PETROLEUM AND CHLORINATED DEGREASING
SOLVENT REDUCTION AT ANNISTON: ANNISTON ARMY DEPOT

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Agenda One

The agenda for the following presentation is

- Solvents used
- Current methods
- HAZMIN methods implemented
- Proposed technology
- Summation.

Solvents Used

There are two general families of degreasing solvents used at Anniston: petroleum based and chlorinated solvents.

The primary petroleum solvent used is P-D-680 Type II, also known as mineral spirits, dry cleaning fluid, or Stoddard solvent. Type II has a flash point of 138°F minimum. In general, a waste with a flash point below 140°F is classified as an ignitable hazardous waste with EPA Hazardous Waste Number D001. During use, the flash point of the petroleum solvent typically rises as the amount of contamination increases. The waste P-D-680 Type II solvent usually has a flash point in the range of 145°F to 155°F, which takes it out of the ignitable hazardous waste category.

The primary chlorinated solvent used is trichloroethylene. The waste generated is classified as a listed hazardous waste with EPA Hazardous Waste Number F001.

Waste generated by degreasing solvent processes will be classified as toxic hazardous waste if it contains specific metals or organic compounds. Trichloroethylene waste is a listed hazardous waste. Examples are cadmium, lead, chrome, benzene, and chlorinated solvents such as trichloroethylene and perchloroethylene. Benzene was added to the list in September 1990 when new regulations went into effect.
The metals may be introduced to the solvent during use when cleaning component parts. Benzene is a compound present in fuels (gasoline, diesel) that can be introduced during use. Chlorinated solvents may be introduced by contamination from vapor degreasers. Benzene and chlorinated solvents are not completely removed during distillation of used solvent for recycle.

**Current Methods**

The greatest volume of petroleum solvent is used in immersion vats and recirculating parts washers.

In immersion vats, the part to be cleaned is submerged in the solvent. Some of the immersion vats have circulating pumps that provide agitation to improve cleaning efficiency.

In recirculating parts washers, the part to be cleaned is washed by a stream of filtered solvent. The operator frequently uses brushes to manually scrub parts.

The solvent is sometimes used on larger parts by spray or brush application.

Petroleum degreasing solvents have many advantages:

- First, we have many years experience in their use. These solvents are used throughout industrial and military operations and they work. Personnel are familiar with the product as a standard work practice.

- Second, they provide a measure of short-term corrosion resistance. The residual film remaining on parts will inhibit rusting of iron or steel components up to several days within the shop.

- Third, this solvent is recycled. A commercial firm collects and purifies the solvent, reducing the volume of material that is actually discarded for disposal.

- Fourth, these solvents are commonly specified in our operating documents (depot maintenance work requirements, standard operating procedures, etc.). Based on their successful use in the past, they are routinely specified in new documents and programs.

Petroleum solvents do have some disadvantages. They are flammable or combustible liquids. The flammability of the material imposes safety and environmental restrictions related to storage, use, and disposal. These include smoking restrictions, use of flame or spark producing tools, labelling, and the transportation and disposal of waste.

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Although these materials are frequently used in the workplace and present a low exposure hazard, there are maximum exposure limits established. These solvents do have an adverse impact on the eyes, respiratory system, and central nervous system. The primary effect usually encountered is removing natural oils from the skin.

Trichloroethylene is used in vapor degreasers. The primary advantage of trichloroethylene is its efficient removal of oil and grease accumulations on the parts to be cleaned. The disadvantages are the potential exposure of personnel operating the degreaser and the waste automatically listed as hazardous waste.

**Waste Reduction Methods Implemented**

The primary waste reduction method implemented at Anniston is distillation and recovery of usable solvent. Petroleum solvent is recycled offsite by an outside contractor. Trichlorethylene is recycled onsite by using stills located at each vapor degreaser.

Until September 1990, when new regulations went into effect, the recommended method of waste reduction for petroleum solvents was the recycling of the waste solvent. This reduced the volume of waste for disposal and returned usable solvent as a product. However, when using offsite recycling services, the solvent returned for use may contain trace quantities of contaminants that require the used solvent to be handled as hazardous waste. These contaminants are not necessarily from the shop that uses the recycled product but can be introduced from other shops that use the same recycling service. Recycling continues to be a viable means of reducing the volume of waste that ultimately is discarded, but the waste solvent has been reclassified from a regulated nonhazardous waste to a hazardous waste.

**Alternative Technology**

The primary alternative for reducing the usage and disposal of petroleum solvent waste is to convert cleaning operations to high-pressure water processes. There are two types of high-pressure water equipment that show potential in typical depot operations. These are

- **High-Pressure Glove Box**: Uses a manually directed high-pressure nozzle to clean soils from components using water and detergents as the cleaning medium. The water and detergent is continuously recirculated and filtered to remove solids.

- **Automatic Parts Washer**: Uses high-pressure water spray directed at the parts. The units operate similar to an automatic dish washer except with much higher cleaning solution velocity. The solution is recirculated in the unit and filtered during use.

Figure 1 shows a diesel engine cylinder with accumulated dirt and oil as it arrives on depot. Note the deposits on the cooling fins. The base material is an aluminum alloy.
Figure 1. A diesel engine cylinder with accumulated dirt and oil.
Figure 2 shows a cylinder that has been cleaned in an automatic parts washer using high-pressure water. Note that the deposits on the cooling fins have been removed. The current cleaning process incorporates manual steam cleaning followed by vapor degreasing. The high-pressure water cleans this part to the same degree as the current process.

**High-Pressure Water Advantages**

Disposal of spent solution will be through the IWTP. Sludge and residue from filters will be drummed for offsite disposal.

The detergent based solutions used represent a low exposure hazard for personnel. The enclosed cabinets also separate personnel from the cleaning operation, thus reducing the potential for exposure.

Since high-pressure water cleaning equipment is commercially available, there will be no developmental costs. The equipment is used in the private sector. Parts test cleaned in available types of equipment have been cleaned successfully. The major concerns are for precision bearings and corrosion of in-process components.

**High-Pressure Water Disadvantages**

High-pressure water will not completely eliminate the use of petroleum solvents.

Although corrosion inhibitors can be used in cleaning solutions, the presence of residual water may degrade some components.

The sludge from the parts washers reservoirs and solids removed from filters will be drummed for disposal. These wastes may be classified as hazardous waste, depending on the contaminants present.

**Current Procurement Actions**

Anniston is procuring two automated parts washers at a cost of approximately $62,000 each. These units have an 84-inch diameter turntable and a work area height of 75 inches. The maximum load for the turntable is 20,000 pounds.

Anniston is also procuring 31 manual spray cabinets, as part of a Depot Systems Command (DESCOM) central purchase of 82 units at a cost of approximately $7,250 each. These units have a work capacity of 32-inches width, 24-inches height, and 20-inches depth.
Figure 2. A diesel engine cylinder that has been cleaned in an automatic parts washer.
Annual waste reductions, based on anticipated performance of the high-pressure water cleaning units are estimated to be 2,255 gallons for trichloroethylene and 10,140 gallons for P-D-680.

**Summation**

Anniston has implemented recycling as a method of reducing hazardous waste generation from degreasing operations. We are working toward substitution of high-pressure water cleaning processes to minimize hazardous waste and personnel exposures.
SOLVENT REDUCTIONS AT ANAD

Solvents used:

✓ PETROLEUM / P-D-680

✓ CHLORINATED /
TRICHLOROETHYLENE
SOLVENT REDUCTIONS AT ANAD

Current Methods:

✔ P-D-680:
   IMMERSION VATS
   RECIRCULATING PARTS WASHERS

✔ TRICHLOROETHYLENE:
   VAPOR DEGREASERS

SOLVENT REDUCTIONS AT ANAD

Waste Reduction Methods Implemented:

✔ P-D-680:
   OFF-SITE RECYCLING

✔ TRICHLOROETHYLENE:
   ON-SITE DISTILLATION
Alternative Technology:

- HIGH PRESSURE WATER PARTS WASHERS
  - MANUAL SPRAY CABINET
  - AUTOMATIC PARTS WASHERS

High Pressure Water Advantages:

- SPENT SOLUTION DISPOSAL THROUGH IWTP
- LOW PERSONNEL EXPOSURE POTENTIAL
- COMMERCIAL EQUIPMENT AVAILABLE
SOLVENT REDUCTIONS AT ANAD

High Pressure Water Disadvantages:

✓ CORROSION / FLASH RUSTING
✓ ASSEMBLED COMPONENTS
✓ SLUDGE DISPOSAL

SOLVENT REDUCTIONS AT ANAD

Current Procurement Actions:

✓ AUTOMATIC UNITS:
  2 TURNTABLES AT $62,000 EACH

✓ MANUAL UNITS:
  31 SPRAY CABINETS AS PART OF DESCOM CENTRAL PURCHASE OF 82,
  ESTIMATED AT APPROX. $7,250 EACH
SOLVENT REDUCTIONS AT ANAD

Summation

✓ IMPLEMENTED RECYCLING
✓ FUTURE PROCESS SUBSTITUTION
WORKSHOP II

Degreasing/Solvent Substitution