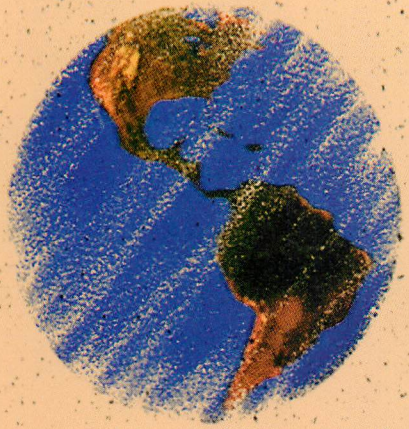
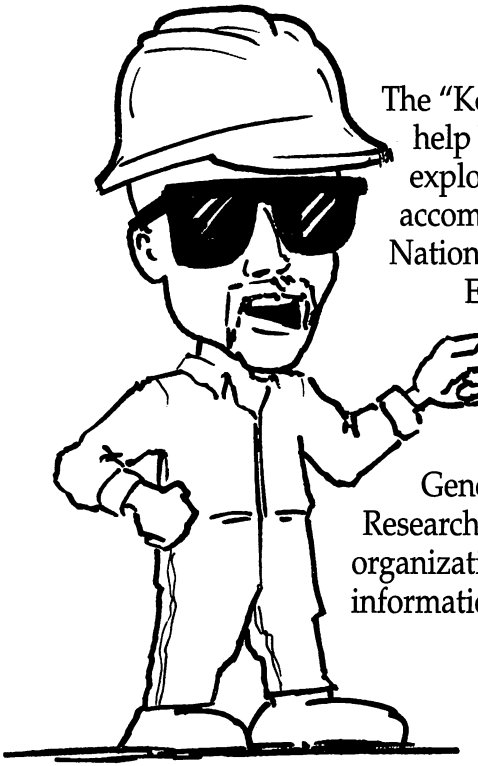


Keepin' It All Clean...

In The Oil Patch

Field Guide



FOR YOUR INFORMATION

The "Keepin' It ALL Clean . . . in the Oil Patch" Field Guide is provided to help YOU identify ways to prevent pollution in your oil and gas exploration and production field operations. The Field Guide and accompanying Video and Instructor's Manual were developed by the National Environmental Training Association (NETA) for the U.S. Environmental Protection Agency (EPA) under grant #T90268. Alice T. Megna, President of EnviroSource Training & Technology, Inc. of Houston, Texas, compiled the Field Guide in a public/private partnership with the many industry and regulatory agency sources acknowledged at the end of the guide. Generous grants from the American Petroleum Institute and the Gas Research Institutue made wide distribution possible. Contact your trade organization or state commission or fax NETA at (602) 956-6692 for additional information or copies.

Copyright NETA, 1995
ISBN No. 1-880996-20-0

USING THE FIELD GUIDE

1. The Field Guide focuses on the Environmental Protection Agency's first two choices in the pollution prevention hierarchy:
   - Reduce pollution at the source.
   - Recycle or reuse materials, or reclaim usable parts.

   While important, the last two choices:
   - Treat to reduce volume or toxicity, and
   - Dispose of properly after the first three options have been exhausted

   are beyond the scope of the Field Guide.

2. State and local laws and regulations must be considered in the selection of pollution prevention activities. Some suggested solutions may not be allowed, or may require agency approval. Examples include injecting for enhanced recovery (permit required) and using wastes as fill or road mix materials (approval may be required by the state agency).

3. Each suggestion must be weighed against other options with regard to cost, feasibility, etc. For example, buying materials in bulk helps minimize the number of containers that must be managed or disposed. However, if only a small amount is needed, smaller, non-bulk containers would be more appropriate.

4. Remember, manufacturers of products used in oil field operations can often offer assistance in waste management issues regarding their product.

5. Publication of this guide does not signify that the contents necessarily reflect the views and policies of the Environmental Protection Agency. Mention of trade names or commercial products does not constitute endorsement or recommendation for use by the Environmental Protection Agency, the National Environmental Training Association, or members of the technical advisory committee.

WASTE	POLLUTION PREVENTION/WASTE MINIMIZATION OPPORTUNITIES	
Absorbent Materials Natural - clay, vermiculite Synthetic - pads	*Recycle:*	▶ Recover oil and absorbent pads, and recycle. ▶ Use repack or cleaned used drums to deliver used pads to the recycler.
Acid, Spent	*Reduce:*	▶ Micro-meter solutions to minimize unused acid (continuous mix versus batch mix). ▶ Use to neutralize excess caustics.
	Recycle:	▶ Reclaim or reuse.
Activated Carbon, Spent	*Recycle:*	▶ Regenerate onsite or send to company for regeneration/recycling.
Air Emissions Nitrogen oxides (NO_x), Sulfur oxides (SO_x), Hydrocarbons,	*Reduce:*	▶ Design and operate to minimize air pollution. ▶ Install/maintain catalytic converters. ▶ Use/install low NO_x burners. ▶ Convert engines to lean-burn.

BETX (Benzene, Ethyl Benzene, Toluene, Xylene)
Carbon Monoxide (CO)
Particulates
Halons (See Fire-fighting Agents)
Fugitive Emissions
Mercury
Chlorofluorocarbons (CFCs, see Refrigerants)
Volatile Organic Componds (VOCs)

- Install pre-combustion chambers on engines.
- Install electronic ignition.
- Maintain and run all engines to be the most fuel efficient.
- Use natural gas engines instead of engines powered by diesel or other fuels.
- Use regular preventive maintenance and monitoring procedures.
- Tighten connections; replace packing to minimize leaks.
- Reduce emissions of unburned hydrocarbons in new facility design (for example, route emissions to flare, route dehydrator still emissions to first stage compression, use electric drivers for compressors, use shorter piping runs with fewer flanges, use welded rather than screwed fittings).
- Reduce horsepower demands to reduce emissions.
- Maintain tank thief hatch seals.

(Air Emissions continued on next page)

WASTE

(Air Emissions continued)

POLLUTION PREVENTION/WASTE MINIMIZATION OPPORTUNITIES

- Route dehydrator still emissions to reboiler, firebox, or flare.
- Lower glycol circulation rate — avoid over dehydrating (vapor recovery).
- Eliminate use of sparge or stripping gas in dehydrators.
- Buy solvents and liquid chemicals in bulk.
- Keep solvent and chemical containers covered.
- Buy less volatile solvents and liquid chemicals.
- Use dust control techniques at facilities.
- Eliminate the use of halon fire extinguishing materials.
- Revise test procedures so halon is not released during testing.
- Flare natural gas rather then venting.

	Recycle:	▶ Use waste heat recovery opportunities where practically possible. ▶ Use flare gas as fuel. ▶ Gas may be collected, compressed, and sold as product.
Amine	See Sweetening/Dehydration	
Ammonium Hydroxide, Spent	*Reduce:*	▶ Convert to copiers which do not require ammonium hydroxide.
Antifreeze	*Reduce:*	▶ Use a less toxic substitute (for example, propylene glycol).
	Recycle:	▶ Regenerate onsite by filtration (if not thermally regraded). ▶ Send to recycler.

WASTE	POLLUTION PREVENTION/WASTE MINIMIZATION OPPORTUNITIES	
Asbestos/Asbestos Containing Materials	*Reduce:*	▶ Purchase asbestos-free products and equipment. ▶ Maintain to keep friable (brittle) asbestos from becoming exposed. Mark materials which contain asbestos.
Ballast/Bilge Water	See Wastewater	
Batteries Alkali Lead-acid Lithium Nickel-cadmium	*Reduce:*	▶ Purchase long-life batteries to decrease the number of batteries needed. ▶ Use rechargeable batteries.
	Recycle:	▶ Recycle lead-acid batteries and nickel-cadmium batteries to recover electrolyte, plastic, and metals. ▶ Return to vendor or manufacturer for recycling.

Biocides, Pesticides, Herbicides, Insecticides, etc.

Reduce:

- Use commercial application service.
- Properly store and label containers to prevent degradation and contamination.
- Use all contents/material and then triple rinse the containers/package. (Also see Container/Package Rinsate.)
- Practice good inventory control.

Recycle:

- Return to vendor.
- Use excess at another facility.
- Sell excess.

WASTE

Blasting Sand/Material

POLLUTION PREVENTION/WASTE MINIMIZATION OPPORTUNITIES

Reduce:

- Use coatings that do not require sandblasting.
- Use equipment that captures used abrasive. Properly enclose work area.
- Brush-blast and paint instead of blasting to base metal.
- Send to cement kiln as a substitute for raw materials.
- Reduce painting/blasting frequency.
- Use copper slag (waste from another industry) instead of virgin materials.
- Use dry ice or recyclable materials instead of sand for some applications.
- Use paints with no lead or lower levels of other metals.
- Buy in bulk hoppers to minimize sacks and pallets.

Recycle:

- Separate from blasted paint and reuse abrasive.
- Use as aggregate in roadmix.
- If uncontaminated, use onsite as fill materials instead of virgin materials.

Blow-out Preventer Test Fluids	*Reduce:*	▶ Collect leakage to avoid ground contamination.
	Recycle:	▶ Return fluids to system if uncontaminated.
Boiler Blowdown	See Wastewater	
Buckets, Empty	*Reduce:*	▶ Purchase materials in bulk.
	Recycle:	▶ Clean, remove all labels and reuse for holding other materials. ▶ Return to vendor. ▶ Sell buckets to scrap metal or plastic recycler.
Carbon Dioxide (CO_2) Wastes	See Sweetening/Dehydration	
Catalyst, Spent	*Reduce:*	▶ Substitute less hazardous catalysts. ▶ Use the catalyst completely before removing from system.

(Catalyst, Spent continued on next page)

WASTE	POLLUTION PREVENTION/WASTE MINIMIZATION OPPORTUNITIES	
(Catalyst, Spent continued)		▶ Operate the system to prevent contamination.
	Recycle:	▶ Regenerate.
		▶ Certain types of catalysts can be sent to pulp and paper mills.
		▶ Recycle for metals recovery.
		▶ Send to cement kiln as a substitute for raw materials.
		▶ Use onsite as fill materials instead of virgin materials.
Caustic, Spent	*Reduce:*	▶ Plan job to minimize volume of fluid, thereby reducing caustic requirements in drilling operations.
	Recycle:	▶ Use to neutralize excess acids.
		▶ Inject for enhanced recovery.
Cement Returns	*Reduce:*	▶ Plan the jobs to minimize excess cement slurry.

Chemical Wastes

Reduce:

- Plan purchases to minimize surplus.
- Minimize the use and variety of similar-use chemicals when one chemical is suitable.
- Label and store all chemicals properly.
- Segregate hazardous from non-hazardous chemicals to minimize volume of hazardous waste.
- Protect chemicals from weather; keep containers covered.
- Practice "first in/first out" or "Just-in-Time" (JIT) inventory control.
- Use all of the chemicals as intended.
- Return used chemicals to vendor/manufacturer.
- Substitute products with longer life and less adverse/negative environmental impacts.
- Use reusable containers.
- Buy chemicals in bulk when possible with supplier retaining ownership of containers.

(Chemical Wastes continued on next page)

WASTE	POLLUTION PREVENTION/WASTE MINIMIZATION OPPORTUNITIES	
(Chemical Wastes)	*Recycle:*	▶ Use surplus chemicals at other locations. ▶ Find alternate uses for unused chemicals. ▶ Reclaim metals and other materials. ▶ Investigate waste exchange networks. ▶ Use as a substitute for virgin fuels.
Chemicals/Materials, Unused Mud/Fluid Additives Cement Corrosion Inhibitors Detergents Methanol Scale Inhibitors Treating Chemicals, Other	*Reduce:*	▶ Buy only the amount needed and use what you buy. ▶ Make arrangements to return containers and unused chemicals to vendors. ▶ Minimize purchasing similar materials from different vendors. ▶ Practice Just-In-Time (JIT) inventory control. ▶ Use all chemicals before purchasing new or different formulas. ▶ Do not accept chemicals near their expiration dates. ▶ Use chemicals at another location.

		▶ Sell to other operators.
	Recycle:	▶ Use as a substitute for virgin fuel.
Cleaning Wastes, Process Equipment	*Reduce:*	▶ Minimize drips, leaks, spills, etc. ▶ Replace defective equipment/facilities. ▶ Wipe up instead of washing (especially when water is scarce).
	Recycle:	▶ Regenerate cleaning material, if possible.
Completion, Workover, Well Treatment Fluids	*Reduce:*	▶ Plan the job to avoid excess fluids. ▶ Use less toxic additives. ▶ Use improved acidizing technology and inhibition technology to decrease frequency of jobs. ▶ Return all unused treatment fluids to supplier. (Bring what you need and pump what you bring.)
	Recycle:	▶ Use on other jobs. ▶ Inject for enhanced recovery.

WASTE	POLLUTION PREVENTION/WASTE MINIMIZATION OPPORTUNITIES	
Concrete	See Construction/Demolition Debris	
Construction/Demolition Debris Spoil Vegetation Wood Scrap Metal	*Reduce:*	▶ Plan site to minimize size. ▶ Minimize demolition requirements. ▶ Consider portable pads or skid-mounted equipment. ▶ Use High Density Polyethylene liners rather than concrete.
	Recycle:	▶ Crush concrete for use as aggregate. ▶ Compost vegetation and use to augment soil properties. ▶ Chip uncontaminated wood for mulch. ▶ Reuse wood for other purposes such as fill or location and road base material if not contaminated. ▶ Sell or send for reuse. ▶ Send scrap metal to a recycler.

Container/Package Rinsate (drums, tank trucks, etc.)	*Reduce:*	▶ Use rinsate as originally intended for the material.
	Recycle:	▶ Use as substitute for commercial product. ▶ Use as process wastewater for oil/hydrocarbon recovery in skim systems. ▶ Use for enhanced recovery operations.
Cooking Oil/Grease/Fat	See Domestic Refuse	
Cooling Tower Blowdown	See Wastewater	
Copier Toner, Developer, Solutions and Cartridges	*Reduce:*	▶ Buy recycled cartridges. ▶ Buy what you need and use what you buy.
	Recycle:	▶ Return empty containers and used components to the manufacturer. ▶ Use as a substitute for virgin fuels.

WASTE	POLLUTION PREVENTION/WASTE MINIMIZATION OPPORTUNITIES	
Crude Oil/Condensate, Waste	*Reduce:*	▶ Use vapor recovery, drip pots, and/or other containment systems to collect and return to system.
	Recycle:	▶ Send to crude oil reclamation plant.
Cuttings, Drill Water-based Oil-based	*Reduce:*	▶ Drill smaller diameter holes or horizontal wells. ▶ Optimize solids control to minimize need to dilute mud. ▶ Use polymer mud systems. ▶ Use closed mud system.
	Recycle:	▶ Use enhanced solids separation equipment to recover oil or water phase for reuse.
Deionized Water, Excess	See Wastewater	
Domestic Refuse Food Waste Packaging Material	*Reduce:*	▶ Reduce packaging; buy in bulk. ▶ Purchase/prepare only what is needed; avoid surplus.

Paper
Plastic/Styrofoam
Cooking oils/Grease
Other Trash

- Purchase higher quality materials with longer use cycles.
- Use washable mugs, cups, plates, and utensils.
- Prepare fewer fried foods.
- Copy on both sides of the paper.
- Purchase recycled/recyclable materials or those containing recycled/recyclable materials.
- Obtain agreements to send packaging waste back to vendor.
- Use microbial enzymes to control grease in grease traps.

Recycle:

- Set up recycle bins at permanent and/or long-term facilities to recycle wood, paper, newspapers, plastic, glass, cardboard, aluminum, and other metals.
- Reuse cardboard boxes and other containers for shipping.
- Use waste paper, styrofoam, etc. as packaging materials and package fillers.

(Domestic Refuse continued on next page)

WASTE		POLLUTION PREVENTION/WASTE MINIMIZATION OPPORTUNITIES
(Domestic Refuse continued)		▶ Send cooking oil/grease/fat to a rendering or reclamation plant. ▶ Compost food and other easily biodegradable materials, and use then to improve soil properties. ▶ Send easily burnable materials to burn for energy recovery instead of virgin fuel.
Domestic and Sanitary Wastewater	*Reduce:*	▶ Use low flow and low water use toilets, showers and faucets. ▶ Repair/replace leaking equipment.
	Recycle:	▶ Use digested sewage sludge for agricultural purposes to augment soil properties. ▶ Use treated water as facility washdown water. ▶ Use treated wastewater for watering lawn, plants, shrubs, etc.
Drill Cuttings		See Cuttings, Drill

Drilling Fluids

Water-based Muds
- Freshwater
- Saltwater

Oil-based muds

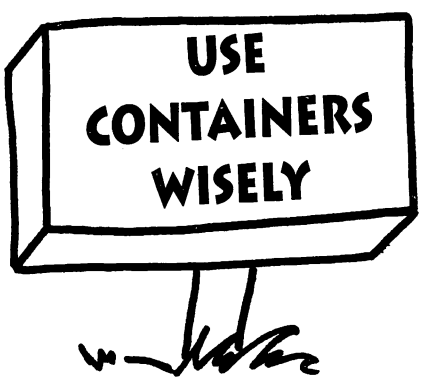
Drill fluid chemicals/additives

Reduce:

- Avoid excess muds, additives, and water.
- Minimize the amount of materials (water, etc.) added to the mud system.
- Substitute organic or synthetic additives (mineral oil) for diesel-based mud.
- Use less toxic drilling fluid additives.
- Use less toxic materials as biocides.
- Minimize containers/packaging (for example, buy in bulk).
- Use closed loop mud system.
- Return unused chemicals/additives/muds to vendor/supplier.
- Improve solids control technology to minimize volume of mud for disposal.
- Mix slag with drilling mud to make cement for casing jobs.

(Drilling Fluids continued on next page)

WASTE		POLLUTION PREVENTION/WASTE MINIMIZATION OPPORTUNITIES
(Drilling Fluids)	*Recycle:*	▶ Reuse muds at another location (spudding or plugging and abandonment). ▶ Return mud to mud company for reconditioning and use as make-up mud.
Drums/Sacks/etc., Empty	*Reduce:*	▶ Use bulk transport and storage. ▶ Purchase materials in returnable/refillable/recyclable drums instead of sacks. ▶ Require vendor to maintain ownership of bulk transportation containers.
	Recycle:	▶ Return drums to the vendor. ▶ Reuse containers after proper draining/rinsing. (Use rinsate as material was originally intended.) ▶ Use drums as containment systems (for example, for fill/drain hose connections). ▶ Refill with nonhazardous materials for transport or storage.



		▶ Send drums to scrap metal recycler or plastic recycler. ▶ Open and handle drums properly to minimize damage and enable refurbishing.
Electrical Equipment, Oil-filled (less than 50 ppm PCBs) Capacitors Transformers Switches Heat Transfer Fluids (Dowtherm G)	*Reduce:* *Recycle:*	▶ Properly maintain and operate to prevent leakage. ▶ Do not refill or service with oils containing more than 50 ppm PCBs. ▶ Reuse or sell for originally intended purpose. ▶ Recycle oil into production system. ▶ Send to scrap metal recycler. ▶ Burn oil for energy recovery.

WASTE	POLLUTION PREVENTION/WASTE MINIMIZATION OPPORTUNITIES	
Electrical Equipment, Oil-filled (greater than 50 ppm PCBs) Capacitors Transformers Switches Heat Transfer Fluids (Dowtherm G)	*Reduce:*	▶ Do not purchase equipment (used) with PCBs more than 50 ppm. ▶ Do not refill or service with oils containing more than 50 ppm PCBs. ▶ Properly maintain and operate to prevent leakage.
	Recycle:	▶ Reuse or sell for originally intended purpose. ▶ Send to scrap metal recycler after cleaning.
Emergency Pits	See Pit Wastes	
Erosion	*Reduce:*	▶ Minimize digging/soil movement. ▶ Protect slopes from erosion with covering, sandbags, or plants. Also see Construction/Demolition Debris

Film (X-ray, etc.)	See Silver-containing Wastes	
Filters and Filter Media Used Oil Natural Gas Fuel Glycol Diatomaceous earth	*Reduce:*	▶ Use permanent filters, such as metal filters, that can be cleaned and reused. ▶ Purchase longer life filters. ▶ Increase time between changes for oil filters and air filters based on pressure drop, lube oil testing, etc. rather than replacing on a routine basis. ▶ Optimize operation of equipment to minimize degradation of fluids (for example, oil, glycol, etc.).
	Recycle:	▶ Send used filters to recycler after draining.
	Also see Activated carbon, spent	
Fire Fighting Agents	*Reduce:*	▶ Contract with vendor to supply, maintain, and take back all unused fire-fighting agents. ▶ Convert to less toxic, more environmentally compatible alternatives. ▶ Minimize dry agents when water will suffice.

(Fire Fighting Agents continued on next page)

WASTE	POLLUTION PREVENTION/WASTE MINIMIZATION OPPORTUNITIES	
(Fire Fighting Agents continued)		▶ Eliminate or minimize the use of halon extinguishers.
	Recycle:	▶ Reuse at other facilities. ▶ Sell to other operators.
Flue Dust Ash	*Recycle:*	▶ Reuse at other facilities.
Hydrotest Fluid	*Recycle:*	▶ Reuse water for purposes not requiring potable water. ▶ Use produced water for hydrotesting. ▶ Inject for enhanced recovery. Also see Wastewater
Insulation Material (excluding asbestos)	*Reduce:*	▶ Keep covered and protected to minimize degradation.
	Recycle:	▶ Reuse at other facilities/equipment.

Iron Sponge	See Sweetening/Dehydration
Glycol	See Sweetening/Dehydration
Hydraulic Fluid	See Lubricants

Laboratory Samples

Reduce:
- Collect only the amount necessary for analysis.
- Minimize testings - do only those necessary and no more often than required.
- Use test methods/procedures which generate no or less waste (for example, colorimetric testing).
- Use process knowledge instead of testing.

Recycle:
- Return excess material to the process.

WASTE	POLLUTION PREVENTION/WASTE MINIMIZATION OPPORTUNITIES	
Laboratory Waste	*Reduce:*	▶ Segregate waste chemicals by hazard class to reduce the amount of hazardous waste for disposal. ▶ Buy only the amount and size necessary. ▶ Use alternative test methods which generate less or no waste. ▶ Sell excess unused chemicals.
	Recycle:	▶ Send oily wastes to a recycler.
Lean Oil	See Crude Oil/Condensate	
Lubricants Lube oil, used Hydraulic fluid	*Reduce:*	▶ Buy in bulk. ▶ Minimize the volume of waste lube oil by extending its use. –Base lubricant changes on testing, not on routine schedule. –Set up a regular inspection and maintenance program for facility to minimize leak or line failures.

		▶ Install mechanical solids removal systems (for example, centrifuges and magnets) directly on equipment/engines to extend oil life.
	Recycle:	▶ Recycle into the production system if the material is a petroleum-based product. ▶ Regenerate oil and reuse. ▶ Send lube oil to recycler. ▶ Use as substitute for virgin fuels.
Mercury and Mercury-contaminated Soil	*Reduce:*	▶ Phase out use of mercury (for example, manometers). ▶ Use secondary containment and good housekeeping to prevent mercury contamination.
	Recycle:	▶ Set up dedicated recycling containers for mercury. ▶ Send mercury to a commercial reclaimer for reuse.
Molecular Sieve	*Reduce:*	▶ Install activated carbon upstream of the unit to remove corrosion inhibitors, amines, absorber oils, glycol, and other contaminants to extend life of molecular sieve.

(Molecular Sieve continued on next page)

WASTE	POLLUTION PREVENTION/WASTE MINIMIZATION OPPORTUNITIES
(Molecular Sieve continued)	*Recycle:* ▶ Regenerate material for reuse. ▶ Use instead of virgin materials for fill material.
Motor Vehicle Maintenance	*Reduce:* ▶ Centralize motor vehicle maintenance activities. ▶ Set up recycling bins and containers for specific wastes. *Recycle:* ▶ Recycle batteries, oil, etc. as appropriate. Also see Batteries, Filters and Filter Media, Lubricants
Natural Gas	*Reduce:* ▶ Install recovery system on tanks and on the casing head connection of pumping wells to return gas to process. *Recycle:* ▶ Re-inject into formation. ▶ Use as fuel or sell as product.

Naturally Occurring Radioactive Material (NORM)

Articles:

- Equipment, Tubing, Piping

Liquids:

- Residual Water from Cleaning

Solids:

- Blast Sand, Scale (Barium Sulfate), Soil, Production Tank Bottoms, Water Treating, Blowdown Sand, Produced Sand

Reduce:

- Select tubular or equipment cleaning techniques which will minimize waste generation.
- Use scale-inhibitor treatments.
- Do not mix produced waters which could precipitate barium scale.
- Design facility to minimize pressure drop points (for example, elbows).
- Centralize pipe cleaning facilities.

Packing Fluids — See Completion, Workover, and Well Treatment Fluids

WASTE	POLLUTION PREVENTION/WASTE MINIMIZATION OPPORTUNITIES	
Paint Related Materials and Wastes Brushes Paint Cans, Empty Thinner	*Reduce:*	▶ Paint less frequently. ▶ Buy in bulk and only volume needed. ▶ Size paint batches systematically to specific jobs. ▶ Purchase less toxic, less volatile paints and solvents (for example, lower metals content). ▶ Use water-based or high-solids coatings whenever possible. ▶ Train operators to minimize unacceptable quality and waste. ▶ Reduce overspray. ▶ Use a brush for small jobs instead of spraying. ▶ Use all the paint. ▶ Keep containers closed to reduce evaporation. ▶ Ensure paint containers are emptied and dried. ▶ Buy "throw-away" brushes and do not clean with solvents.

- Purchase paints with greater durability.
- Ensure proper volumes are mixed.
- Buy in smaller containers to reduce excess paint when mixed.

Recycle:

- Regenerate (for example, distillation) solvents onsite or offsite.
- Use separate solvents and/or containers for each paint color, when spent, use as thinner for that particular color.
- Use as a substitute for virgin fuels.

Also see Blasting Sand/materials; Solvents

Pallets

Reduce:

- Buy materials in skid-mounted bulk hoppers or containers.
- Purchase recycled plastic pallets which have a longer life than wooden ones.

(Pallets continued on next page)

WASTE		POLLUTION PREVENTION/WASTE MINIMIZATION OPPORTUNITIES
(Pallets continued)	*Recycle:*	▶ Reuse pallets. ▶ Return to vendor. ▶ Chip uncontaminated wooden pallets and use as mulch.
Paraffin	*Reduce:*	▶ Use paraffin inhibitor chemicals. ▶ Treat wells and pipelines with hot oil. ▶ Use paraffin solvents to dissolve.
	Recycle:	▶ Reheat and return to process. ▶ Send mechanically removed paraffin to recycler. ▶ Send to fuels blending facility for use instead of virgin fuels.
Pigging Wastes Plastic Solids	See Pipe/Equipment Scale, Pipe/Equipment Hydrates, Paraffin	

Pipe/Equipment Scale and Corrosion (non-NORM)	*Reduce:*	▶ Replace with piping/liners made of materials that do not corrode. ▶ Optimize chemical treatments and cathodic protection programs to minimize scale build-ups.
	Recycle:	▶ Use as fill material instead of virgin material. ▶ Use as roadmix material.
Pipe/Equipment Hydrates	*Reduce:*	▶ Inject methanol or glycol to prevent hydrate formation. ▶ Melt in place.
	Recycle:	▶ Return to water treating system to recycle any contained hydrocarbons.
Pipe Dope	*Reduce:*	▶ Switch to less toxic (for example, lead-free) pipe dope materials. ▶ Use only the amount of dope needed to protect pipe threads. ▶ Use excess at another location.

WASTE		POLLUTION PREVENTION/WASTE MINIMIZATION OPPORTUNITIES
Pipe/Tubing		See Construction/Demolition Debris
Pit Wastes Reserve pits Emergency pits	*Reduce:*	▶ Use rig wash water judiciously. ▶ Segregate fresh water, salt water, and oil-based fluids and solids. ▶ Remove oil as soon as possible to minimize contamination. ▶ Examine and eliminate all sources of water leaks. ▶ Segregate and release water that does not contain hydrocarbons or high salinity. ▶ Use automatic shut-off nozzles on rig floor water hoses. ▶ Grade site and use diversion structures to prevent or minimize stormwater run-on. ▶ Use closed-loop mud systems. ▶ Design pits/pit systems to minimize waste.

–Design separate pits for shaker solids, settling, storage, and emergency discharges.

–Size and construct pits to accommodate only the necessary volumes anticipated plus an adequate freeboard.

–Eliminate use of pits or reduce pit size by 1/3 to 1/2.

–Use pit liners.

- Replace pits with above-ground or double-walled, partially buried tanks.
- Segregate RCRA-exempt and non-exempt wastes.
- Eliminate the use of workover pits.
- Use a catchment pan installed on top of the wellhead to prevent spills.
- Close reserve pit in timely manner once dewatering has occurred.

Recycle:

- Use stabilized solids from drilling for lining or capping landfill sites.

(Pit Wastes continued on next page)

WASTE		POLLUTION PREVENTION/WASTE MINIMIZATION OPPORTUNITIES
(Pit Wastes continued)		▶ Recycle recovered weighting materials and drilling fluids. ▶ Recycle/reuse mud system water. ▶ Send used mud to a commercial mud plant.
Plastic Solids (Pigs, etc.)	*Reduce:*	▶ Purchase products manufactured with recycled plastic.
	Recycle:	▶ Send to a plastic recycler.
Polychlorinated Biphenyls (PCBs)	See Electrical Equipment, Oil-filled	
Process Water	See Wastewater	
Produced Sand	*Reduce:*	▶ Use appropriate gravel pack size and screens. ▶ Engineer solids control equipment to maximize cleaning efficiency and minimize oil and/or salt contamination.

		▶ Optimize production rate. ▶ Keep solids mixed and in solution for eventual central removal.
	Recycle:	▶ Use as fill material instead of virgin materials, if no fuel oil. ▶ Wash sand to recover and recycle the oil. ▶ Send to cement kiln as substitute for raw materials.
Produced Water	*Reduce:*	▶ Drill wells to minimize water production (for example, horizontal wells). ▶ Complete wells to minimize water production. ▶ Re-perforate wells to minimize water production. ▶ Use downhole fluid separation techniques, when available, or use water shut-off (blocking) techniques. ▶ Use corrosion inhibition chemicals and "cold treatment" for produced water.

(Produced Water continued on next page)

WASTE	POLLUTION PREVENTION/WASTE MINIMIZATION OPPORTUNITIES	
(Produced Water continued)		▶ Replace thick coalescer panel in oil water separators with thin panel baffles.
	Recycle:	▶ Inject for enhanced recovery
		▶ Use for hydrotesting pipelines and equipment/tanks.
		▶ Use for agricultural or ranching purposes, if quality is acceptable.
		▶ Desalinate for use in other E & P operations if water supply is scarce and process is cost effective.
Radioactive Waste (tracer materials)	Reduce:	▶ Use less toxic and non-radioactive alternatives.
Rags, Oily	*Reduce:*	▶ Maintain equipment/facilities to prevent drips, leaks, spills, etc. which would require cleanup.
		▶ Use drip pans or other containment to collect drips, leaks, etc.
	Recycle:	▶ Segregate from other materials; wash and reuse.
		▶ Send to recycling facility.

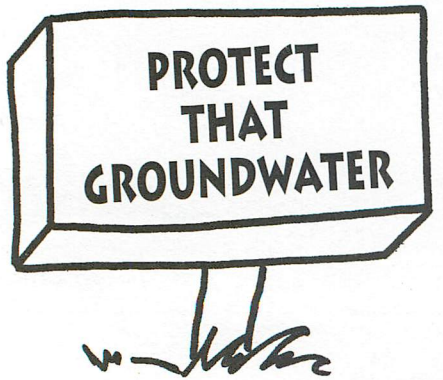
Refractory Waste	*Recycle:*	▶ Send to a cement kiln for recycling. ▶ Use as fill material instead of virgin material.
Refrigerants (CFCs)	*Reduce:*	▶ Replace CFCs with more environmentally compatible refrigerants.
	Recycle:	▶ Collect for reuse. Do not vent to atmosphere.
Reserve Pits	See Pit Wastes	
Rigwash	*Reduce:*	▶ Use high-pressure, low-volume washing equipment. ▶ Set up regular maintenance program for water systems. ▶ Remove paint solids from water arrestor holding tanks with a centrifuge or cyclone system. ▶ Reduce washwater by sweeping/dry cleaning when practical. ▶ Install automatic shutoff nozzles on hoses.

(Rigwash continued on next page)

WASTE	POLLUTION PREVENTION/WASTE MINIMIZATION OPPORTUNITIES
(Rigwash continued)	*Recycle:* ▶ Reuse water whenever possible. ▶ Use contaminated water for first stage washing of equipment. ▶ Use as make-up water in drilling/completion operations (drilling mud, completion fluids, etc.)
Rinsate Wastes	See Container/Package Rinsate
Saltbath Heater Salt (sodium nitrite/nitrate mixture)	*Reduce:* ▶ Use alternative heat transfer media which is less toxic. *Recycle:* ▶ Regenerate. ▶ Use at another location.
Sanitary Wastewater	See Domestic and Sanitary Wastewater

Scrap Metal	See Construction/Demolition Debris	
Scrubber Wastes	*Reduce:*	▶ Convert to natural gas as a fuel to avoid generating SO_2 and flyash.
	Recycle:	▶ Remove solids through gravity separation, filtration, etc., and send liquids to water softening for steam generation or direct injection for enhanced recovery. ▶ Use as oxygen scavenger.
Silver-containing Waste	*Reduce:*	▶ Minimize number of film reproductions. ▶ Install on-line equipment to remove silver from process liquids.
	Recycle:	▶ Recover silver from the film/developing solution before disposal. ▶ Send liquids to recycler. ▶ Send solids and film to recycler.

WASTE	POLLUTION PREVENTION/WASTE MINIMIZATION OPPORTUNITIES	
Soft Water, Excess	See Wastewater	
Soil, Contaminated with: Crude Oil Chemical Produced Water Sulfur Refined OIl	*Reduce:*	▶ Improve housekeeping and use drip pans, double-walled sumps and above-ground sumps. ▶ Use pit liner material around and under production facilities. ▶ Use impervious secondary containment. ▶ Install fences around facilities to minimize releases caused by vandalism. ▶ Use cathodic protection, coated pipe, etc. to minimize leaks. ▶ Install high-level alarm systems and/or shut-off devices on tanks. ▶ Install leak detection equipment on gathering lines. ▶ Replace conventional storage tanks with "false bottom" tanks that allow for early leak detection. ▶ Monitor/repair/replace leaking lines.



		▶ Consolidate produced fluid separation and well testing facilities. ▶ Use "canned submersible pumps" to replace conventional impeller type pumps used for fluid transfer service.
	Recycle:	▶ Recover free liquids if possible.
Solvents MEK Oil/Toluene Mixtures Petroleum Naphtha, spent Petroleum Naphtha distillation bottoms 1,1,1-trichloroethane Xylene	*Reduce:*	▶ Eliminate solvent use where possible. ▶ Purchase and use the appropriate quantity for the job. Buy in bulk when appropriate. ▶ Use less toxic and less hazardous solvents, such as citric acid-based solvents. ▶ Use high-pressure water, steam or other non-toxic solvents to clean equipment. ▶ Segregate RCRA-listed and non-listed solvents in order to reduce the amount of hazardous waste. ▶ Keep solvent containers covered when not in use to decrease loss.

(Solvents continued on next page)

WASTE		POLLUTION PREVENTION/WASTE MINIMIZATION OPPORTUNITIES
(Solvents continued)		▶ Use Just-in-Time (JIT) inventory control. ▶ Use dirty solvent for initial cleaning and clean solvent for final cleaning.
	Recycle:	▶ Recycle into process if a petroleum-based solvent. ▶ Filter, replenish, and reuse cleaners. ▶ Regenerate (for example, distill) solvents onsite. ▶ Send to commercial recycler for regeneration. ▶ Use for paraffin dissolving or cutting. ▶ Use as a substitute for virgin fuels.
Source Sand	See Produced Sand	
Source Water	See Produced Water	
Spill Cleanup Waste Crude Oil	*Reduce:*	▶ Minimize spills. ▶ Provide impervious secondary containment.

Refined Oil Chemical		▶ Use collection system for drips, leaks, hose connections, etc. ▶ Minimize use of absorbents to collect spilled material.
	Recycle:	▶ Return oil to process. ▶ Use as a substitute for virgin fuels.
	Also see Soil, Contaminated	
Spoil	See Construction/Demolition Debris	
Stack Wash Waste	*Recycle:*	▶ Add caustic to precipitate metals and hardness salts and filter liquid. Once filtered and softened, this elevated pH liquid can be used as makeup fluid for the SO_2 scrubbers.
Stormwater	*Reduce:*	▶ Improve work processes and properly maintain equipment/facilities to reduce leaks, spills, etc.

(Stormwater continued on next page)

WASTE	POLLUTION PREVENTION/WASTE MINIMIZATION OPPORTUNITIES
(Stormwater continued)	▶ Cover facilities to eliminate contamination of stormwater.
	▶ Segregate drainage from liquid storage, loading/unloading facilities and operations areas from un-impacted areas. ▶ Clean up spills to minimize stormwater contamination.
Recycle:	▶ Reuse water in the process whenever possible. –Use contaminated water for first stage washing of equipment. –Use as make-up water in drilling/completion operations (drilling mud, completion fluids, etc.) –Reuse for process water and agricultural purposes.
Sulfa-check	See Sweetening/Dehydration
Sulfurox	See Sweetening/Dehydration

Sweetening/Dehydration	*Reduce:*	▶ Use an amine filter to extend life of solution and maintain efficiency. ▶ Maintain a testing program to avoid problems (for example, corrosion). ▶ Operate and maintain at proper temperatures to avoid hydrocarbon contamination. ▶ Install a reclaimer (distillation unit) as part of the amine system to regenerate the amine onsite.
	Recycle:	▶ Regenerate glycol for reuse. ▶ Return collected glycol drips to production facility for recycling.
Tank Bottoms	*Reduce:*	▶ Minimize the volume of solids collected in drainage water storage tanks. ▶ Use tanks designed to reduce the volume of tank bottoms produced (for example, cone-shaped bases). ▶ Keep gas blanket on tanks to reduce oxygen and formation of iron oxides.

(Tank Bottoms continued on next page)

WASTE

POLLUTION PREVENTION/WASTE MINIMIZATION OPPORTUNITIES

(Tank bottoms continued)

- Install facilities and return line to run bottoms through heater-treater more frequently than normal.
- Identify sources of solids and then attempt engineering or operations solutions.
- Reduce sand production. (See Produced Sand.)
- Engineer continuous chemical treatment programs.

Recycle:

- Reclaim oil onsite or send to reputable reclaimer.
- Treat light oil tank bottoms in heavy oil dehydration facilities.
- Send to a refinery coker.
- Use centrifuge or filter press to recover oil and water from tank bottoms.
- Mix with aggregate in an asphalt batch process.
- Use as a substitute for virgin fuels.

Thread Protectors

Reduce:

- Specify plastic protectors and lead-free pipe dope.

		▶ Require supplier to maintain ownership and take back from operator after running of tubulars (collect in drum).
	Recycle:	▶ Reuse protectors.
		▶ Send to scrap metal or plastic recycler.
Tires	*Reduce:*	▶ Rotate and do alignments regularly.
		▶ Maintain appropriate pressure.
		▶ Purchase tires with greater road-wear abilities.
	Recycle:	▶ Send to recycler.
		▶ Purchase re-treaded tires.
		▶ Use as a substitute for virgin fuels.
Tracers	See Radioactive Waste	
Transformers	See Electrical Equipment, Oil-filled	

WASTE	POLLUTION PREVENTION/WASTE MINIMIZATION OPPORTUNITIES	
Transformer Oil	See Electrical Equipment, Oil-filled	
Used Oil	See Lubricants	
Wastewater Ballast, Bilge Water Boiler Blowdown Cooling Tower Blowdown Process Water (Engine Cooling, Pump Lubrication, etc.) Deionized Water, Excess Soft Water, Excess	*Reduce:*	▶ Use lower toxicity chemicals and cleaners (for example, no chromates in cooling towers). ▶ Store oils and hazardous chemicals containers in segregated/bermed areas with liners. ▶ Replace cooling towers with air fin coolers. ▶ Develop regular maintenance program. ▶ Use drip pans to keep oils and hazardous chemical drips, leaks, spills, etc. from entering the system. ▶ Use collected materials for their original purpose. ▶ Return oils to the production system. ▶ Design new systems to ensure leak minimization.

	Recycle:	▶ Use in other processes (for example, agricultural, fire-fighting reserve, etc.) ▶ Inject for enhanced recovery if compatible with reservoir fluids. ▶ Reuse as process water.
Water, Non-contact	See Wastewater	
Water Softener Regeneration Brine	See Produced Water and/or Wastewater	
Water Well Wastes	*Reduce:*	▶ Eliminate water storage tank for suction.
Well Blowdown	See Produced Water and/or Completion, Workover, Well Treatment Fluids	
Wire Line	See Construction/Demolition Debris	
Wood	See Construction/Demolition Debris	

PROJECT PARTNERS

This guide and the accompanying video and Instructor's Manual are the results of a very successful public/private partnership. Many people contributed technical information, time, and support to the project. NETA recognizes the following technical advisory committee comprising industry and governmental agency representatives who provided continual guidance on the development of the training materials: Vladimir Babich, OXY USA; Bill Baird, Phillips Petroleum Company; James Erb, Pennsylvania Department of Environmental Resources; Clyde Hicks, Langham Petroleum Exploration Corp; Steve Kropla, International Association of Drilling Contractors; Terri Lorenzon, Wyoming State Environmental Quality Council; Scott Maddox, Phillips Petroleum Company; Michelle McFadden, Esq., Gordon and Lawton; Inc.; Jeannette NewVille, Chevron USA Production Co.; Janet Peargin, Chevron Research & Technology Co.; John Pepper, Langham Petroleum Exploration Corp.; Bob Redweik, Shell Oil; Danny Rycroft, Phillips Petroleum Company; Leslie Savage, Railroad Commission of Texas; Bart Sims, Railroad Commission of Texas; Brent Smith, Phd, Department of Energy.

The project was managed by EPA Office of Solid Waste project officer Steve Souders and NETA Executive Director Charles Richardson and Director of Training Carol Kinias, with technical assistance from Andy Holtan, International Studies & Training Institute, Inc. and Susan McMaster, McMaster & Associates.

Publication of this guide does not signify that the contents necessarily reflect the views and policies of the Environmental Protection Agency. Mention of trade names or commercial products does not constitute endorsement or recommendation for use by the Environmental Protection Agency, the National Environmental Training Association, or members of the technical advisory committee.