. Table 3 lists TRI chemical usage and disposal for chemicals with usage greater than 10,000 lb or disposal greater than 500 lb.

Table 3 shows that, in the majority of cases, the usage of TRI chemicals exceeds the disposal of these chemicals as hazardous waste (HW). For many of these chemicals, the explanation for the much larger usage is the consumption of the chemicals during a process. Components of gasoline, benzene, ethyl benzene, n-hexane, toluene, and xylene are consumed during combustion in internal combustion engines. Other TRI chemicals are volatile components of materials and evaporate during the materials use. For Example, 1,1,1-trichloroethane is a volatile component of cleaners, paints, contact cements, and correction fluid. CFC-12 evaporates primarily during refrigerant equipment maintenance. Isopropyl alcohol is a volatile component of cleaners, disinfectants, and painting products. Methanol is used in laboratories and is a volatile component of cleaners and deicers. Chlorine is consumed during swimming pool water treatment or wastewater treatment. Chlorine either evaporates during use or is dissolved in wastewater leaving Fort Lewis through sewer lines.

Table 3. Comparison of individual TRI chemicals used and disposed of as HW (1996).

Chemical Name	Quantity Used (lb)	Quantity Disposed of as Hazardous Waste (lb)
1,1,1-Trichloroethane	3,499	592
Acetonitrile	0	1,629
Benzene	1,404,207	45
Cadmium	671	968
Chlorine	65,625	0
Dichlorodifluoromethane (CFC-12)	14,828	4
Ethyl benzene	1,404,949	24
Ethylene glycol	124,124	30,232
Isopropyl alcohol (mfg-strong acid process)*	14,287	1,543
Lead	5,251	512
Methanol	10,145	2,685
Mercury	200	1,191
n-Hexane	1,407,499	37
Phenol	123	1,558
Sulfuric acid (acid aerosols ...)*	28,596	93
Toluene	3,521,907	2,430
Xylene	7,031,524	1,483
Zinc	1,901	1,542

*Sulfuric Acid and Isopropyl Alcohol are listed under Section 313 reportable chemicals, however they are listed with a qualifier. Fort Lewis actually had no usage of these chemicals in their qualified form.

Materials accounting for the large majority of lead usage are lead-acid batteries and traffic paint. A program at Fort Lewis allows users to turn in discharged lead-acid batteries. Therefore, these batteries are not disposed of. This program also explains the usage versus disposal difference for sulfuric acid, which is the electrolyte used in lead-acid batteries. Traffic paint is eroded from roads and airfields and will not be disposed of as a hazardous waste. Ethylene glycol is primarily used in antifreeze although it is also a component of some paints. The large difference in usage and disposal may indicate that a large fraction of used antifreeze is not disposed as hazardous waste. Fort Lewis does have an antifreeze recycling program, which may account in part for the lack of antifreeze being disposed of during 1996.

A few TRI chemicals have disposal weights greater than usage rates. Acetonitrile, cadmium, and mercury are components of waste batteries. Cadmium and mercury were also components of waste ash from munitions treatment. Munitions use is not regularly tracked in the EPCRA Reporting Database. Battery use is partially tracked in the EPCRA Reporting Database, but not to the extent as waste batteries (which are carefully documented). The phenol disposal in Table 3 was caused by a large disposal of an antidote kit for a nerve agent, which would not be captured as "used" since materials downgraded to wastes are not counted as usage in the EPCRA reporting data base.

TRI Chemicals Categories Used During CY1996 at Fort Lewis > 500 lb (Appendix C)

If a chemical does not appear on the individual chemical TRI list, it may belong to a Toxic Chemical Category. A chemical belonging to one of these categories must be reported if the reporting threshold for the category as a whole has been reached. Sometimes, a chemical may appear on both lists. If so, it should only be reported as a single chemical. To capture chemicals that do not appear on the individual TRI list, but do belong to a toxic chemical category, USACERL developed a query to retrieve all TRI chemical categories exceeding 500 lb of usage at Fort Lewis. For CY96, the query retrieved 12 chemical categories that met or exceeded 500 lb. Of the 12, only glycol ethers' usage was estimated in excess of 10,000 lb (24,494 lb). Table 4 lists Fort Lewis' estimated usage for glycol ethers from its 1996 TRI reporting, and the types of exemptions taken by Fort Lewis for 19,404 of the 23,873 lb. After the exemptions were considered, the balance did not trigger the reporting threshold. The slight differences for glycol ethers are the result of improvements made to the EPCRA reporting data base since Fort Lewis generated its TRI report.

Table 4. Estimate for TRI chemical categories greater than 10,000 lb (1996).

Chemical Category Name	Total Quantity (lb)	Quantity Exempt (lb)	Reportable	Exemptions Taken
Glycol Ethers	23,873	19,404	No	Routine janitorial/grounds maintenance, structural component use, personal use, motor vehicle maintenance exemptions

Table 5. TRI chemical categories used and disposed of as HW (1996).

Chemical Category Name	Quantity Used (lb)	Quantity Disposed of as Hazardous Waste (lb)
Glycol Ethers	24,494	536
Manganese Compounds	3,017	4,298
Zinc Compounds	9,481	776

TRI Chemicals Categories Disposed of as Hazardous Waste > 500 lb (1996) (Appendix D)

This query was designed to retrieve all TRI chemical categories disposed of as a hazardous waste during 1996. For comparison, Table 5 lists TRI chemical category usage and disposal for any chemical category with usage greater than 10,000 lb or disposal greater than 500 lb.

Table 5 shows trends similar to Table 3. Both glycol ethers and zinc compounds are used to a much greater extent than they are disposed of. Usage of 2-butoxyethanol, diethylene glycol, and an unknown glycol ether make up the majority of glycol ethers usage. One of these, 2-butoxyethanol, is a component of many different types of cleaning compounds, detergents, and paints. These materials are either consumed during a process or become part of the wastewater stream. Diethylene glycol is a component of newer less toxic antifreezes and DOT 3 brake fluid containing an unknown glycol ether. Both of these glycol ethers should show up as hazardous waste, but are not accounted for in the HW Tracking System. This could indicate a problem with the usage estimates, the disposal estimates, or a problem with proper disposal of these materials. Zinc compounds are used in motor oils, batteries, primer, and hydraulic fluids. Waste disposal records show zinc compounds being disposed of in contaminated motor oils and batteries. A large part of the difference between usage and disposal of zinc compounds is explained by Fort Lewis use of uncontaminated motor oil for recycling. The HW Tracking System accounts for this oil, but the chemical composition does not include zinc dithiophosphate as a component of this motor oil.

Process Categories Using Individual TRI Chemicals With Installation Usage > 500 lb During 1996 at Fort Lewis (Appendix E)

This query was built by beginning with the Fort Lewis 1995 Annual Progress Report. This report described processes that Fort Lewis identified as using hazardous materials or generating hazardous waste. A data table that assigned a process number to each process identified by Fort Lewis was created in the EPCRA Reporting Database. The process and process descriptions identified in the 1995 Annual Report, and used for this report, are:

1. *Vehicle and Equipment Maintenance.* This process includes military operated motor pool activities encompassing routine servicing and repair of vehicles and equipment. Motor pools are generally only equipped to handle organizational-level maintenance (e.g., fluid checks and routine services) of tactical vehicles and equipment.
2. *Aviation Maintenance.* Fort Lewis rotor and fixed wing aircraft maintenance activities for rotor aircraft are performed by aviation regiments and by Directorate of Logistics (DOL) repair. Regiments maintaining rotor aircraft perform routine engine maintenance and minor repairs.
3. *Industrial Maintenance.* Industrial maintenance comprises activities performed by DOL repair. DOL repair provides maintenance support to the military units at Fort Lewis and completes special projects for other military units, such as servicing equipment returning from military operations. Specific industrial maintenance activities include maintaining vehicles, helicopters, weapons, batteries, electronic equipment, and furniture, and also performing vehicle cannibalization. Equipment maintenance activities include completing equipment modifications and other repairs that require major disassembly and draining of fluids. Vehicle cannibalization includes disassembling decommissioned military vehicles and draining fluid reservoirs. Weapons maintenance includes servicing artillery, and performing routine overhauls and recoating of small arms, e.g., rifles, machine guns, etc. Battery maintenance includes repairing and recharging nickel-cadmium and lead-acid batteries. Industrial maintenance painting operations are considered a separate process.
4. *Painting Operations.* Fort Lewis painting operations includes painting of vehicles, aircraft, buildings, signs, traffic lines, grounds maintenance, and structures. Painting is performed in paint booths and outside. Paint booths at Fort Lewis use dry filter systems to decrease emissions. Painting

operations range from aerosol spray painting to vehicle/aircraft painting with high-volume, low-pressure (HVLV) spray guns. Also paint is applied to public works structures and equipment. DOL and AMCOM Project OLR paint shops operate relatively large paint booths for painting tactical and nontactical vehicles and aircraft. The Directorate of Personnel and Community Activities (DPCA) Auto Crafts Center operates one paint booth for painting privately owned vehicles. Hazardous waste associated with painting operations include aerosol paint cans, empty paint containers, unusable and used paint thinner, paint chips, and paint remover.

5. *Training.* Training exercises are routinely performed at Fort Lewis to simulate field warfare situations. Training exercises use battery-operated field communication, weapon simulation, lighting equipment, chemical warfare agent detection kits, water purification and latrine disinfectant materials, air-purifying respirators, decontamination kits, air monitoring equipment, pesticides, and fuels.
6. *Photography Operations.* Three Fort Lewis organizations operate photography laboratories. The Directorate of Plans, Training, and Mobilization (DPTM) has consolidated its laboratories and reduced the number of photographic processes and automated equipment. The DPCA operates a community laboratory, and MAMC operates x-ray photography laboratories. Photography facilities use hazardous substances, but photographic process waters are processed through silver recovery units prior to discharge, when appropriate (for black-and-white x-ray processes). Spent photographic solutions at DPTM have been tested and are approved for discharge to the sanitary sewer.
7. *Printing Operations.* Printing facilities in operation at Fort Lewis include reproduction facilities only. Before 1992, hazardous substances were used in offset printing operations at Defense Printing Service (DPS). DPS switched to high-resolution laser copiers, and has eliminated the need for printing chemicals. No HW is reportedly generated from reproduction operations, therefore no usage was reported.
8. *Medical Activities.* MAMC, a tenant activity, is the largest medical operation at Fort Lewis. Most medical practices and their associated laboratories are represented at MAMC. Other medical activities performed at Fort Lewis are conducted by mobile army surgical hospital units. These units generate a small amount of medical waste, which is consolidated with MAMC waste and disposed of through the Defense Reutilization and Marketing Office (DRMO).

9. *Troop Deactivation/Downsizing Movements.* This process captures the HW generated when troops and military units are reorganized and/or leave Fort Lewis. Unused HW must be collected and disposed of and can create a substantial waste stream.
10. *Facilities Maintenance/Public Works.* The maintenance and management of facilities and housing at Fort Lewis are performed by the Operations and Maintenance Division of Public Works (PW). The Electrical Branch is responsible for repair and maintenance of high voltage distribution and interior electrical systems. The Mechanical Branch performs maintenance and repair of plumbing, refrigeration, and heating systems. The Supply and Service Branch was found to not use HS or generate HW in regular, significant quantities. Roads and Sanitation duties entail the servicing of water and sewer systems, collecting refuse, maintaining roads, and performing high/low-level maintenance of vehicles and equipment. The Building and Grounds Branch is responsible for performing lock repair and maintenance, painting, woodworking, metal working, grounds maintenance, pest control, and maintaining the self help unit.
11. *Directorate of Personnel and Community Activities (DPCA):* The DPCA is responsible for the quality of life for soldiers and civilians at Fort Lewis. DPCA also oversees facilities that soldiers, their dependents, or eligible civilians can use in their leisure time. DPCA also assists Fort Lewis in wartime personnel operations. DPCA oversees: Education Centers, Officer and noncommissioned Officer's Clubs, bowling alleys, recreation centers, golf courses, gym/fitness centers, libraries, arts and crafts, child care and child development activities.
12. *Directorate of Plans, Training and Mobilization (DPTM).* The DPTM is responsible for the readiness of Fort Lewis for wartime missions and peacetime support units that train at Fort Lewis. Several organizations are responsible for executing these missions. Battle Simulation Center (BSC) provides computer-simulation for peacetime exercises. Gray Army Airfield (GAAF) provides transportation capability within Fort Lewis. Range Control manages the use of various small-arms and artillery ranges on the Fort. The Training Support Center (TSC/TASC) provides training aides such as mock weapons for units.

In this 1995 Annual Progress Report, Fort Lewis matched some of its buildings with the process categories shown above. A table was created in the EPCRA Reporting Database associating these buildings with a process number.

Buildings that appeared in the EPCRA Reporting Database, but were not part of the 1995 Annual Progress Report, were then also assigned process numbers using information in the Inventory Database as guidance. Buildings matched with a process in the 1995 Annual Progress Report and those in the Reporting Database were compared to eliminate duplication. In some cases, more than one process was assigned to a particular building. For example, painting operations often take place in buildings typically used for vehicle and equipment maintenance and photography operations often take place in hospitals and clinics.

A total of 401 Fort Lewis buildings identified in the 1995 Annual Report and EPCRA Reporting Database were matched with one or more processes identified and described below. Fort Lewis is currently assigning processes to buildings. It has been a multiyear effort that should be completed some time this fiscal year. Hence the processes that were assigned to buildings for the purpose of this report should not be considered binding.

After a data table of building numbers and processes was created, a data table was designed to assign each inventory record in 1996 to a process. For those inventory records with a building number assigned to a single process, the new inventory data table already had a correct process assigned. For all other records in the new inventory data table, a single process was selected based on information associated with these records. After the new inventory data table was populated, it was used as the basis for queries designed to show usage of individual TRI chemicals and TRI chemical categories in each process categories.

Since DPS switched to high-resolution laser copiers, and has eliminated the need for printing chemicals, no HW is reportedly generated from reproduction operations, therefore no usage was reported for Printing Operations. In addition, it was impossible for USACERL to determine the TRI chemicals associated with process 9, Troop Deactivation/Downsizing Movements, from the information available in the EPCRA Reporting Database. Hence, these two processes have no associated TRI chemical usage in Table 6.

Table 7 lists the 10 process categories and the quantity (pounds) of individual TRI chemicals associated with each process. A (non-inclusive) list of the types of materials retrieved within each process follows:

1. *Aviation Maintenance*: adhesives, oil penetrants, lubricants, carburetor and choke cleaners, sealing compounds, paint, polyurethane, antifreeze, deicing/defrosting fluid, general purpose supplies

Table 6. Process and associated TRI chemical usage.

Process Name	TRI Chemical Quantity
Aviation Maintenance	2,901
Directorate of Personnel & Community Affairs	38,411
Directorate of Plans, Training & Mobilization	7,788
Facilities Maintenance/Public Works	116,824
Industrial Maintenance	31,568
Medical Activities	2,880
Painting Operations	29,108
Photography Operations	1,297
Training	64,755
Vehicle and Equipment Maintenance	119,489

Table 7. Process and associated TRI chemical category quantity.

Process Name	TRI Chemical Category Quantity
Aviation Maintenance	2,010
Directorate of Personnel & Community Affairs	6,864
Directorate of Plans, Training, & Mobilization	5,410
Facilities Maintenance/Public Works	11,298
Industrial Maintenance	6,173
Medical Activities	372
Painting Operations	9,265
Photography Operations	478
Training	6,496
Vehicle and Equipment Maintenance	19,418

2. *Directorate of Personnel and Community Affairs (DPCM)*: unleaded gasoline, adhesives, lubricants, penetrating oil, grease, insecticide, corrosion preventative, paint remover, paint, antifreeze, deicer, general supplies, carburetor choke cleaner, hydraulic fluid, gas treatment, batteries, contact cement, lacquer
3. *Directorate of Plans, Training and Mobilization (DPTM)*: general supplies, lubricants, paint, lacquer, batteries, deicing/defrosting fluid, adhesives
4. *Facilities Maintenance/Public Works*: adhesives, insecticides, general purpose supplies, cleaning supplies, paint, polyurethane, solvents, lubricants, rust preventatives, grease, chlorine, Freon, caulk, air sanitizers, denatured alcohol, solder lead alloy, stripper, cement contact, cleaning compound acid pipeline, weather-stripping supplies, lead acid batteries
5. *Industrial Maintenance*: electrical insulating compound, adhesive, sealing compounds, lubricants, corrosion preventative, general supplies, isopropanol, batteries, paint, diesel fuel, grease, adhesives, hydraulic fluid, polyurethane coatings

6. *Medical Activities*: formaldehyde solution, alcohol pads, general purpose cleaning supplies (including disinfectants), lubricants, instrument cleaners, isopropyl rubbing alcohol, adhesives, dental resin
7. *Painting Operations*: adhesives, paints, polyurethane, primer, spray paint, spray primer, thinners, lacquers
8. *Photography Operations*: duplicator wash, wetting agent, general purpose supplies, isopropyl alcohol anhydrous, stabilizer, prebleach conditioner
9. *Training*: adhesives, lubricant, general purpose supplies, insecticide, paint, antifreeze, chemical agent detector kits, leak preventive (radiator stop leak), isopropyl alcohol, training aid personal decontamination kit, batteries (rechargeable and nonrechargeable), deicing/defrosting fluid, denatured alcohol, simulator detector
10. *Vehicle and Equipment Maintenance*: cleaner and lubricant, bonding compound tire repair, lubricants, fire retardant coatings, paint, general supplies, welding supplies, cleaning solvents, antifreeze, tire lubricant, penetrating oil, polyurethane, isopropyl alcohol, batteries, soldering fluid, denatured alcohol, gasoline antifreeze (HEET), deicing/defrosting fluid, carburetor and choke cleaner, diesel fuel, adhesives, hydraulic fluid.

All EPCRA Section 313, exemptions may apply to these processes depending on how they are used within an activity. The motor vehicle maintenance exemption would most likely apply to most of the chemicals used during the vehicle and equipment maintenance process. Many of the same chemicals used in the vehicle and equipment maintenance process are used in the industrial process. However, chemicals used in the industrial processes are not exempt because intermediate and depot level maintenance of tactical vehicles and aircraft are not exempt. Chemicals used during DPCM MWR activities would largely be exempt under the personnel use exemption. Chemicals used during DPTM activities in support of training activities such as general cleaning supplies and chemicals used in maintaining vehicles would be exempt under personnel use and the motor vehicle maintenance exemptions. Many medical activities are exempt under the laboratory activity exemption (unless the activity is not conducted under the direction of a technically qualified individual). Painting operations that would be conducted in vehicle maintenance operations such as touch-up work, paint applied to building exteriors and interiors, and paint used for traffic control, are also exempt. Depainting at the depot level would require consideration of the chemicals contained in the waste paint. Although photography operations use hazardous substances, the photographic process waters are treated in silver recovery units prior to discharge. The treated

process waters have been approved for discharge to the sanitary sewer. However, reporting is still required under EPCRA 313 if the 10,000-lb threshold is reached. Fort Lewis did not trigger the reporting threshold. Processes occurring during a training activity may be exempt. For example, routine vehicle maintenance occurring during a training activity is exempt.

Process Categories Using TRI Chemical Categories With Installation Usage > 500 lb During 1996 at Fort Lewis (Appendix F)

The same inventory data table described in the previous section, with each record assigned to a process, was used to develop the data in this section also. Table 7 lists the 10 processes and the quantity (pounds) of TRI chemical categories associated with each process. The same logic to apply exemptions is used here as was used in the individual chemical query for 1996.

Munitions Used at Fort Lewis in 1996 (Appendix G)

According to Army guidance, post-firing munition releases do not have to be reported until July 1999 for CY98. Hence comprehensive munitions data such as munition constituents are not yet available. The Army Environmental Center is currently working on a project to identify the constituents in munitions and to develop calculations for post-fired releases. The only data available for Fort Lewis are munition descriptions and the quantity used. The munition information contained in Appendix E is from the microcomputer based FIRE-system at Fort Lewis. The FIRE-system provides operational data to manage noise impacts. The munitions are assigned an ammunition description number (DODAC), which in theory only captures "in service munitions." The munitions usage by outside agencies that use Fort Lewis to train, such as the FBI and other law enforcement agencies, may not be captured. In addition munitions used by foreign troops training at Fort Lewis also might not be accurately captured. For example, U.S. troops use M16 rifles and most European nations use the NATO G3 rifle, however the NATO G3 is very similar to the M16 so it might be entered into the system as an M16 rifle. Hence, the munitions list in Appendix G may contain surrogates for munitions used by outside agencies or foreign troops.

Individual TRI Chemicals Used During 1995 at Fort Lewis > 500 lb (Appendix H)

This query was designed to retrieve all individual TRI chemicals used in quantities exceeding 500 lb during 1995. The query includes details on the products containing these chemicals. The EPCRA Reporting Database inventory information for 1995 was not supplemented with fuel usage and hospital usage information as occurred for the 1996 inventory information. Of the 54 chemicals retrieved, 12 chemicals were used in quantities in excess of 10,000 lb. Table 8 shows the estimated usage of TRI chemicals during 1995. Table 2 shows the usage quantities estimated by Fort Lewis as part of its 1996 TRI reporting.

According to the Washington State EPA, Community Right-to-Know Unit, Department of Ecology, Fort Lewis opted to report 990 lb of ethylene glycol releases, of which 901 was released to the air and 89 lb released to land. The remainder was either recycled or treated off-site, or exemptions were applied. Note that the 1995 data are not as complete as the 1996 data contained in the EPCRA Reporting Database.

TRI Chemical Categories Used During 1995 at Fort Lewis > 500 lb (Appendix I)

This query was designed to retrieve all TRI chemical categories used in quantities exceeding 500 lb during 1995. The query includes details on the products containing these chemicals. Of the 11 chemical categories retrieved, one chemical category was used in quantities in excess of 10,000 lb.

Table 8. Estimated usage of individual TRI chemicals (1995).

Chemical Name	Estimated Quantity Used (lb)
Chlorine	55,737
Chlorodifluoromethane (HCFC-22)	20,527
Dichlorodifluoromethane (CFC-12)	23,505
Dichloromethane	12,028
Ethylene Glycol	159,868
Lead	12,430
Malathion	35,684
Methanol	11,914
Naphthalene	343,933
Sulfuric Acid*	21,491
Toluene	10,511
Triadimefon(1-(4-Chlorophenoxy)-3,3-dimethyl-1-(1H-1,2,4-triazol-1-yl)-2-butanone)	35,964

* Sulfuric Acid is listed under Section 313 reportable chemicals, however it is listed with a qualifier. Fort Lewis actually had no usage of this chemical in its qualified form.

Table 9 shows the estimated usage of TRI chemical categories during 1995. The only category to trigger reporting was that of glycol ethers, which was found to not be reportable. Note that the 1995 data are not as complete as the 1996 data contained in the EPCRA Reporting Database. Therefore, a direct comparison of the two data sets is not possible.

1994 Data

Since 1994 was considered the baseline year, Fort Lewis was not required to report. Table 10 lists the chemicals and chemical categories greater than 500 lb that Fort Lewis inventoried, according to the 1995 Annual Progress Report. Of the 18 chemicals inventoried for 1994, six individual chemicals and one chemical category were still present on the 1996 individual TRI chemicals used list.

Of the 1994 chemicals and chemical categories, four would have been subject to the 10,000-lb threshold reporting requirement. Of the four, it is concluded that chlorine would have been exempt under the routine janitorial and facility grounds maintenance exemption, and/or personal use. Ethylene glycol and glycol ethers would have been largely exempt under the motor vehicle exemption. Methyl ethyl ketone would have largely been exempt under motor vehicle exemption, laboratory activity, and/or the facility grounds maintenance exemption.

Table 9. Estimated usage of TRI chemical categories (1995).

Chemical Category Name	Estimated Quantity Used (lb)
Cadmium compounds	1,815
Chlorinated ethanes	2,565
Chromium compounds	774
Copper compounds	1,294
Diisocyanates	6,727
Glycol ethers	36,237
Lead compounds	600
Manganese compounds	1,997
Nickel compounds	3,165
Nitrate compounds	2,250
Zinc compounds	7,298

Table 10. Estimated usage of TRI chemicals (1994).

Chemical Name	Estimated Usage (lb)
2-methoxyethanol	8,584
2,4-D	877
Amonia	546
Chlorodifluoromethane (HCFC-22)	514
Chlorine	47,601
Chromium	1,367
Cyanide Compound	7,546
Dibutyl Phthalate	1,188
Dichloromethane	618
Ethylene glycol	48,290
Freon 113	8,054
Glycol Ethers	4,966
Isopropyl Alcohol	726
Methanol	149
Methyl ethyl ketone	2,193
Methyl isobutyl ketone	787
Monochloropentafluoroethane (CFC-115)	511
Toluene	2,105

4 Conclusion

Since legislation that will change the scope of EPCRA is pending, it seems likely that it is only a matter of time before the law will require military installations to extend continually shrinking resources to comply with the full intent of EPCRA.

Although the EPCRA reporting thresholds for "otherwise use" is 10,000 lb, for the purpose of this report all queries were developed to extract data for those TRI chemicals and chemical categories used at or above 500 lb. The reason for reporting data on lower usage rates was to determine the impact to troop type installations in the event that reporting thresholds are lowered, to show which TRI chemicals and chemical categories are threatening the reporting threshold and which are not, and to show the diversity of TRI chemicals and chemical categories used at troop installations. Lower reporting thresholds for persistent or bioaccumulative chemicals, as proposed by the USEPA, may increase the number of future reportable TRI chemicals. However, none of the TRI chemicals used at Fort Lewis in quantities exceeding 500 lb (Table 1) appear to be either persistent or bioaccumulative.

Lower reporting thresholds would have a significant impact at Fort Lewis. For example, in 1996, Fort Lewis triggered the TRI reporting requirement for 11 chemicals. If the reporting threshold were lowered to 8,000 lb, 13 chemicals would trigger reporting. If the reporting threshold were lowered to 5,000 lb, 20 chemicals would trigger reporting. Although troop installations are able to take advantage of various exemptions that often preclude them from actual TRI reporting, it takes resources (time, money, and manpower) to prepare the documentation that determine whether an exemption may be taken. The more chemicals that trigger a reporting requirement, the more work involved to comply with EPCRA.

The information presented in this report depicts an installation using a very diverse set of TRI chemicals and chemical categories. Fort Lewis used 500 lb or more of 58 different TRI chemicals and 12 different TRI chemical categories in 1996. A troop type installation is similar to a small city in the variety of activities occurring within its boundaries. It is not surprising that a large number of hazardous chemicals would be used at these installations.

If certain EPCRA exemptions are repealed, the data in this report suggest that, although Fort Lewis currently reports very little in terms of reportable TRI chemicals, it uses a significant quantity that may be reportable in the future. For example, in 1996, Fort Lewis used 1,404,207 lb of benzene, n-Hexane, 1,404,949 lb of ethyl benzene, 7,031,524 lb of xylene (mixed isomers), and 3,521,907 lb of toluene. Because fuels are currently exempt from reporting, Fort Lewis did not take into consideration the fuel constituents in their reporting database. Hence, Fort Lewis' estimates of the quantities for the above chemicals were significantly lower. If the exemption is repealed, Fort Lewis would be required to report the final disposition of releases of these chemicals, develop the information needed to create these reports, and document the assumptions and calculations used to create the reports. These efforts would require a significant investment of time.

If the exemption for munition releases is lifted in 1999 as expected, the data handling and storage requirements at troop installations will be greatly expanded. This report shows the extensive use of munitions at Fort Lewis during 1996. (Munitions information was collected in electronic format at Fort Lewis for their noise prediction program.) However significant effort was expended in translating these data to a form useful for this report. Other installations may only have this information available in paper format. Information could not be found on the chemical composition of these munitions or the likely environmental release pathways. If this information is made available to installations, it is likely that a model would be required to predict releases at each installation. At a minimum, all the munitions data would need to be collected and stored, and all assumptions and calculations documented. Aside from the information reported in this study, the reportable TRI chemicals may significantly increase due to munitions.

Fort Lewis estimated that seven TRI chemicals and TRI chemical categories in 1996 would trigger the reporting requirement (not including the fuel constituents). Of these, only toluene (10,051 lb) and a portion of the ethylene glycol (34,753 lb) triggered a reporting requirement. The other five (chlorine, dichlorodifluoromethane, isopropyl alcohol, sulfuric acid, and xylene), and 59,864 lb of ethylene glycol — totaling 182,057 lb — were exempt from reporting.

This information has similar implications for other troop type installations. Even with the exemptions available to DOD installations as per the USEPA EPCRA DOD EO 12856 Guidance of March 95, and the DOD Guidance of June 96, EPCRA reporting is still a challenging task. Eliminating exemptions under EPCRA will significantly increase the reporting workload. Installations will

have to identify the processes that use and release TRI chemicals and chemical categories, and document the final disposition of all releases. Although this information exists, it is not likely to be compiled at a centralized location. Reporting TRI chemical releases without exemptions would require significantly more time and manpower at a time when these resources are being downsized.

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 ATTN: AFZH-DE
 Ft. Bragg 28307
 ATTN: AFZA-DPW
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 ATTN: AFZB-DPW
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 ATTN: AFZA-PP-E
 Ft. Stewart 31314
 ATTN: AFZP-De
 Ft. Buchanan 00934
 ATTN: AFZK-B-PW
 Ft. Drum 13602
 ATTN: 13602
 Ft. Irwin 92310
 ATTN: AFZJ-DPW
 Ft. Hood 76544
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