

Safe Tank Cleaning

SUPPLEMENTAL DATA SHEETS



HOWELL TRAINING

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**This program has been reviewed and approved by the
API Committee on Safety and Fire Protection**

Special Acknowledgement

For the guidance and support of the Task Force of the API Personnel Protection and Development Subcommittee.

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DATA SHEETS PREFACE

The following **Tank Design/Materials Chart** and **Supplemental Data Sheets** are designed as a reference to be used after completion of the **Safe Tank Cleaning** program. They are not intended to be used alone, without the remainder of the program.

TANK DESIGN/MATERIALS CHART

KIND OF SERVICE		TANK TYPE		
Tank Contents	Cone Roof Tank	Open Floating Roof Tank	Covered Floating Roof Tank	Pressure Storage Tank
Crude Oil — High H ₂ S	Data Sheet No. 3	Data Sheet No. 1	Data Sheet No. 2	—
Crude Oil — Low H ₂ S	Data Sheet No. 4	Data Sheet No. 4	Data Sheet No. 4	—
Unfinished naphtha, jet fuel, diesel fuel, and other light & intermediate distillates with high H ₂ S content	Data Sheet No. 3	Data Sheet No. 1	Data Sheet No. 2	—
Same as above, but low H ₂ S content	Data Sheet No. 4	Data Sheet No. 4	Data Sheet No. 4	—
Gasoline — leaded (inc. manganese additives)	Data Sheet No. 5	Data Sheet No. 6	Data Sheet No. 6	—
Gasoline — no lead content in tank	Data Sheet No. 7	Data Sheet No. 7	Data Sheet No. 7	—
Lube Oil	Data Sheet No. 8	—	—	—
Waxy Distillates	Data Sheet No. 9	—	—	—
Residual Fuel Oil	Data Sheet No. 10	—	—	—
Aromatic Gas Oil	Data Sheet No. 11	—	—	—
Aromatic Tars	Data Sheet No. 12	—	—	—
Asphalt	Data Sheet No. 13	—	—	—
Butane/Propane	—	—	—	Data Sheet No. 14

Note: These data sheets contain suggested methods for preparing, ventilating and cleaning storage tanks. If these methods cannot be followed due to your particular circumstances, consult with other qualified personnel.

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DATA SHEET #1

PROCEDURES APPLY TO THESE TANK DESIGNS

Open floating roof tank.

TANK SERVICE

Crude oil - pyrophoric deposits are suspected - high level of H_2S is present (higher than 20ppm in the tank vapor space). The following procedures are also suitable when the tank service is unfinished naphtha, jet fuel, diesel fuel, and other light and intermediate unfinished distillates with a high H_2S content.

SUMMARY OF PROBLEMS POSED

Pyrophoric deposits are materials that form when tank metal combines with H_2S to create iron sulfides. Pyrophoric deposits will (or may) ignite when exposed to the air. They must be kept wet during gas-freeing. High pressure water streams are used to loosen rust and remaining residue from the tank walls and bottom during the last stages of gas-freeing. Appropriate respiratory protection is required to protect against the H_2S hazard. Be sure that the roof has not rotated so that the legs will lower onto the tank internal structures.

GAS-FREEING METHOD

Place a 90° ell-shaped duct on one shell manhole with an air mover looking up from the ell. This part of the procedure is the same as described in Unit 2 for gas-freeing of open and covered floating roof tanks. After the air mover has been operating correctly (for about 5 minutes), another shell manhole cover is removed and a *fog nozzle* is firmly secured and bonded at the manhole. The fog should be aimed so that it effectively covers all air being drawn into the tank. It is important that the water is a *fog*, not a straight stream. Any additional shell manholes that are opened should be equipped with fog nozzles during gas-freeing. Once gas tests show that flammable vapors have been reduced to less than 50% of their LFL, high pressure water can be introduced into manholes to break up sediment. Tank walls, supports, and the tank bottom should be freed of rust, scale, and debris by this method. Ventilation of the tank is continued, but fogging at the manholes can be stopped.

Caution: The walls and roof should not be permitted to dry out until all scale and other deposits have been removed from them.

TESTING

Tests are performed such as described in Unit 2. However, once tests made from outside the tank show that combustible vapors inside the tank are below 50% of their LFL, the ventilation equipment and fog nozzles should be shut down for about 15 minutes, and the tests should be run again. All tank openings, including roof openings, should be tested. Test results should show less than 50% of their LFL. If they do not, ventilation and fogging is resumed, and the tests must be repeated in the same manner. Testing for tank entry is the same as described in Unit 2. Throughout the gas-freeing procedure, anyone entering the tank firewall must wear positive air pressure, full facepiece respiratory protection unless tests show that no H_2S hazard is present.

PERSONNEL ENTRY

The criteria for entering the tank *without* appropriate respiratory protection are the same as described in Unit 2. The Tank Cleaning Coordinator should inspect the tank interior to see if any residue containing pyrophoric materials is left on tank surfaces. High pressure water is used to remove the remaining scale and debris from the tank walls and floor.

CLEANING PROCEDURE

Essentially the same as described in Unit 3.

DATA SHEET #2

PROCEDURE APPLIES TO THIS TANK DESIGN

Covered floating roof tank.

TANK SERVICE

Crude oil - pyrophoric deposits are suspected - high level of H_2S is present (higher than 20ppm in the tank vapor space). The following procedures are also suitable when the tank service is unfinished naphtha, jet fuel, diesel fuel, and other light and unfinished distillates with a high H_2S content.

SUMMARY OF PROBLEMS POSED

Covered floating roofs are usually constructed of very light material which may be hazardous for personnel to walk on. They are also easily damaged. They must be inspected first from the outside, and secondly from the inside by a competent person. They may require the addition of auxiliary walking surfaces before it is safe for personnel to enter and walk on top of them.

The space between the fixed and floating roofs may contain flammable and/or toxic gas. Tests must be run and the area made safe for entry by gas-freeing before anyone enters this space to lower legs or do any other type of work without appropriate respiratory protection. A permit to enter is required, and sturdy personnel equipped to initiate rescue must be stationed at the fixed roof opening. Be sure that the roof has not rotated so that the legs will lower onto the tank internal structures.

GAS-FREEING METHOD

If gas is detected between the fixed and floating roofs, it must be removed. One method was described in Unit 2. It consists of dropping a flexible tube down through a fixed roof manhole to within about one foot of the floating roof and attaching it to the suction side of an air mover mounted on the manhole. When the air mover is placed in operation, it draws air in through the tank side vents, down and across the floating roof, and out above the tank - sweeping the circulated air out of the space between the fixed and floating roofs. Subsequent tests by a qualified person should show the space to be safe for entry, at which time the roof legs can be moved to the "high" position. The tank is now ready for pump-out and final gas-freeing.

The tank gas-freeing technique is the same as Data Sheet #1. Place a 90° ell-shaped duct on one shell manhole with an air mover looking up from the ell. This part of the procedure is the same as described in Unit 2 for gas-freeing of open and covered floating roof tanks. After the air mover has been operating correctly (for about 5 minutes), another shell manhole cover is removed and a *fog nozzle* is firmly secured and bonded at the manhole. The fog should be aimed so that it effectively covers all air being drawn into the tank. It is important that the water is a *fog*, not a straight stream. Any additional shell manholes that are opened should be equipped with fog nozzles during gas-freeing. Once gas tests show that flammable vapors have been reduced to less than 50% of their LFL, high pressure water can be introduced into manholes to break up sediment. Tank walls, supports, and the tank bottom should be freed of rust, scale, and debris by this method. Ventilation of the tank is continued, but fogging at the manholes can be stopped.

Caution: The walls and roof should not be permitted to dry out until all scale and other deposits have been removed from them.

TESTING

Tests are performed as described in Unit 2. However, once tests made from outside the tank show that combustible vapors inside the tank are below 50% of their LFL, the ventilation equipment and fog nozzles should be shut down for about 15 minutes, and the tests should be run again. All tank openings, including roof openings, should be tested. Test results should show less than 50% of the LFL. If they do not, ventilation and fogging are resumed, and the tests must be repeated in the same manner. Testing for tank entry is the same as described in Unit 2. Throughout the gas-freeing procedure, anyone entering the tank firewall must wear positive air pressure, full facepiece respiratory protection unless tests show that no H₂S hazard is present.

PERSONNEL ENTRY

The criteria for entering the tank *without* appropriate respiratory protection are the same as described in Unit 2. The Tank Cleaning Coordinator should inspect the tank interior to see if any residue containing pyrophoric materials is left on tank surfaces. High pressure water is used to remove the remaining scale and debris from the tank walls and floor.

CLEANING PROCEDURE

Essentially the same as described in Unit 3.

DATA SHEET #3

PROCEDURES APPLY TO THESE TANK DESIGNS

Cone roof tanks.

TANK SERVICE

Crude oil - pyrophoric deposits are suspected - high level (20ppm in the vapor space) of H_2S is present. Procedures are also suitable when the tank service is unfinished naphtha, jet fuel, diesel fuel, and other light and intermediate distillates with a high H_2S content.

SUMMARY OF PROBLEMS POSED

Pyrophoric deposits are materials that form when tank metal combines with H_2S to create iron sulfides. Pyrophoric deposits will (or may) ignite when exposed to the air. They must be kept wet during gas-freeing. High pressure water streams are used to loosen rust and remaining residue from the tank walls and bottom during the last stages of gas-freeing. Appropriate respiratory protection is required to protect against the H_2S hazard.

GAS-FREEING METHODS

One or more air movers discharging upward are installed at roof manways by personnel protected with positive air pressure, full facepiece respiratory protection equipment. The air movers are placed in operation, and a manhole cover on the side of the tank away from the air movers is removed *immediately* and covered by a water fog so that *all* of the air that enters the tank is thoroughly saturated with water. The nozzle supplying the water must be bonded to the tank. (An alternate, and better, procedure is to connect flexible tubes to the suction side of the air movers, and drop the inlets to within about one foot of the liquid remaining in the tank. With this system one or more top manheads are then opened and covered by fog nozzles bonded to the tank side. Air saturated with water enters the tank from the top and works like a piston to pressure the heavier, contaminated air to the air movers, and out of the tank. This is the fastest method, and provides minimum exposure of personnel to toxic gases.) Once gas tests show that flammable vapors have been reduced to 50% of their LFL or less, high pressure water can be introduced through a side manhole to break up sediment, and fogging can be discontinued. Tank walls, supports, and the tank bottom should be freed of rust, scale, and other deposits by this method. Ventilation should be continued.

Caution: The interior walls, roof, and other internal surfaces should not be allowed to dry out until all scale and other deposits have been removed from them.

TESTING

Tests are performed as described in Unit 2. However, once tests made from outside the tank show that combustible vapors inside the tank are below 50% of their LFL, the ventilation equipment and fog nozzles should be shut down for about 15 minutes, and the tests should be run again. All tank openings, including roof openings, should be tested. Test results should show less than 50% of the LFL. If they do not, ventilation and fogging are resumed, and the tests must be repeated in the same manner. Testing for tank entry is the same as described in Unit 2. Throughout the gas-freeing procedure, anyone entering the tank firewall must wear positive air pressure, full facepiece respiratory protection, unless tests show that no H_2S hazard is present.

ENTRY

The criteria for entering the tank *without* appropriate respiratory protection are the same as described in Unit 2. The Tank Cleaning Coordinator should inspect the tank interior to see if any residue containing pyrophoric materials is left on tank surfaces. High pressure water is used to remove the remaining scale and debris from the tank walls and floor.

CLEANING PROCEDURE

Essentially the same as described in Unit 3.

DATA SHEET #4

PROCEDURES APPLY TO THESE TANK DESIGNS

Open floating roof tank, covered floating roof tank, or cone roof tank.

TANK SERVICE

Crude oil - low in sulfur content - or a tank containing naphtha, jet fuel, diesel fuel, process gas oil, or other unfinished light and intermediate distillates with a low sulfur content.

SUMMARY OF PROBLEMS POSED

Be sure that the roof has not rotated so that the legs will lower onto the tank internal structures.

GAS-FREEING, TESTING, ENTRY, AND CLEANING

Refer to Units 2 and 3 of the **Safe Tank Cleaning** program. Specific procedures are outlined in the slide/tape and workbooks about gas-freeing and cleaning tanks in this service. In Unit 2 of the program the cone roof, open floating roof, and covered floating roof tanks are discussed separately since there are some differences in gas-freeing and preparation for cleaning procedures. The cleaning procedures described in Unit 3 are suitable for any of the three tank types in this service.

DATA SHEET #5

PROCEDURES APPLY TO THESE TANK DESIGNS

Cone roof tank.

TANK SERVICE

Leaded gasoline (also leaded gasoline with manganese additives).

SUMMARY OF PROBLEMS POSED

Most gasolines contain lead antiknock compounds that are toxic to humans. Even storage tanks for unleaded gasolines or for crudes and middle distillates may contain lead left over from previous leaded gasoline service. Also, organic lead deposits may leak at manifolds, in pipelines, and at other places, contaminating tanks no longer in leaded service. A tank that contains gasoline should be assumed to contain organic lead unless it is certain that the tank has *never* contained any leaded product since it was last cleaned. Because of its toxicity, organic lead makes several procedures necessary, notably, the use of positive air pressure, full facepiece respiratory protection equipment for entering the tank, and the use of special testing to determine if a tank is lead-hazard-free *after* cleaning. Note that the extent of the organic lead hazard posed by a tank *cannot* be determined before or during the cleaning process. Most gasolines also contain benzene, which is also an inhalation and skin contact hazard. Personnel cleaning leaded gasoline tanks must be equipped with proper clothing and must follow all hygiene practices shown in Unit 3 of this program.

GAS-FREEING METHOD

Essentially the same gas-freeing method can be used as described in Unit 2 of the **Safe Tank Cleaning** program. An air mover is used at a roof manway to pull fresh air through shell manways and dissipate the vapors remaining inside the tank.

TESTING

The tank can be tested for flammable vapors and benzene in the same way as the tank in crude service discussed in Unit 2. However, remember that the tank cannot be tested for lead until *after* it has been cleaned.

ENTRY

Tank cleaners can enter the tank for cleaning when flammable vapors have been reduced to below 20% of their LFL. Ideally, toxics other than lead have been reduced to below their recognized TLV's. The tank cleaners *must wear* positive air pressure, full facepiece respiratory protection when working in the tank.

CLEANING PROCEDURES

Similar to that described in Unit 3. However, special provisions must be made for the disposal of the leaded sludge.

TESTING FOR LEAD

Once the tank has been cleaned, the Tank Cleaning Coordinator should enter the tank, wearing positive air pressure, full facepiece respiratory protection equipment for an inspection. He should look for any remaining loose residue or liquid puddles. He should inspect the tank for signs of a leaking bottom. If the bottom is not leaky, if all residue has been eliminated by cleaning, and if the tank is dry, then a lead-in-air test can be run on the tank atmosphere. (Ventilation equipment should be shut off during the four-hour period preceding the lead-in-air testing.) Follow the instructions provided with the lead-in-air test equipment your company uses. The tank can be considered "lead-hazard-free" if tests show that its atmosphere contains less than 0.075 milligrams of organic lead per cubic meter (0.075 mg Pb/m³), or 2 micrograms of organic lead per cubic foot (2µg Pb/Ft³). Lead-hazard-free means that workers can enter the tank for hot or cold work without wearing appropriate respiratory protection equipment. It does not mean that the tank is *completely* free of all organic lead deposits.

In testing for lead-in-air concentrations, two tests should be conducted. If the results do not match closely, a third test should be made. Testing in this manner should be continued until two consecutive tests yield the same results.

HOT WORK

If hot work is to be performed on the tank, it is advisable for that area to be sandblasted or scraped clean to bare metal first.

DATA SHEET #6

PROCEDURES APPLY TO THESE TANK DESIGNS

Open and covered floating roof tanks.

TANK SERVICE

Leaded gasoline (also leaded gasoline with manganese additives).

SUMMARY OF PROBLEMS POSED

Most gasolines contain lead antiknock compounds that are toxic to humans. Even storage tanks for unleaded gasolines or for crudes and middle distillates may contain lead left over from previous leaded gasoline service. Also, organic lead deposits may leak at manifolds, in pipelines, and at other places, contaminating tanks no longer in leaded service. A tank that contains gasoline should be assumed to contain organic lead unless it is certain that the tank has *never* contained any leaded product since it was last cleaned. Because of its toxicity, organic lead makes several procedures necessary, notably the use of positive air pressure, full facepiece respiratory protection equipment for entering the tank, and the use of special testing to determine if a tank is lead-hazard-free *after* cleaning. Note that the extent of the organic lead hazard posed by a tank *cannot* be determined before or during the cleaning process. Most gasolines contain benzene, which is also an inhalation and skin contact hazard. Personnel cleaning leaded gasoline tanks must be equipped with proper clothing and must follow all hygiene practices shown in Unit 3 of this program.

Be sure that the roof has not rotated so that the legs will lower onto the tank internal structures.

GAS-FREEING METHOD

As described in Unit 2 of **Safe Tank Cleaning** for floating roof tanks. An air mover is connected at a shell manway to a 90° ell-shaped duct to draw fresh air through remaining shell manways, diluting the air and vapor mixture inside the tank. If it is necessary for workers to enter into the space between the two roofs of a covered floating roof tank, this area should first be checked for flammable vapors and gas-freed, if needed, by the method described in Unit 2 and Data Sheet #2. Because it is impossible to determine the amount of the lead hazard in a tank, and because an inhalation hazard at the roof might exist, workers entering the area between the two roofs should wear positive air pressure, full facepiece respiratory protection.

TESTING

See Data Sheet #5.

ENTRY

Same considerations as Data Sheet #5.

CLEANING PROCEDURE

Similar to that described in Unit 3 for these tank designs. Special provisions must be made for the disposal of the leaded sludge.

TESTING FOR LEAD

Same considerations as mentioned in Data Sheet #5.

HOT WORK

See Data Sheet #5.

DATA SHEET #7

PROCEDURES APPLY TO THESE TANK DESIGNS

Cone roof tank, open floating roof tank, and covered floating roof tank.

TANK SERVICE

Unleaded gasoline.

SUMMARY OF PROBLEMS POSED

When a tank contains an "unleaded" gasoline, it is frequently the case that the tank was formerly in leaded gasoline service and contains some organic lead deposits. Therefore, a tank that contains unleaded gasoline should be cleaned as discussed in Data Sheets #4 and #5 unless it is *absolutely* certain that the tank has *never* contained lead since it was last cleaned. Sometimes, even a tank that has not been in leaded service becomes contaminated with some percentage of leaded product, because the product has leaked into manifolds, pipes, and headers and is carried through pipelines into the new and uncontaminated tank. A tank that contains unleaded gasoline should be cleaned and tested as discussed in Data Sheets #5 and #6, unless it is *certain* there is no lead contamination hazard posed by the tank.

Unleaded gasoline usually contains moderate to high concentrations of benzene. Either inhalation or skin contact with benzene can be hazardous to health, and workers must be protected by proper gas-freeing and by the use of the correct protective equipment.

Be sure that the roof has not rotated so that the legs will lower onto the tank internal structures.

GAS-FREEING METHOD

Cone roof tank - as covered in Unit 2

Open floating roof tank - as covered in Unit 3

Covered floating roof tank - as covered in Unit 2 and, in more detail, in Data Sheet #2. Some companies may elect not to use fog nozzles to wet the air used for tank ventilation.

TESTING AND ENTRY

The same as described in Unit 2.

CLEANING

The same as described in Unit 3.

DATA SHEET #8

PROCEDURES APPLY TO THESE TANK DESIGNS

Cone roof tank.

TANK SERVICE

Lube oil.

SUMMARY OF PROBLEMS POSED

Finished lube oil tanks are usually gas-free. But, *dewaxed lube* and other *lube intermediate* tanks are frequently very gassy and pose the hazard of flammable vapors that must be ventilated from the tank before it is cleaned. Also, a variety of additives may be used in lube oils. Some of these may be highly toxic. It's necessary to know just what is in the tank to be cleaned so that the proper precautions can be taken. The process supervisor responsible for the tanks should have information on what additives, if any, the lube oil contains.

GAS-FREEING, TESTING, AND ENTRY

Refer to the information discussed for cone roof tanks in Units 2 and 3 of the **Safe Tank Cleaning** program. Essentially the same procedures can be used for a cone roof tank in lube oil service.

To determine if it will be necessary to gas-free a lube oil tank, the tank can be tested for flammable vapors once the product is pumped out. A combustible gas meter probe can be inserted in a gage hatch or through a roof manway to a depth of about 5 feet to test for flammable vapors. The probe should be pointed straight down into the tank.

If the tank is not gassy, manway covers on the shell should be removed, and the employee performing gas testing should test for flammable vapors, toxics, and oxygen deficiency. The tank may be entered without appropriate respiratory protection if it meets the entry criteria outlined in Units 2 and 3 of this program.

CLEANING

Tanks containing this material are usually cleaned by wiping out any residue with rags. A clean, absorbent material such as sawdust might also be used. The residue may be very sticky, and caution is required when moving about on slippery surfaces.

DATA SHEET #9

PROCEDURES APPLY TO THESE TANK DESIGNS

Cone roof tank.

TANK SERVICE

Wax, petrolatum, waxy lube feed, raffinate, and waxy gas oil.

SUMMARY OF PROBLEMS POSED

Tanks in this service may have contained naphtha or another solvent, carbon monoxide, H_2S , or excess nitrogen. Testing the tank for oxygen deficiency before anyone enters the tank is therefore very important. Like the lube oil tank, a tank in this service may or may not be gassy, and it will be necessary to test for flammable vapors through a gage hatch or a roof manway to determine this prior to gas-freeing. Anyone who goes to the top of the tank for testing before gas-freeing must wear appropriate respiratory protection. The main problem posed by the products themselves is their waxy composition, which turns to a solid when not heated. It may be necessary to activate a heating coil in the tank so that residual product can be floated out prior to gas-freeing and cleaning. In extreme cases, the build-up of waxy material on tank supports, roof, and walls is bad enough to require steaming the tank before all of the product is completely pumped out.

PREPARATIONS FOR GAS-FREEING

As with any tank, the product is first pumped out. Waxy residue often remains. Turn on the tank's heating coil, and heat the waxy residue until it floats on top of the water that has been previously introduced into the tank to float off sediment. When the wax floats, the water and wax can be pumped out. It may be necessary to repeat this procedure until most of the waxy sediment at the bottom has been eliminated.

If waxy residue coats the entire interior of the tank, steam will be necessary for removing this residue. As much product as possible is pumped out first. Water is used to float off some sediment if possible. Some product should be left at the bottom of the tank.

GAS-FREEING, TESTING, ENTRY, AND CLEANING

Refer to information discussed for cone roof tanks in Units 2 and 3 of the **Safe Tank Cleaning** program. Essentially the same procedures can be used for a cone roof tank in the services listed above.

DATA SHEET #10

PROCEDURES APPLY TO THESE TANK DESIGNS

Cone roof tank.

TANK SERVICE

Residual fuel.

SUMMARY OF PROBLEMS POSED

Residual fuel tanks often contain toxic materials, with H₂S the most common. H₂S testing and wearing of appropriate respiratory protection will be necessary when working around tanks in this service. This product often contains solids and sediment that are heavier than water and difficult to remove from the tank by simply floating out the remaining materials. The Tank Cleaning Coordinator should notify his plant's waste control or pollution control department when a tank of this type is to be cleaned, since the heavy sediment washed from the tank may pass through separators and water treatment facilities. Tanks in this service may also contain pyrophoric deposits. During gas-freeing, a water fog will be necessary for wetting down the tank interior.

GAS-FREEING METHOD

If pyrophorics *are* suspected, use the gas-freeing method outlined in Data Sheets #1 and #3. If pyrophoric materials are not suspected, the gas-freeing method outlined for cone roof tanks in Unit 2 of the **Safe Tank Cleaning** program can be used.

TESTING AND ENTRY

Testing and entry should follow the procedures outlined in Units 2 and 3 of **Safe Tank Cleaning**. The additional cautions outlined in Data Sheets #1 and #3 should be included if pyrophorics are a problem.

CLEANING PROCEDURE

It may be possible to use conventional cleaning methods as outlined in Unit 3 of **Safe Tank Cleaning**.

DATA SHEET #11

PROCEDURES APPLY TO THESE TANK DESIGNS

Cone roof tank.

TANK SERVICE

Aromatic gas oil or cycle oil.

SUMMARY OF PROBLEMS POSED

Catalytically cracked gas oils contain toxic aromatics. These substances can be hazardous to humans if inhaled or if the skin is exposed to them continuously. Personal protection equipment that is impervious to the tank product will be necessary for tank cleaners. Precautions similar to those used with lead should be followed. Tank cleaners should shower and change clothing at the end of each workday or each job. The liberation of vapors from tank residue as tank cleaners stir up sludge may also make appropriate respiratory protection necessary inside the tank.

GAS-FREEING, TESTING, ENTRY, AND CLEANING

Substantially the same gas-freeing, testing, entry, and cleaning procedures can be used for this product as is described in Units 2 and 3 of the **Safe Tank Cleaning** program. However, consideration must be made of the toxic nature of the sludge inside the tank, and tank cleaners must wear appropriate protective clothing and equipment. If pyrophoric materials are known or suspected, fog nozzles should be installed at shell manways, and the tank should be fogged throughout gas-freeing.

Tanks in this service may accumulate heavy deposits of solids that must be removed by mechanical or powered means after a door sheet has been opened in the side of the tank.

DATA SHEET #12

PROCEDURES APPLY TO THESE TANK DESIGNS

Cone roof tank.

TANK SERVICE

Aromatic tars.

SUMMARY OF PROBLEMS POSED

Aromatic tars contain toxic substances. These substances can be hazardous to humans if inhaled or if the skin is exposed to them continuously. Personal protection equipment that is impervious to the tank product will be necessary for tank cleaners. Tank cleaners should shower and change clothing at the end of each workday or each job. Aromatic tars have a tendency to ignite spontaneously when dried, so special precautions must be taken to keep the tank wet during product pump-out, gas-freeing, and cleaning.

PREPARATIONS FOR GAS-FREEING

As the product is pumped out, steam should be continuously injected into the vapor space between the top of the tank roof and the product. This prevents spontaneous ignition of aromatic tar residue left on the tank walls.

GAS-FREEING METHOD

Substantially the same gas-freeing procedure can be used as is described in Data Sheets #1 and #3 for pyrophoric products. A water fog should be used to keep the tank interior wetted down while the tank is gas-freed.

TESTING, ENTRY, AND CLEANING

The same testing procedures described in Units 2 and 3 of **Safe Tank Cleaning** can be used. Entry may require appropriate respiratory protection. Clothing impervious to the tank product must be worn. While work is carried out inside the tank, it is advisable to periodically wet down the interior surface with a water hose equipped with a fog nozzle. Any time the tank is left unattended or overnight, the interior surfaces should be wetted down thoroughly, and all tank openings except for a roof vent should be covered. Any air movers should be turned off when workers leave the tank cleaning area. The Tank Cleaning Coordinator should contact his plant's waste control or pollution control department when a tank of this type is to be cleaned. Aromatic tars are heavier than water, and they may pass through water treatment facilities.

DATA SHEET #13

PROCEDURES APPLY TO THESE TANK DESIGNS

Cone roof tank.

TANK SERVICE

Asphalt - straight run, oxidized, or fluxed.

SUMMARY OF PROBLEMS POSED

Asphalts are generally high flash point products. In other words, they will usually ignite only at temperatures over 500°F. However, when asphalts are transported from place to place and from tank to tank, they may accumulate some volatile low flash point materials. A gas test should be made to determine whether or not the tank contains a flammable vapor-and-air mixture, as it may be necessary to gas-free the tank.

PREPARATIONS FOR GAS-FREEING

Make a gas test at a roof manhole, placing the combustible gas meter probe about five feet into the tank. If the tank is gas-free, ventilation is not necessary.

GAS-FREEING, TESTING, AND ENTRY

If ventilation is necessary, the tank can be gas-freed using an air mover and the method outlined for a cone roof tank in Unit 2 of **Safe Tank Cleaning**. Testing procedures and entry criteria are the same as outlined in Unit 2.

CLEANING

If the tank contains penetration grade asphalt, the residue will probably be hard and can be broken up mechanically and transported from the tank in wheelbarrows or similar equipment. If the tank is especially large, it may be necessary to cut a door sheet and use mobile equipment, such as a bulldozer, to remove tank residue.

If the tank contains fluxed asphalt, it may be necessary to further soften the asphalt with pipe still residium, gas oil, or another stock selected by the Tank Cleaning Coordinator. It will be necessary to use heater coils to help soften the residue, and an external pump will be needed for pumping the stock into and out of the tank.

HOT WORK

For penetration grade asphalt tanks, hot work such as welding may be permitted while solidified asphalt remains at the tank bottom, provided the tank is gas-free, and all lines to and from the tank have been disconnected. Hot work can proceed as follows:

- (1) If the hot work is below or near the surface of the solidified asphalt, a dike should be built of wood or soil around the work area. The area to be worked should be cleared of asphalt residue. Flood the area behind the dike with water so as to cover the asphalt residue with water while hot work is carried out in the diked and cleaned area.
- (2) If the work is above the level of the asphalt residue, the entire bottom of the tank can be flooded with water while hot work is carried out.

DATA SHEET #14

PROCEDURES APPLY TO THESE DESIGNS

Pressure storage vessels - spheres and spheroids, bullets, or vessels designed for similar services.

TANK SERVICE

Propane, butane, or other liquified petroleum gasses.

SUMMARY OF PROBLEMS POSED

Petroleum gases such as propane and butane are usually stored as liquids under pressure. Generally, vapors remaining after product pump-out can be removed by displacing or diluting the remaining product with water or air. Inert gas (nitrogen) or steam may be used to purge in some instances. However, either of these latter two methods require special different precautions.

PREPARATIONS FOR GAS-FREEING

The tank should be blocked off from other equipment except for the pump-out line. Then the liquid product is pumped out. After this is done, the tank will contain gases under pressure. One of two methods of gas-freeing can be used. In the first method, water is used to displace the remaining vapors. The tank is filled from the bottom, and vapors are displaced to a flare or vapor recovery system if a dependable method for water level indication is available on the tank. If no dependable water level indication is available, it will be necessary to displace the vapors slowly to the atmosphere. In any event, the final overflowing of water from the tank should be to the atmosphere, with the flare or vapor recovery system closed off to prevent water from entering these systems. If this method is used, subsequent draining of the water from the tank should also remove the rest of the sediment.

If a sufficient volume of water is not available (or if there is a question regarding the ability of the tank foundation to sustain the dead weight load) air may be used to gas-free the tank. In this case, it will be necessary to first vent the pressure from the tank either to a flare, or to a vapor recovery system, or to the atmosphere. When the tank has been vented to atmospheric pressure, it will remain full of hydrocarbon vapors, which can be removed by diluting with air. However, prior to diluting with air, the flare system or vapor recovery system *must* be disconnected. It is essential that no air is permitted to enter either the flare system or the vapor recovery system.

GAS-FREEING METHOD

If water is used to displace the vapors, the tank should be clean and gas-free after the water has been drained out through the bottom.

If the tank is to be purged with air, an air mover, bonded to the tank and discharging upward, is installed on a top opening, preferably a manway. All but two bolts should be removed from a bottom connection, and the air mover placed in operation. The bottom connection should be opened immediately thereafter. Purging, with air entering at the bottom and discharging from the air mover at the top, should continue until the tank is gas-free.

TESTING

After the tank has been filled to the top with water, about 3 feet of water should be pumped or drained out. The probe of a combustible gas meter should be inserted into the top of the tank to test for flammable vapors. If the results of this test indicate that gases are at greater than 10% of their LFL, the tank should be ventilated and the process repeated until these test results are obtained.

If the tank is purged with air, the air mover should be shut down for 15 minutes when the tank is thought to be vapor-free. Gas tests are then made at top and bottom openings. Air mover operation should begin again and continue until readings of less than 10% of the LFL are obtained.

ENTRY

The criteria for entering the tank *without* appropriate respiratory protection are the same as given in Unit 2 of the program.

CLEANING PROCEDURE

If water flushing did not remove sediment, shell manways can be removed, and the tank can be hosed out with high-pressure water once it is gas-free.

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