APPENDIX F
MINIMIZATION OPPORTUNITIES FOR WASTES GENERATED IN OIL AND GAS OPERATIONS

NOTES

RAILROAD COMMISSION OF TEXAS
WASTE MINIMIZATION PROGRAM

MINIMIZATION OPPORTUNITIES FOR WASTES GENERATED IN O&G OPERATIONS

WASTE	RCRA CLASSIFICATION*	WASTE MINIMIZATION OPPORTUNITIES
Absorbent materials	Exempt (if contaminated with exempt waste)	SR: Prevent spills and leaks by practicing preventive maintenance and good housekeeping. R: Recover and contain used absorbent pads for recycling. R: Return used absorbent pads to vendor for recycling.
Acid, spent	Exempt	SR: Micro-meter solutions to minimize unused acid (continuous mix versus batch mix). R: Use to neutralize excess caustics (see 40 CFR 264.1 (g)(6))
Activated charcoal filter media	Exempt	R: Send to recycling facility.
Air emissions Includes: Nitrogen oxides (NO_x), sulphur oxides (SO_x), hydrocarbons, BTEX, carbon monoxide, particulates, halons, mercury, chlorofluorocarbons, refrigerants, VOCs, and fugitive emissions.	Classify depending upon source	SR: Design and operate to minimize air emissions. Use regular preventative maintenance and monitoring procedures. SR: Install and maintain catalytic converters. SR: Use low NO_x burners. SR: Convert engines to lean-burn. Maintain and run all engines to be the most fuel efficient. SR: Install pre-combustion chambers on engines. SR: Install electronic ignition systems on engines. SR: Use natural gas engines instead of engines fueled by diesel or other fuels. SR: Tighten connections and replace packing to minimize leaks and fugitive emissions. SR: Reduce emissions of unburned hydrocarbons in new facility design (e.g., 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 or bolted fittings. SR: Reduce horsepower demands to reduce emissions. SR: Maintain tank thief hatch seals. SR: Route dehydrator still emissions to reboiler, firebox, first stage compression, or flare. SR: Lower glycol circulation rate - avoid over dehydrating (vapor recovery). SR: Eliminate use of sparge or stripping gas in dehydrators. SR: Buy solvents and liquid chemical in bulk and keep containers covered. SR: Buy less volatile solvents and liquid chemicals. SR: Use dust control techniques at facilities. SR: Eliminate the use of halon fire extinguishing materials. SR: Revise test procedures so halon is not released. R: Use waste heat recovery opportunities where possible. R: Use vented or flared gas as fuel. R: Collect vented or flared gas, compress, and sell as product.

SR = SOURCE REDUCTION R = RECYCLING

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Aerosol cans	Nonexempt	SR: Use non-aerosol containers whenever possible. R: Recycle metal cans at appropriate recycling facility.
Amines, used	Exempt	SR: Use an amine reclaimer in the system to allow reuse of amine and minimization of the volume of waste amine generated. SR: Use an amine filter to extend life of solution and maintain efficiency. SR: Operate and maintain at proper temperatures to avoid hydrocarbon contamination. SR: Maintain a testing program to avoid problems (e.g., corrosion). R: Return to vendor or send to recycler.
Amine sludge, precipitated	Exempt	SR: Maintain sufficient pH to reduce the contribution of heavy metals to the sludge as a result of corrosion. SR: Substitute potassium hydroxide for sodium hydroxide for pH control to reduce sodium content of sludge.
Ammonium hydroxide, spent (copy machine use)	Nonexempt	SR: Convert to copiers which do not require ammonium hydroxide.
Antifreeze	Nonexempt	SR: Use a less toxic substitute for ethylene glycol (e.g., propylene glycol). R: Regenerate on site by filtration (if not thermally degraded). R: Send to a recycler.
Asbestos-containing material	Nonexempt & Regulated by NESHAPS	SR: Purchase asbestos-free products and equipment. SR: Maintain to keep friable (brittle) asbestos from becoming exposed (e.g., encapsulation). Mark materials which contain asbestos.
Batteries, lead acid	Nonexempt	SR: Use other sources of electrical current whenever possible. R: Return to vendor. When batteries are permanently taken out of service, send for recycling as soon as possible.
Batteries Includes nickel-cadmium, lithium alkali, and lead-acid	Nonexempt	SR: Use other sources of electrical current whenever possible. SR: Purchase long-life batteries to decrease the number needed. SR: Use rechargeable batteries. R: Return to vendor or manufacturer. R: When batteries are permanently taken out of service, send to recycler as soon as possible.
Biocides, pesticides, herbicides, insecticides (used for site or facility maintenance)	Nonexempt	SR: Use a commercial application service. SR: Properly store and label containers to prevent degradation and contamination.

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Biocides, pesticides, herbicides, insecticides (Continued)		SR: Use all contents/material and then triple rinse the container. Use rinsate as originally intended for the material. SR: Practice good inventory control. Use excess at another facility. R: Return unused chemicals to vendor for recycling. R: Send unusable chemicals to a recycler.
Blasting sand/media	Nonexempt	SR: Use coatings that do not require sandblasting. SR: Use alternative methods to reduce unnecessary sandblasting (e.g., use a paint that does not require sandblast preparation, cathodic protection from corrosion rather than paint, use tanks constructed of materials that do not need to be painted). SR: Brush-blast and paint instead of blasting to base metal. SR: Reduce blasting/painting frequency. SR: Substitute suitable wastes (e.g., copper slag) for virgin blast media. SR: Use dry ice pellets or recyclable media for some applications. SR: Use lead-free paint or paints with lower levels of other metals. SR: Buy in bulk hoppers to minimize sacks and pallets. SR: Insure that purchased sandblast grit does not contain metal or other contaminants. SR: Do not allow contractors to conduct unnecessary sandblasting and painting of their equipment on site. R: If permissible, send to a cement kiln as a substitute for feedstock. R: Separate from blasted paint waste and reuse blast media. R: Use as aggregate in road mix, if permissible. R: If uncontaminated and permissible, use on site as a substitute for virgin fill material.
Blowdown, cooling tower	Exempt	SR: Operate cooling towers efficiently to minimize the generation of blowdown. SR: Cascade water use. SR: Substitute more acceptable biocides such as isothiazoline and amines for biocides such as pentachlorophenols and formaldehyde releasing compounds. SR: Substitute corrosion inhibitors such as sulfite and organic phosphates for inhibitors that contain chromates.
Blow-out preventer test fluids	Exempt	SR: Collect leakage to avoid soil contamination. R: Return test fluids to system if uncontaminated.
Catalyst, spent (e.g., sulphur recovery process)	Exempt	SR: Substitute a less hazardous catalyst. SR: Use catalyst completely before removing from system. SR: Operate the system to prevent contamination. R: Regenerate spent catalyst.

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Catalyst, spent (Continued)		R: Certain types of catalysts can be sent to pulp and paper mills for reuse. R: Send to recycler for metals recovery. R: If permissible, send to cement kiln as a substitute feedstock. R: If uncontaminated and permissible, use on site as fill material.
Caustics, used (used for gas treatment or drilling fluids)	Exempt	SR: For gas treatment, consider alternate recyclable products. SR: Plan drilling operation to minimize volume of fluid, thereby reducing caustic requirements. SR: Use inventory control; e.g., a surplus chemicals exchange network that offers unused chemicals to other company facilities in lieu of disposal. R: Return unused caustic to vendor. R: Reuse to neutralize excess acids (see 40 CFR 264.1 (g)(6)).
Cement returns	Exempt	SR: Calculate cement needs carefully to excess cement mixture. SR: Use cement in other projects, such as erosion prevention. SR: Require vendors to use nonhazardous cement additives. R: Return unused dry cement to vendor. R: Solid cement may be reclaimed if not contaminated.
Chemicals, surplus or unusable	Nonexempt (May be hazardous)	SR: Use inventory control; e.g., a surplus chemicals exchange network that offers unused chemicals to other company facilities in lieu of recycling, treatment or disposal. Label and store chemicals properly (e.g., protect containers from weather and keep covered). SR: Purchase chemicals in bulk with supplier retaining ownership of containers. SR: Calculate chemical needs carefully to avoid surplus. SR: Use all of the product. Transfer for use at other sites or find alternate uses. SR: Use nonhazardous products whenever possible. SR: Minimize the use and variety of similar-use chemicals when one chemical is suitable. R: Return surplus to vendor. R: Donate surplus laboratory chemicals to a high school or college. R: Send to a recycler.
Cleaning wastes	Nonexempt	SR: Minimize drips, leaks and spills by practicing good housekeeping. SR: Wipe with recyclable rags rather than washing with cleanser or chemical. R: Regenerate cleansers or cleaning solvents for reuse. R: Send to a recycler.

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Compressor oil, filters, and blowdown waste	Nonexempt	SR: Use stainless steel, reusable filters. SR: Isolate all drained fluids in a resealable container. (See Oil, Lube.) SR: When handling filters, take precautions to prevent oil spilling. SR: Change oil and filters only when necessary. Lab testing of oil and differential pressure gauge will indicate the need for filter replacement. (Note: Many lubricating oil vendors provide a testing service at no charge.) SR: Evaluate applicability of filterless centrifugal oil cleaning. R: Before recycling spent filters, drain all free liquids from the cartridge or filter media into a container. Recycle back into production stream. R: Send used oil to a recycling facility. R: Introduce used oil into production stream.
Completion, workover, and well treatment fluids	Exempt	SR: Plan the job carefully to reduce excess fluids. SR: Use less toxic substitutes for chemicals and products. SR: Use improved acidizing technology and inhibition technology to decrease the frequency of well workovers and formation treatments. SR: Use leftover, excess fluids on other jobs. R: Return all unused treatment fluids to the supplier.
Condensate	Exempt	SR: Prevent releases by complete regular inspection and maintenance of all surface lines and facilities. SR: Treat as a product. R: Condensate should be recycled back into production stream.
Construction/demolition debris Includes: Spoil, vegetation, wood, scrap metal	Nonexempt	SR: Plan site to minimize size. SR: Minimize demolition requirements. SR: Consider portable pads or skid-mounted equipment. SR: Use high-density polyethylene liners rather than concrete. R: Crush uncontaminated concrete for use as aggregate. R: Compost vegetation and use as soil supplement. Chip uncontaminated wood to use as mulch. R: Sell or for reuse. R: Send scrap metals to a recycler.
Copier toner, developer, solutions and cartridges	Nonexempt	SR: Buy recycled cartridges. SR: Buy what you need and use what you buy. R: Return empty containers and used components to the supplier or manufacturer.
Debris and soil, contaminated by used chemicals	Exempt	SR: Use proper containers, keep lids on containers and store properly to prevent overflow or spillage. SR: Install containment to allow for better recovery of spills.

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Debris, crude oil soaked (if contaminated within production system, i.e., before point of sale)	Exempt	SR: Develop operational procedures that prevent contamination with crude oil by keeping areas clear of debris. SR: Use leak-proof storage containers.
Debris, lube oil contaminated	Nonexempt	SR: Develop operational procedures that prevent contamination with lube oil by keeping areas clear of debris. R: Contractors are available to pick up and clean used rags for reuse.
Debris, uncontaminated	Nonexempt	SR: Store in labeled containers/dumpsters. SR: Do not mix with material that is contaminated or may be hazardous. R: Recycle paper, metal, cardboard, aluminum cans whenever possible.
Domestic refuse Includes: Food waste, packaging material, paper, plastic, styrofoam, cooking oils and greases, and other trash	Nonexempt	SR: Reduce packaging; buy in bulk. SR: Purchase and prepare only what is needed; avoid surplus. SR: Purchase higher quality materials with longer use cycles. SR: Use washable mugs, cups, plates, and utensils. SR: Prepare fewer fried foods. SR: Copy on both sides of the paper (duplex copying). SR: Purchase recycled/recyclable materials. SR: Use microbes and enzymes to control grease in traps. R: Obtain agreements to send packaging waste back to the vendor for reuse or recycling. R: Set up recycle bins for wood, paper, newspapers, plastic, glass, cardboard, aluminum, and other metals (i.e., food cans). R: Reuse waste paper or styrofoam as packaging materials and fillers. R: Send used cooking oils, grease and fat to a rendering or reclamation facility for reuse. R: Compost food and other biodegradable waste to use as soil additive.
Domestic and sanitary wastewater	Nonexempt	SR: Use low flow and low water use toilets, showers and faucets. SR: Repair or replace leaking equipment. R: Use treated water as facility washdown water or to water grasses, plants, etc. R: Use digested sewage sludge for agricultural purpose, if permissible.
Drilling fluids and additives, used	Exempt	SR: Use a closed-loop mud system whenever possible to reduce volumes of drilling fluid wastes. SR: Use solids control technology (e.g., chemically enhanced centrifuge) to recover water from drilling mud and reserve pit. SR: Optimize solids control (e.g., hydrocyclones or centrifuges) to minimize need to dilute mud. SR: Use low solids, non-dispersed muds whenever drilling conditions allow it.

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Drilling fluids and additives, used (Continued)		SR: Use an inside-diameter wiping tool for drill pipe to minimize loss of drilling fluid (can save approximately 0.4 barrels of drilling fluid per 1,000 feet of drill pipe). SR: Use inventory control and careful planning to avoid unused materials. SR: Use all of the product whenever possible. SR: Transfer unused additives for use at other sites. SR: Use products low in toxicity whenever possible. SR: Carefully screen barite weighting agents for naturally occurring concentrations of heavy metals, particularly mercury and cadmium. SR: Substitute organic additives, polymers, or biodegradable additives for oil-based mud to reduce toxicity. SR: Use lubricants such as lubra beads and gilsonite-based additives for spotting fluids, rather than diesel oil. R: Have a drilling mud recycler pick up waste drilling mud for reconditioning and reuse. R: Condition mud for reuse in drilling your next well. R: Reuse waste drilling mud for upcoming well spudding or plugging operations. R: Return surplus additives to vendor. R: Return oil-based mud to vendor for recycling. R: Reuse water-based mud whenever possible.
Drilling cuttings/solids	Exempt	SR: Minimize hole size (if feasible) when drilling. SR: Drill horizontal holes if feasible to reduce number of wells required. SR: Carefully design and monitor drilling mud programs to minimize caving, etc. SR: Substitute organic additives, polymers, or biodegradable additives for oil-based mud to reduce costs associated with cleanup of oil-based drill cuttings.
Drums/containers, containing unused chemicals or lube oil	Nonexempt	SR: Use the remaining chemical or lube oil for its intended propose whenever possible before disposing of drum. (See Chemicals, surplus.) SR: Switch to purchase of chemicals in bulk containers, reducing the amount of drums requiring handling. Added benefit: less drum handling results in fewer spills and releases requiring cleanup of contaminated soil or debris. R: Return unused chemical, in original drum/container (properly sealed and labeled), to vendor. R: If drum can be properly emptied: triple rinse, and recycle drum (add the rinse water to the chemical stream). R: Recycle empty drums/containers whenever possible.

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Drums/containers, empty	Nonexempt	SR: Switch to purchase of materials and chemicals in bulk containers, reducing the amount of drums requiring handling. Added benefit: less drum handling results in fewer spills and releases requiring cleanup (of contaminated soil). SR: Purchase materials in returnable/recyclable drums and containers. R: Return undamaged drums/containers to vendor or send to a drum reconditioner/recycler. R: Reuse uncontaminated drums for other purposes (e.g., storage and transfer of nonhazardous waste).
Electrical equipment, oil-filled (less than 50 parts per million polychlorinated biphenyl content) and out of service Includes: Capacitors, transformers, switches, heat transfer fluids	Nonexempt	SR: If putting back into service, do not refill or service with oils containing more than 50 ppm PCBs. R: Refurbish and reuse or sell for reuse. R: Recycle oils into production stream. R: Send scrap equipment to a metal recycler. R: Burn oil for energy recovery if permissible (PCB content may prohibit this option; check appropriate regulations).
Filters, lube oil	Nonexempt	SR: When handling filters, take precautions to prevent oil spillage and the contamination of soil, etc. SR: Change filters only when necessary. Use differential pressure as an indicator of needed change. SR: Use stainless steel, reusable filters. SR: Evaluate applicability of filterless centrifugal oil cleaning. (Use "spinners" to replace or lengthen oil filter life.) SR: Install lubricating oil purification equipment to reduce frequency of conventional filter replacement. R: Isolate all drained fluids in a resealable container for recycling. (See Oil, Lube.) R: Before recycling spent filters, drain all free liquids from the cartridge or filter media into a container. Recycle back into production stream. R: Send to a recycling facility.
Filters, process	Exempt	SR: Use or retrofit with stainless steel, reusable filters to reduce the volume of filters requiring recycling or disposal. SR: Change filters only when necessary. Use differential pressure as an indicator of needed change. SR: Evaluate applicability of filterless centrifugal oil cleaning. (Use "spinners" to replace or lengthen oil filter life.) R: Before disposing of spent filters, drain all free liquids from the cartridge or filter media into a container. Recycle back through production stream, on the lease from which the filters are generated.

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Fire fighting agents	Nonexempt	SR: Convert to less toxic alternatives. SR: Eliminate the use of halon extinguishers. SR: Avoid the use of dry agents when water will suffice. R: Contact with vendor to maintain fire fighting equipment and take back all unused fire fighting agents.
Fracturing fluids, unused	Nonexempt	SR: Use "mix-on-the-fly" systems for frac fluids. SR: Recycle unused frac oil back into production stream. SR: Plan frac job carefully to avoid mixing unnecessary fluids.
Glycol	Exempt	SR: Maintain a testing program to avoid problems (e.g., corrosion). SR: Optimize flow rates in the dehydration system. SR: Operate and maintain at proper temperatures to avoid hydrocarbon contamination. R: Regenerate for reuse. R: Send to a recycling facility.
Hydrocarbon liquids	Exempt if from primary operations; otherwise Nonexempt	R: Reclaim and manage as product. R: Blend with product.
Hydrates	Exempt if from primary operations; otherwise Nonexempt	SR: Inject methanol or glycol to inhibit hydrate formation. SR: Melt in place. R: Return to water treating system to recover any contained hydrocarbons.
Hydraulic fluids	Nonexempt	SR: Introduce into production stream at facility where generated. R: Recycle whenever possible.
Hydrotest water from gathering lines (in primary field operations)	Exempt	SR: Conduct tests only when necessary. Use of "smart pigs" or ultrasonic devices to test wall thickness or holidays may enable better targeting of pipeline sections requiring pressure testing or replacement. SR: Efficiently pig and pre-clean pipelines prior to hydrotesting to reduce the toxicity of the hydrotest water. SR: Use produced water for hydrotesting rather than fresh water (reduction in use of water). R: Reuse hydrotest water in other tests.

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Iron sponge and iron sulfide scale, spent	Exempt	SR: Consider alternative methods of removing hydrogen sulfide from gas stream. SR: Treat production streams with biocide or scale inhibitor to reduce iron sulfide formation.
Laboratory samples	Dependent upon source of sample and test method	SR: Collect only the amount necessary for analysis. SR: Minimize testing; sample and analyze no more often than required. SR: Use test methods /procedures which generate no or less waste (e.g., colorimetric testing). SR: Use process knowledge instead of testing.
Laboratory waste	Nonexempt	SR: Segregate waste chemicals (i.e., keep hazardous and nonhazardous waste chemicals separate) to reduce the amount of hazardous waste for management. SR: Buy only the amount and size necessary. SR: Use test methods which generate less or no waste. R: Sell excess unused chemicals. R: Send laboratory wastes to a recycler. R: Provide excess laboratory chemicals to schools for their use.
Lubricating oil	Nonexempt	SR: Minimize the volume of lube oil by extending its use. SR: Test oil and extend its use based on wear vs. accumulated operating hours. (Note: Many lubricating oil suppliers offer testing service at no charge.) SR: Install lubricating oil purification equipment on engines to eliminate the need for lubricating oil changes. SR: Practice preventative maintenance to reduce leaks and drips. SR: Contract with service company to purify and regenerate oil for reuse rather than replacing with new lubricating oil. SR: Consider use of synthetic oil. SR: Use oil additives that improve engine and oil performance. R: Recycle back into production stream on facility where generated. (Note: Ensure that no conflict arises with purchaser or refiner.) R: Send to a recycling facility.
Mercury, free	Nonexempt	SR: Replace mercury manometers, level switches, flow meters and gas meters with electronic (digital) instruments. SR: Do not use mercury in operations. R: Send to mercury recycler.
Metal, scrap	Nonexempt	SR: If clean, re-use for structural steel. R: Sell to salvage/scrap dealer (metal recycler).
Methanol, used	Nonexempt	SR: Use all of the product whenever possible. R: Send to a recycling facility.

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Molecular sieve, spent	Exempt	SR: Install activated carbon upstream of the unit to remove corrosion inhibitors, amines, absorber oils, glycol, and other contaminants to extend the life of the molecular sieve. SR: Regenerate molecular sieves for reuse. R: Before disposing of spent filters, drain all free liquids from the sieve media into a container. Recycle back through production stream, on the lease from which the sieves are generated.
Naturally Occurring Radioactive Materials (NORM), NORM-containing materials	Subject to other regulation (e.g., Statewide Rule 94)	SR: Periodic monitoring for accumulations of NORM may minimize potential risks and liabilities. SR: Use scale inhibitors where NORM scale accumulates. Circulate inhibitor in well or inject inhibitor into producing formation. SR: Avoid mixing incompatible produced waters which will result in scale formation. SR: Design facility to reduce locations prone to scale formation (e.g., large pressure drops and unnecessary pipe elbows). SR: Do not mix NORM with other materials. SR: Dually complete oil zone and water zone to allow water to be produced simultaneously but separately from oil and to allow control of water coning (research indicates that water production may be reduced by as much as half, thereby reducing exposure to NORM of production equipment carrying the oil stream). SR: Use polymer injection to reduce permeability to water in the production zone, thereby reducing the volume of radionuclide-containing water produced. SR: Use rock plugging with gel slugs to block off water production in completions where there is a discernible separation of the oil and water zones. SR: Carefully design gravel packs and other well screening procedures to reduce the volume of NORM-contaminated formation sand (coated by NORM scale) that is produced. SR: Coat material surfaces with chemicals at critical points in the production system to reduce the availability of nucleation points for NORM-containing scale formation. SR: Reinject NORM-containing produced water (containing scale inhibitors) for enhanced recovery, (preferably into the same zone from which it was produced), as soon as possible after initial production to increase the amount of NORM returned to the subsurface and decreasing the potential for the precipitation of NORM-containing scale in surface equipment. SR: Store NORM-contaminated waste in either tanks or lined pits which will accommodate the eventual recovery and proper disposal of the NORM-contaminated waste. The contamination of soils with NORM may be averted by not storing NORM containing produced water or other waste in earthen pits, thereby decreasing the volume of NORM-contaminated waste. SR: Provide NORM management procedures training for employees involved with the operation and maintenance of affected production facilities.

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Naturally Occurring Radioactive Materials (NORM), NORM-containing materials (Continued)		R: Clean NORM-contaminated scale from pipe and equipment to minimize the volume of NORM-contaminated waste requiring disposal and allow the recycling of the pipe and equipment. However, restrictions on the level of radioactivity of the NORM-contaminated waste may be imposed. R: Use of NORM-contaminated waste (metals) as feedstock at smelters may be a potential method of recycling. However, restrictions on the level of radioactivity of the NORM-contaminated waste may be imposed.
Oil, slop	Exempt	SR: Recycle back into production stream. SR: Install a mechanical stirrer inside slop oil tank to keep sediment in suspension. SR: Implement the use of `canned submersible pumps' to replace conventional impeller type pumps used for fluid transfer service. Eliminates leaks from impeller pump seals and gear boxes. R: Send slop oil that cannot be recycled into production stream to a state-permitted tank bottoms reclamation facility.
Oil, weathered	Exempt	SR: Pick up free liquids or solids spilled as soon as possible after the spill is contained. Recycle back into production stream. SR: Prevent spills or waste whenever possible.
Paint and paint wastes	Nonexempt	SR: Paint less frequently; only when necessary. SR: Buy in bulk and only the volume needed. Use all of the product before it becomes unusable. SR: Size paint batches systematically to specific jobs. SR: Eliminate the use of lead paint; use waterbase, lead-free paint or high-solids coatings. SR: Purchase less toxic, less volatile paints and solvents. Purchase paints with greater durability. SR: Paint contractor should be responsible for the proper management of unused paint, solvents, and empty containers. SR: Reduce and control overspray. Use a brush for small jobs rather than spraying. SR: Keep containers closed to reduce evaporation. SR: Ensure paint containers are completely emptied and dried. SR: Use separate solvents and/or containers for each paint color. When solvent is spent use it as a thinner for that particular color. R: Regenerate solvents for reuse. R: Send to a recycler.

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Pallets	Nonexempt	SR: Buy materials in skid-mounted bulk hoppers or containers. SR: Purchase recycled plastic pallets which have a longer life than wooden pallets. R: Reuse pallets. R: Return pallets to the vendor. R: Send wooden pallets to a pallet or wood recycler. R: Chip uncontaminated wooden pallets and use as mulch.
Paraffin	Exempt	SR: Collect solidified paraffin in tanks, mix with paraffin solvent, and recycle back into production stream. SR: Investigate the feasibility of installing magnetic fluid conditioner(s) to prevent paraffin formation. SR: Use paraffin inhibitor chemicals. SR: Use hot-oil treatment to dissolve paraffin in well and flow lines; send to production. R: Send mechanically removed paraffin to a recycler (Call RRC @ (512) 463-6874 for current list of permitted crude oil reclamation plants; some recycle paraffin.)
PCB, oil	Subject to additional regulation	SR: Replace any electrical equipment that is determined to be PCB containing with non-PCB containing, electrical equipment. Note: Cleanup of PCB spills and contaminated soils is regulated by both RCRA and TSCA. Special Handling: *Contact your Health and Safety Coordinator immediately!*
Pesticides and herbicides	Nonexempt	SR: Use rinse water in original application whenever possible. SR: Use inventory control; e.g., a surplus chemicals exchange network that offers unused pesticides and herbicides to other company facilities in lieu of disposal. SR: Use a commercial application service. SR: Properly store and label containers to prevent degradation and contamination. SR: Use all contents/material and then triple rinse the container. Use rinsate as originally intended for the material. SR: Practice good inventory control. Use excess at another facility. R: Return unused chemicals to vendor for recycling. R: Send unusable chemicals to a recycler.
Pigging wastes from gathering lines in primary field operations	Exempt	SR: Minimize paraffin accumulation (see paraffin). Add appropriate chemical agents to reduce accumulation of paraffin. SR: Reduce accumulation of hydrates (see hydrates). SR: Reduce accumulation of scale (see scale). R: If possible, reuse pigs and reclaim paraffin whenever possible.

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Pigging wastes from transportation pipelines	Nonexempt	SR: Minimize paraffin accumulation (see paraffin). Add appropriate chemical agents to reduce accumulation of paraffin. SR: Reduce accumulation of hydrates (see hydrates). SR: Reduce accumulation of scale (see scale). R: If possible, reuse pigs. R: Recycle paraffin whenever possible. (See paraffin.)
Pipe dope, used	Exempt	SR: Choose biodegradable, lead-free pipe dope. SR: Use all of the product whenever possible. SR: Minimize waste, conserve compound for use at the next job. SR: All drilling, well servicing, pipeline, and other contractors should be responsible for unused and waste pipe dope and containers.
Pit wastes Includes: waste in reserve pits and emergency pits	Exempt	SR: Use rig wash judiciously. Install high-pressure, low-volume spray nozzles with automatic cutoffs. SR: Segregate fresh water, salt water, and oil-based fluids and solids. Use the "reserve pit management system." SR: Remove oil as soon as possible to minimize contamination of pit. SR: Locate and eliminate all sources of water leaks. SR: Grade site and use diversion structures to prevent or minimize stormwater run-on volume. SR: Use a closed-loop drilling fluid system if feasible. SR: Design pit and pit system to minimize waste. For example, use the "V" shaped pit or the "reserve pit management system." SR: Size and construct pits to accommodate only the necessary volumes anticipated plus an adequate freeboard. SR: Use tanks/vacuum trucks rather than earthen pits for workovers. R: Stabilized, uncontaminated solids may be suitable for use as daily cover at landfills. R: Recover and reuse weighting materials and drilling fluids. Waste drilling mud can be reused at other locations for spudding or plugging and abandoning operations. R: Contract a drilling mud recycler to take waste drilling mud.
Plastic liners	Nonexempt	SR: Use reusable steel pits or portable tanks whenever possible. SR: Purchase liners constructed of recycled plastic. R: Send to a plastic recycler.

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MINIMIZATION OPPORTUNITIES FOR WASTES GENERATED IN O&G OPERATIONS

WASTE	RCRA CLASSIFICATION*	WASTE MINIMIZATION OPPORTUNITIES
Produced sand	Exempt	SR: Improved gravel pack design. SR: Optimize production rate to minimize sand production. SR: Design perforations in completion to minimize sand production. R: Use as fill material, if uncontaminated R: Send to cement kiln as a substitute for feedstock, if permissible.
Produced water	Exempt	SR: Assess the feasibility of treating the producing formation with polymers that decrease the permeability of the formation for water, while the permeability of hydrocarbons remains unchanged. SR: Use rock plugging with gel slugs to block off water production in completions where there is a discernible separation of the oil and water zones. SR: Dually complete oil zone and water zone to allow water to be produced simultaneously but separately from oil and to allow control of water coning (research indicates that water production may be reduced by as much as half). SR: Investigate feasibility of dually completing gas/water producing zone and injection (Class II) disposal zone (water phase separates and is not produced at surface). SR: Carefully planned well completions. SR: Reperforate well to reduce water production. SR: Drill wells to minimize water production (e.g., horizontal wells when feasible). SR: Optimize production rate to minimize the influx of water (e.g., coning). R: Create a system that distributes produced water to various waterfloods in area. Results: reduction in volume of produced water requiring disposal and reduction of the amount of make up water purchased. Also, the need for water storage tanks for suction at water injection stations is eliminated by pumping directly from the water separation tanks to provide pressured water to the high pressure injection pumps. This reduces cost associated with operating charge pumps at the water station. R: Use produced water for hydrotesting of pipelines, equipment and tanks. R: Desalinate for use in other E&P operations if water supply is scarce and the process is cost effective.
Rags, oily	Exempt (if soaked with crude oil or other exempt waste)	SR: Maintain equipment and facilities to prevent drips, leaks, and spills which would require cleanup. SR: Use drip pans or other containment devices to collect leaks, drips or accidental spills. Empty containment devices properly. R: Keep separate from other wastes and wash for reuse. R: Send to recycler.

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MINIMIZATION OPPORTUNITIES FOR WASTES GENERATED IN O&G OPERATIONS

WASTE	RCRA CLASSIFICATION*	WASTE MINIMIZATION OPPORTUNITIES
Rigwash	Exempt	SR: Prudent use of water in rig maintenance. SR: Use high-pressure, low-volume hose nozzles with automatic cutoffs. SR: Set up a regular maintenance program for water systems to reduce leaks and drips. SR: Remove paint solids from water arrestor holding tanks with a centrifuge or cyclone system. SR: Reduce rigwash use by sweeping or other dry cleaning when feasible. SR: Collect rigwash in tanks rather than earthen pits. R: Collect and reuse rigwash for subsequent rig washdowns or for first stage washing of equipment. R: Use as make-up water in drilling and completion operations.
Sandblast media		See Blasting sand, media
Scale, pipe and equipment	Exempt (If generated in primary field operations)	SR: Use scale inhibitors. Circulate inhibitor in well or inject inhibitor into producing formation. SR: Avoid mixing incompatible produced waters which will result in scale formation. SR: Design facility to reduce locations prone to scale formation (e.g., large pressure drops and unnecessary pipe elbows). SR: Dually complete oil zone and water zone to allow water to be produced simultaneously but separately from oil and to allow control of water coning (research indicates that water production may be reduced by as much as half, thereby reducing scale formation in production equipment carrying the oil stream). SR: Use polymer injection to reduce permeability to water in the production zone, thereby reducing the volume of water produced which is the source of scale. SR: Use rock plugging with gel slugs to block off water production in completions where there is a discernible separation of the oil and water zones. SR: Coat material surfaces with chemicals at critical points in the production system to reduce the availability of nucleation points for scale formation. R: Clean scale from pipe and equipment and recycle the pipe and equipment.
Scrubber wastes	Exempt	SR: Convert to natural gas as a fuel to avoid generating SO_2 and flyash. R: Remove solids through gravity separation, filtration, etc., and send liquids to water softening for steam generation or direct injection for enhanced recovery. R: Use as an oxygen scavenger.
Silver-containing waste	Nonexempt	SR: Minimize the number of film reproductions. SR: Install on-line equipment to remove silver from process liquids. R: Recover silver from the film/developing solution before disposal and recycle. R: Send waste liquids to a recycler. R: Send waste solids and film to a recycler.

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MINIMIZATION OPPORTUNITIES FOR WASTES GENERATED IN O&G OPERATIONS

WASTE	RCRA CLASSIFICATION*	WASTE MINIMIZATION OPPORTUNITIES
Soils, unused-chemical contaminated	Nonexempt	SR: Develop operational procedures that prevent contamination of soils. For example, use containment devices in chemical storage areas to prevent contamination of soils. SR: Install fencing around chemical storage to discourage losses due to vandalism. R: Recover free liquids and recycle.
Soils, crude oil contaminated (in primary field operations)	Exempt	SR: Pick up free liquid or solids spilled as soon as possible after the spill is contained. Recycle back into production stream. SR: Develop operational procedures that prevent contamination of soils. For example, preventative maintenance on flowlines and containment under tank battery load-line connections. SR: Use impervious secondary containment. Use pit liner material around and under production facilities. SR: Consider use of magnetic ion coating technology for stuffing box packing rubbers, valve stems and other friction and wear points that may provide a source of leakage. SR: Prepare and implement Spill Prevention, Control and Countermeasures (SPCC) Plans for each facility. SR: Use cathodic protection or coated pipe to reduce leaks caused by corrosion. SR: Consolidate produced fluid separation and well testing facilities. SR: Use "canned submersible pumps" to replace conventional impeller type pumps use for fluid transfer service. R: Recover free crude oil and return to production stream.
Soils, lube oil contaminated`	Nonexempt	SR: Pick up free liquid or solids spilled as soon as possible after the spill is contained and recycle. SR: Develop operational procedures that prevent contamination of soils. For example, preventative maintenance on lubricating oil system and containment under system. SR: Use impervious secondary containment. Use pit liner material around and under lubricating oil systems. R: Recover free lubricating oil and recycle.
Soil, produced water-contaminated	Exempt	SR: Develop operational procedures that prevent contamination of soils. For example, preventative maintenance on flowlines and containment under tank battery load-line connections. SR: Use impervious secondary containment. Use pit liner material around and under production facilities. SR: Consider use of magnetic ion coating technology for stuffing box packing rubbers, valve stems and other friction and wear points that may provide a source of leakage. SR: Use cathodic protection or coated pipe to reduce leaks caused by corrosion. SR: Consolidate produced fluid separation and well testing facilities. SR: Use "canned submersible pumps" to replace conventional impeller type pumps use for fluid transfer service.

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MINIMIZATION OPPORTUNITIES FOR WASTES GENERATED IN O&G OPERATIONS

WASTE	RCRA CLASSIFICATION*	WASTE MINIMIZATION OPPORTUNITIES
Soil, produced water-contaminated (Continued)		SR: Pick up free liquid as soon as possible after the spill is contained. SR: Use smaller injection pumps at each injection well for secondary recovery projects and supply water by gravity drainage (low pressure lines) from a central water storage tank. SR: Prepare and implement Spill Prevention, Control and Countermeasures (SPCC) Plans for each facility.
Solvents (organic solvents used in cleaning and degreasing equipment)	Nonexempt	SR: Use water-based solvents or soap cleaners that are biodegradable whenever possible. SR: Substitute nonhazardous surfactants (soap) for hazardous solvents (mineral spirits) for equipment cleaning. SR: Use up all solvent in container, ensuring no residue remains. SR: Minimize amount of solvent being lost during cleaning or maintenance; for example, use drip pans to collect solvent for reuse. SR: Use high-pressure water, steam or other non-toxic solvents to clean equipment. SR: Keep solvent containers tightly covered when not in use to decrease loss due to vaporization. SR: Use inventory control to minimize volume of unnecessary solvent stored. SR: Use dirty solvent for initial cleaning and clean solvent for final cleaning. R: Send to a recycler. R: Filter/clean or regenerate solvents and reuse. R: Use spent solvent for paraffin removal.
Stormwater	Refer to Mixture Rules	SR: Improve work process and properly maintain equipment and facilities to reduce leaks, spills, etc. SR: Cover facilities to eliminate contamination of stormwater. SR: Segregate stormwater drainage from liquid storage, loading/unloading facilities and, operations areas from un-impacted areas. SR: Clean up spills and leaks promptly to minimize stormwater contamination. R: Use stormwater as make-up water in the process. For example, use contaminated stormwater for first stage washing of equipment, use stormwater as make-up water in drilling/completion operations, and use stormwater for process water and agricultural purposes.
Sulfur recovery unit wastes, including sulfur-contaminated	Exempt	SR: Substitute a less hazardous catalyst in the Scot Tailgas process of a sulfur recovery plant. Nonhazardous spent catalyst waste can result, thereby resulting in disposal cost savings.
Tank bottoms (basic sediment and water)	Exempt	SR: Recycle back through treatment system, with no additional requirements. SR: Keep turbulent flow in tank to prevent sedimentation whenever possible. The use of mechanical stirring devices in oil storage tanks will eliminate build-up of tank bottom sediments and reduce chemical storage. SR: Add appropriate chemical agents to reduce tank bottom accumulation.

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MINIMIZATION OPPORTUNITIES FOR WASTES GENERATED IN O&G OPERATIONS

WASTE	RCRA CLASSIFICATION*	WASTE MINIMIZATION OPPORTUNITIES
Tank bottoms (basic sediment and water) (Continued)		SR: Treat light oil tank bottoms with high temperature in heavy oil dehydration facilities. SR: Recover product by recycling light oil tank bottoms through heavy oil dehydration facilities. Results: added revenue and substantial cost savings through reduction of waste disposal. SR: Use cone bottom stock tanks and run bottoms through heater-treater more frequently than normal. SR: Reduce the number of tanks by consolidating produced fluid storage facilities. SR: Keep a gas blanket on tanks to reduce oxygen and formation of iron oxides. A gas blanket can also reduce risk of explosion and subsequent leakage due to lightning strikes. SR: Identify and minimize the source of solids. R: Send tank bottoms to crude oil reclamation plants. (Call RRC @ (512) 463-6874 for current list of permitted crude oil reclamation plants.) R: Send to a refinery coker. R: Use a centrifuge or filter press to recover oil and water from tank bottoms.
Thread protectors	Nonexempt	SR: Avoid using excess pipe dope. SR: Return to vendor or send to recycler. R: Reuse in operations or sell for re-use. R: Send to a reclamation facility that removes pipe dope and markets for reuse.
Tires	Nonexempt	SR: Rotate tires and align regularly. SR: Maintain proper inflation pressure. SR: Purchase tires with greater road-wear abilities. R: Send to a tire recycler. R: Purchase retreaded tires if feasible.
Vacuum truck rinsate	Nonexempt	SR: Use chemicals and products that are less hazardous or toxic. SR: Avoid mixing nonhazardous and hazardous wastes in vacuum truck.
Well completion, treatment, and stimulation fluids, unused	Nonexempt	SR: Recycle unused frac oil back into production stream. SR: Use all of the product whenever possible; e.g., use excess frac oil, acid, stimulation fluids, and xylene in other wells. SR: Use inventory control; e.g., a surplus chemicals exchange network that offers unused chemicals to other company facilities in lieu of disposal. SR: Return unused portion to vendor.
Workover wastes	Exempt	SR: Place into production stream whenever possible. R: Recycle free liquids back into production stream.

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