Office of
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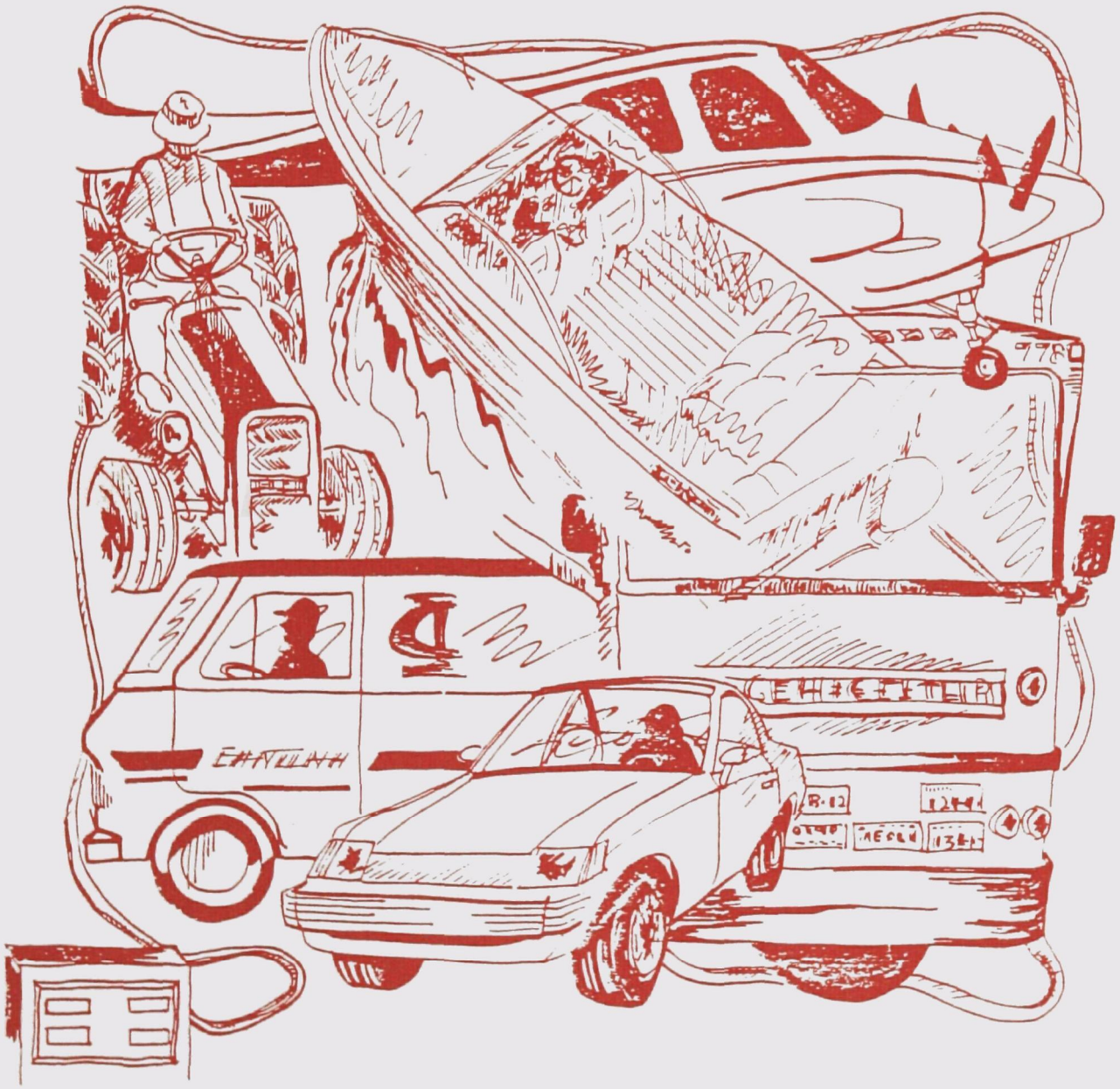
EPA

More About Leaking Underground Storage Tanks: A Background Booklet for the Chemical Advisory



MORE ABOUT LEAKING UNDERGROUND STORAGE TANKS:

A Background Booklet for the Chemical Advisory

Prepared by:

Exposure Evaluation Division

Office of Toxic Substances

U.S. Environmental Protection Agency

October 1984

DISCLAIMER

The mention of specific trade names in this booklet is for informational purposes only. EPA does not endorse any particular product or system.

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INTRODUCTION

Leaking underground storage tanks can be dangerous and costly. Leaks can mean loss of motor fuel and they can mean contamination of community drinking water supplies. The U. S. Environmental Protection Agency (EPA) is concerned with the health and environmental problems caused by leaking underground storage tanks. EPA is concerned that underground storage tanks that are not properly installed and managed pose a great risk of leakage. EPA believes that it is important to prevent leakage. This is why EPA issued a Chemical Advisory on leaking underground storage tanks containing motor fuel in September 1984.

EPA is also working on a national survey of about 1,050 facilities where motor fuel is stored in underground tanks. This survey will tell EPA how widespread the problem of leaking underground motor fuel storage tanks really is. The survey will also help answer questions about the best ways to prevent leaks. Finally, this survey will provide EPA with information that will help it decide the types of requirements that are most likely to be effective in reducing the problem of leaking underground storage tanks.

While this booklet focuses on the problems of leaking underground storage tanks that contain motor fuels, EPA recognizes that underground tanks that store other materials can also leak. EPA intends to investigate tanks storing other materials in the future. The term "motor fuels" in this booklet means all finished gasolines, diesel fuels, aviation gasoline, and jet fuels. Petroleum products that are <u>not</u> included in the term motor fuels are fuel oils, kerosene, and residential fuel oils.

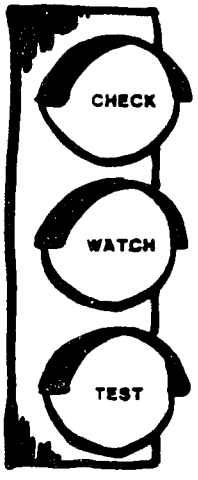
In summary, this booklet will give you information (not recommendations) about tank leak identification methods; replacement and repair of underground storage tanks; Federal, state and local regulations of underground storage tanks; and insurance for liability. If you have questions about leaking

underground storage tanks that are not answered in this booklet, you should call EPA at its toll-free hotline number (800) 424-9346 or, if you are calling from the Washington, DC area dial 382-3000.

LEAK IDENTIFICATION METHODS

A number of methods are available to identify leaking underground storage tanks and pipes. The information that EPA has gathered so far on these leak identification methods indicates that leak identification is not simple and it is not certain. EPA has also found that there is not one "perfect" method for leak identification. Each method has good and bad points. Therefore, EPA is not ready to recommend any particular method to identify tank or piping leaks, but wants to inform all owners and operators about currently available methods. EPA is undertaking a research project that will study a number of methods in greater detail.

EPA encourages all tank owners and operators to have an active leak identification program for every underground storage tank. In fact, in some localities certain leak identification steps are required. EPA believes that a leak identification program does not have to be complicated or expensive; but, the program does need to be followed on a regular basis. EPA believes that in setting up a leak identification program, owners and operators should consider three basic actions:



1. **CHECK** the inventory;
2. **WATCH** for the environmental and mechanical signs of a leak; and
3. **TEST** tanks and piping for leaks.

There are a number of leak identification methods that can be used to **CHECK**, **WATCH**, and **TEST** for leaking underground storage tanks and piping. These methods will be described in more detail in this chapter.

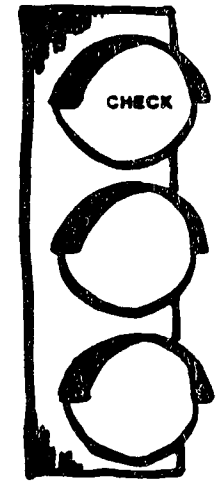
In some cases, leaks can be identified right away without doing additional checking, watching, or testing. The important thing is that when a tank or piping leak is actually identified, there should be quick action to inform the proper authorities, correct the problem, and clean up the leak. Depending on the

situation, there may be specific responses to a leaking underground storage tank that are required by Federal, state, or local regulations. The chapter in this booklet entitled "Federal, State, and Local Regulations" briefly describes a number of these required responses. However, if there is a question about the proper action to be taken in an emergency, the local fire official should be consulted.

CHECK THE INVENTORY

Simple Inventory Review

Inventory review methods are generally an inexpensive and relatively easy way to check underground storage tanks for motor fuel losses. These reviews do require good bookkeeping and proper tank inventory procedures. Inventory review methods can be used successfully to identify larger leaks. Although they may not be able to detect very small leaks right away, the longer the period over which inventory reviews are done, the more likely the owner or operator will be able to identify small leaks.



EPA has developed inventory review methods for underground storage tanks that either have metered dispensing pumps or do not have metered dispensing pumps. These inventory review methods are relatively simple and inexpensive. The only equipment needed to do these inventory reviews is a dipstick (or gauge stick), the correct inches-to-gallons conversion chart for the tank, and (for tanks with metered dispensing pumps) a 5-gallon "proving can." The cost would be the few minutes a day that it takes to check the tanks, write down a few numbers, and review the information.

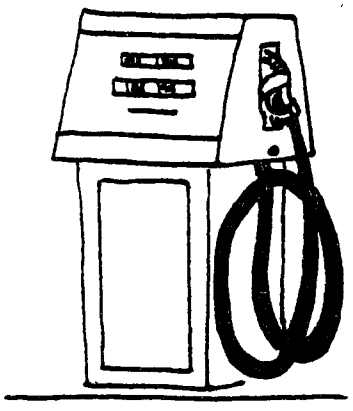
Several factors make inventory review methods subject to error (for example, changes in the fuel temperature, errors in reading the dipstick, or inaccurate fuel dispensing meters).

These inventory review methods should be used only as a first step in discovering a problem. If the inventory is short based on these review methods, the owner or operator should check the situation more carefully to determine if the shortage is due to theft, short deliveries, errors in measurement or calculation methods. Ruling these problems out, other leak identification methods should be used to confirm that a tank or its piping is leaking.

More information on inventory review is found in the American Petroleum Institute's (API) "Recommended Practice for Bulk Liquid Stock Control at Retail Outlets" API Publication No. 1621. This publication is available from API for 75¢. For a copy write the American Petroleum Institute at 1220 L Street NW, Washington, DC 20005, or phone (202) 682-8375.

Inventory Review for Tanks with Metered Dispensing Pumps

This section describes an inventory review method that can be used by the owner or operator of an underground storage tank with a metered dispensing pump--such as a gas station tank or aviation fuel tank. Using this method, the owner or operator can determine if daily product levels in the tank inventory are tending to be "short" (show a loss of fuel) or "over" (show a gain of fuel). This loss or gain could be caused by a leak, theft, delivery errors, or errors in measurement.



The inventory review method for tanks with metered dispensing pumps involves counting the number of days the inventory is short over a period of at least 30 days of operation. The more 30-day periods that inventory records are kept, the better the chance of identifying a motor fuel leak if there truly is one. (The chance that the method will incorrectly indicate a

leak when there really is none is very small.) If the number of days of short inventory is greater than the "action number" (to be described later), this indicates a continuing loss and the operator or owner should investigate the situation more carefully. The action number alerts the owner or operator to take action to correct a problem.

There are three different forms that may be filled out in order to keep an inventory review: (1) the "Manifolded Tank System Recording Sheet", (2) the "Dispenser Meter Recording Sheet", and (3) the "Inventory Review Sheet" (samples of these forms are provided later in this booklet). The forms that will be used at each facility will depend on the tank-to-meter-to-dispenser hookups (or "tank systems") that are shown in Figure 1. For example, the inventory review for a manifolded tank system (a tank system with a number of tanks interconnected by piping) would use all three forms:

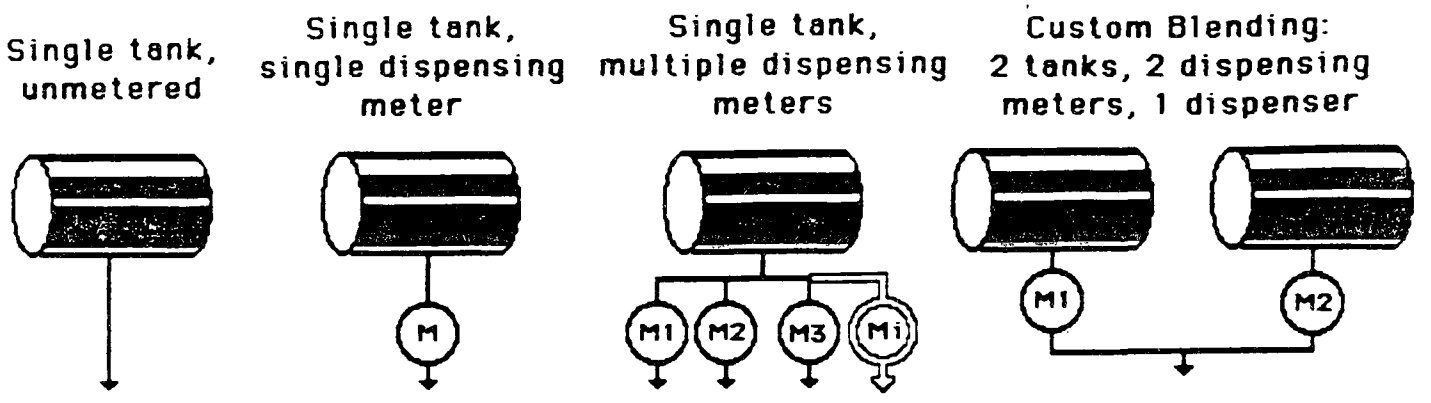
- Stick readings for all of the interconnected tanks would be recorded on the "Manifolded Tank System Recording Sheet;"
- Readings from all of the meters hooked up to those interconnected tanks would be recorded on the "Dispenser Meter Recording Sheet;" and
- Daily totals from the "Manifolded Tank System Recording Sheet" and the "Dispenser Meter Recording Sheet" would also be recorded on the "Inventory Review Sheet."

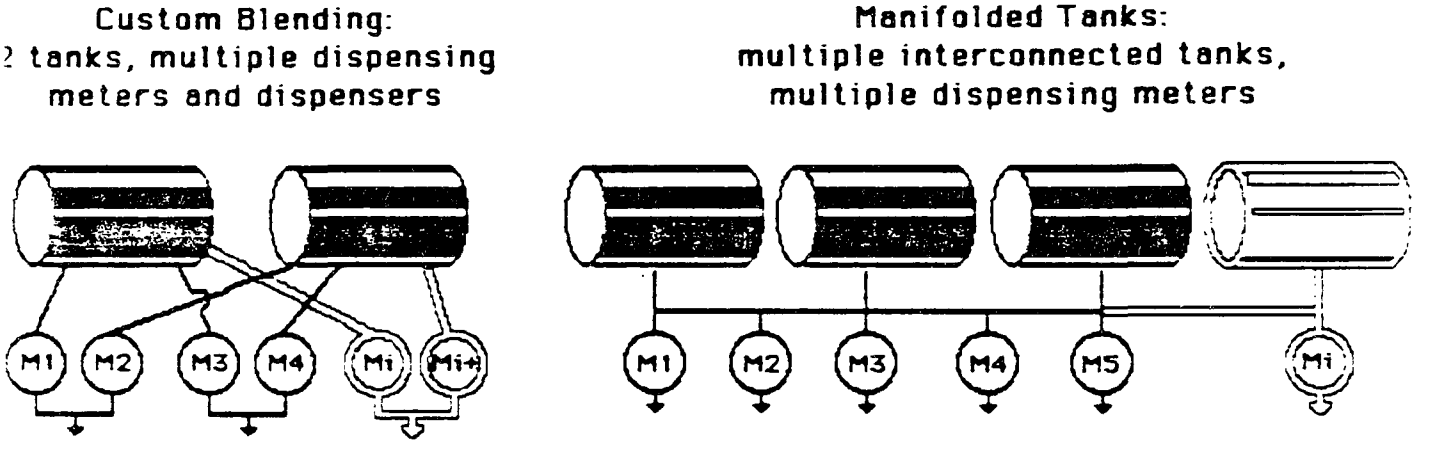
Figure 2 is a guide that will show which forms will be needed for the various types of tank hookups. Blank forms for your use are included in Appendix A in the back of this booklet.

The basic steps to be followed in the inventory review method for metered dispensing pumps are described below:

Step 1: Test the accuracy of the pump meter. Before starting the inventory review, it is important that the fuel-dispensing meter is giving accurate readings. A meter that is reading higher than the true volume pumped may be hiding a large leak. A meter that is reading lower than the true volume may be suggesting incorrectly that the tank or piping is leaking. Many

Figure 1. Tank-to-Meter-to-Dispenser Hookups





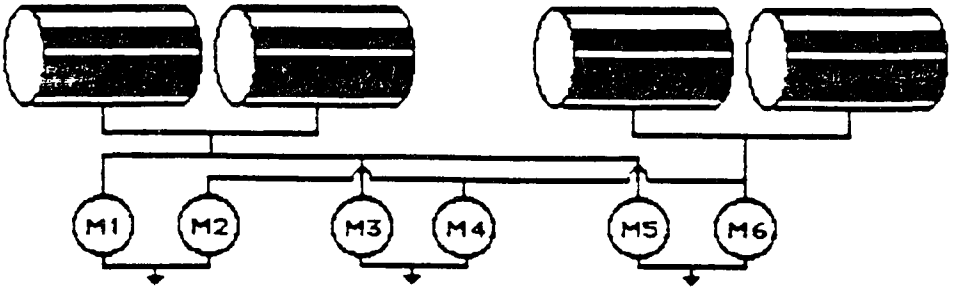
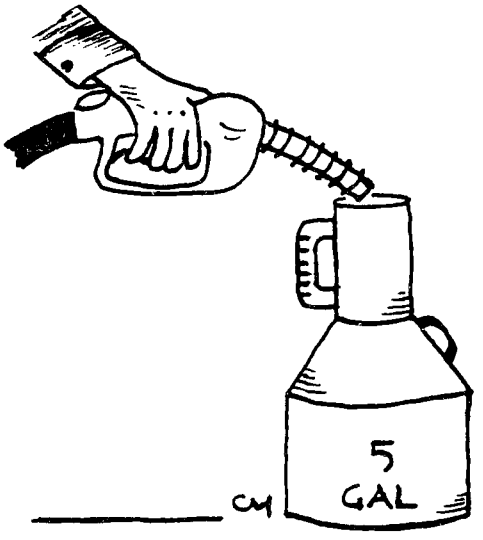


Figure 2. Tank hookups and the appropriate inventory review forms.

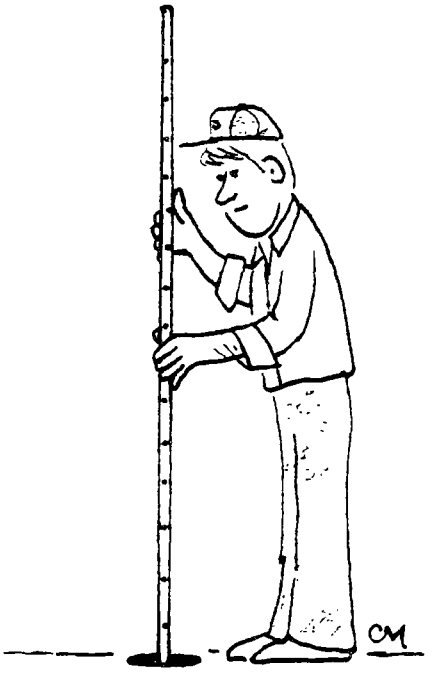
POSSIBLE TANK/DISPENSING METER/DISPENSER HOOKUPS	APPROPRIATE INVENTORY REVIEW FORMS			
	DISPENSING METER RECORDING SHEET	MANIFOLDED TANK SYSTEM RECORDING SHEET	INVENTORY REVIEW SHEET FOR TANKS WITH METERED DISPENSING PUMPS	INVENTORY REVIEW SHEET FOR TANKS WITHOUT METERED DISPENSING PUMPS
Single tank without dispensing meter				X
Single tank with single dispensing meter	X		X	
Single tank with multiple dispensing meters	X		X	
Custom Blending: 2 tanks, 2 dispensing meters, 1 dispenser	X		X	
Customer Blending: 2 tanks, multiple dispensing meters and dispensers	X		X	
Manifolded Tanks: multiple interconnected tanks, multiple dispensing meters	X	X	X	
Manifolded Tanks, Custom blending	X	X	X	

localities have passed regulations that specify how frequently meters must be checked for accuracy. It is important to know the local regulations on how frequently the meters are to be checked.

The pump meter check is done by dispensing 5 gallons (as shown by the pump meter) into a 5-gallon proving can. A 5-gallon proving can is a container that is marked at the level where, when filled with fuel, it will contain exactly 5 gallons. Proving cans may be purchased from local distributors of petroleum marketing equipment. The names of these distributors are found under the heading "Service Station Equipment" in the Yellow Pages.



The fuel level in the proving can is then examined to see whether it is above (+) or below (-) the 5-gallon mark on the proving can. If the meter is inaccurate, the error should be measured and recorded as described in Step 2. Information can be found in API Publication 1621 which presents a procedure for testing the accuracy of dispensing meters. If the meter is not accurate, the meter should be checked by the State or local weight and measurement office.



Step 2: Record inventory information daily: Dispensing Meter Recording Sheet and Inventory Review Sheet Part A. The daily inventory information is based on dipstick measurements. A dipstick (or gauge stick) is a stick that is usually 6 to 10 feet long and has been marked off at certain regular distances (generally 1/8 or 1/4 inch). The dipstick is slowly lowered straight down to the bottom of the tank, always lowering the same end of the stick into the tank. It is important that

the dipstick be carefully lowered into the tank, especially if the tank is fiberglass, to avoid rupturing the tank. An API-recommended procedure for taking dipstick measurements ("sticking") of the fuel in a tank and for detecting water in a tank is given in API Publication 1621.

A water-finding paste can be applied to the bottom of the dipstick to tell if water may be leaking into the tank. This paste will not react with the motor fuel, but will change color in water. If this paste turns color when inserted into the tank, further investigation should be made to determine the source of the water in the tank.

When the dipstick is withdrawn from the tank, the mark at the top of the wet area is read. Charts are available that show conversions from dipstick measurements into gallons of motor fuel in the tank. These inches-to-gallons conversion charts are specific for each tank based on the tank's diameter and length. The correct chart for a specific tank must be used to accurately convert dipstick measurements to gallons of fuel. For a tank that has been repaired by lining, it is necessary to use an updated conversion chart.

The daily inventory information is recorded in the following way. On the Inventory Review Sheet for each tank (see sample, Figure 3), or on the Manifolded Tank System Recording Sheet for manifolded systems (see sample, Figure 4), record the dipstick inventory information. On the Dispensing Meter Recording Sheet (see sample, Figure 5), record at the end of the day the number of gallons dispensed (daily sales) for each meter hooked to the same tank or manifolded tank system, based on the present day's and preceding day's closing meter readings. Enter also on the dispensing meter recording sheet the daily line totals, and transfer that number to Column 8 of the Inventory Review Sheet for that tank or manifolded system. Finally, complete the Inventory Review Sheet (Columns 9 and 10) to show the daily loss

Figure 3. Sample inventory review sheet for tanks with metered dispensing pumps.

TANK NO. T-2

DISPENSING METER NO(S). M-1
OR, TANK SYSTEM NO(S). M-2
IF MANIFOLDED TANKS, M-3

PROVING CAN METER CHECK ok

PART A

	Dipstick Inventory								
Column 1	Column 2	Column 3	Column 4	Column 5	Column 6	Column 7	Column 8	Column 9	Column 10
Date	Opening Dipstick Inventory (gallons)	Deliveries (in gallons)	Total (Column 2) plus (Column 3)	Closing Dipstick Inventory (inches)	Closing Dipstick Inventory (gallons)	Gone from Tank (Column 4) minus (Column 6)	Meter Sales* (gallons) (from meter sheet)	Column 8 less than (-) or greater than (+) Column 7	Columns 7 & 8: Subtract Smaller from Larger
6-1	6604	0	6604	41 1/2	4843	1761	1778	+	17
6-2	4843	1801	6644	41 3/4	4925	1719	1649	−	70
6-4	4925	0	4925	32 1/4	3383	1542	1500	−	42
6-5	3383	6525	9908	62 1/8	8456	1452	1489	+	37
6-6	8456	0	8456	50 1/2	6389	2067	2002	−	65
6-7	6389	0	6389	43 1/2	5199	1190	1217	+	27
6-8	5199	2745	7944	52 3/4	6781	1163	1132	−	31
6-9	6781	1981	8762	57 3/4	7701	1061	1058	−	3
6-11	7701	0	7701	49 7/8	6308	1393	1382	−	11
6-12	6308	0	6308	42	4942	1366	1382	+	16
6-13	4942	3374	8316	48 1/4	6031	2285	2239	−	46
6-14	6031	1981	8012	50 5/8	6451	1561	1319	−	242
6-15	6451	0	6451	44 3/4	5416	1035	1050	+	15
6-16	5416	0	5416	38 1/4	4263	1153	1153	0	0
6-18	4263	2745	7008	46 1/8	5647	1361	1346	−	15
6-19	5647	2475	8122	51 1/8	6540	1582	1587	+	5
6-20	6540	0	6540	39	4397	2143	2108	−	35
6-21	4397	0	4397	31 5/8	3115	1282	1256	−	26
6-22	3115	2745	5860	39 7/8	4558	1302	1262	−	40
6-23	4558	2475	7033	47 3/8	5875	1158	1194	+	36
6-25	5875	0	5875	41 5/8	4864	1011	998	−	13
6-26	4864	4996	9860	62 1/4	8184	1676	1627	−	49
6-27	8184	0	8184	48 7/8	6146	2038	2046	+	8
6-28	6146	0	6146	42	4930	1216	1206	−	10
6-29	4930	0	4930	34 3/8	3600	1330	1329	−	1
6-30	3600	2225	5825	41 1/2	4852	973	954	−	19
7-2	4852	2225	7077	47 1/8	5823	1254	1289	+	35
7-3	5823	0	5823	38 3/8	4301	1522	1494	−	28
7-5	4301	0	4301	26 3/8	2184	2117	2057	−	60
7-6	2184	4050	6234	42 5/8	5039	1195	1253	+	58

* Transferred from Line 1 of Dispenser Meter Recording Sheet.

PART B

1. NUMBER OF MINUSES (-) IN COLUMN 9, PART A 19
2. CUMULATIVE NUMBER OF MINUSES RECORDED FOR PREVIOUS 30-DAY PERIOD(S). COPY FROM LINE 3, PART B OF PRECEDING 30-DAY SHEET, OR ENTER ZERO (0) IF CURRENTLY THE FIRST PERIOD . . . 70
3. ADD LINES 1 AND 2 89
4. ACTION NUMBER FROM TABLE FOR TANKS WITH METERED DISPENSING PUMPS . . . . . 85 (Fifth 30-day period)
5. IS LINE 3 GREATER THAN LINE 4? . . . . . [X] YES [ ] NO

IF "YES", CONCLUDE THAT DAILY INVENTORIES ARE SHORT. IF "NO", CONTINUE WITH INVENTORY TO COMPLETE 1-YEAR EVALUATION.

Figure 4. Sample manifolded tank system recording sheet.

(Sheet 1 of 8)

Manifolded Tank System I.D. Number MTS-1 Type of Fuel Diesel

Day	Date	Physical Inventory Measurements	Tank # 1	Tank # 2	Tank # 3	Tank # 4	Tank # 5	Tank # 6	Tank # 7	Tank # 8	Line F* Totals
		A. Opening stick (gals.) (Yesterday's line E)	3460	2980	3270						
		B. Deliveries (gals.)	0	0	0						
1	7/5	C. Total of fuel in tank (A+B)	3460	2980	3270						
		D. Closing stick (inches)	48 3/4	41 3/8	44 1/2						
		E. Closing stick (gals.)	3050	2450	2725						
		F. Fuel gone from tank (gals.) (C-E)	410	530	545						1485
		A. Opening stick (gals.) (Yesterday's line E)	3050	2450	2725						
		B. Deliveries (gals.)	0	0	0						
2	7/6	C. Total of fuel in tank (A+B)	3050	2450	2725						
		D. Closing stick (inches)	43	34 3/4	37 7/8						
		E. Closing stick (gals.)	2570	1890	2150						
		F. Fuel gone from tank (gals.) (C-E)	480	560	575						1615
		A. Opening stick (gals.) (Yesterday's line E)	2570	1890	2150						
		B. Deliveries (gals.)	1000	2000	1500						
3	7/7	C. Total of fuel in tank (A+B)	3570	3890	3650						
		D. Closing stick (inches)	41	51 3/4	47						
		E. Closing stick (gals.)	2920	3280	2925						
		F. Fuel gone from tank (gals.) (C-E)	650	610	725						1985
		A. Opening stick (gals.) (Yesterday's line E)									
		B. Deliveries (gals.)									
4		C. Total of fuel in tank (A+B)									
		D. Closing stick (inches)									
		E. Closing stick (gals.)									
		F. Fuel gone from tank (gals.) (C-E)									

*Transfer Line F totals to the correct Inventory Review Sheet for this Tank System.

Figure 5. Sample dispensing meter recording sheet.

Tank No. T-2 ;
or, if manifolded tanks, tank system no. _____

(Sheet 1 of 5)

Type of fuel Regular Unleaded

Day	Date	Meter Recordings in Gallons	Meter #1	Meter #2	Meter #3	Meter #4	Meter #5	Meter #6	Meter #7	Meter #8	Line I* Totals
		G. Today's Closing Meter	53782	49956	64210						
1	6-1	H. Yesterday's Closing Meter	53311	49420	63439						
		I. Gallons dispensed (G-H)	471	536	771						1778
		G. Today's Closing Meter	54332	50443	64822						
2	6-2	H. Yesterday's Closing Meter	53782	49956	64210						
		I. Gallons dispensed (G-H)	550	487	612						1649
		G. Today's Closing Meter	54742	51073	65282						
3	6-5	H. Yesterday's Closing Meter	54332	50443	64822						
		I. Gallons dispensed (G-H)	410	630	460						1500
		G. Today's Closing Meter									
4		H. Yesterday's Closing Meter									
		I. Gallons dispensed (G-H)									
		G. Today's Closing Meter									
5		H. Yesterday's Closing Meter									
		I. Gallons dispensed (G-H)									
		G. Today's Closing Meter									
6		H. Yesterday's Closing Meter									
		I. Gallons dispensed (G-H)									

* Transfer Line I totals to Column 8 of Inventory Review Sheet

Figure 6: Action numbers for tanks with metered dispensing pumps.

30-Day Period[1]	Action Number[2]
1st	20
2nd	37
3rd	54
4th	69
5th	85
6th	101
7th	117
8th	133
9th	149
10th	165
11th	180
12th	196

[1]30-business day inventory period.

[2]Cumulative count of short (-) daily inventories. Enter appropriate number on Inventory Review Sheet (Part B, Line 4).

or gain in motor fuel inventory for the given tank or manifolded tank system.

Step 3: Review inventory results: Inventory Review Sheet Part B. At the end of each 30-day inventory period, a summary of the total period's inventory outcome is calculated in Part B of the Inventory Review Sheet. The purpose of this step in the inventory review method is to find out whether daily inventories are actually short and further action is needed to determine why they are short. Statisticians have calculated the number of days showing shortages during one or more 30-day periods that should alert the owner or operator to take action to find the source of the problem. The problem could be theft, bookkeeping errors, inaccurate meters, delivery errors, or leaks in the tank or piping. These action numbers for successive 30-day periods are shown in Figure 6.

From Column 9 of the Inventory Review Sheet (see Figure 3), count the number of days the inventory measured short (count all the minuses) during the period. To this number add the accumulated number of days of short inventory (all the minuses) from the previous period's sheet and record the total on Line 2. Compare this new total (Line 3) with the appropriate action numbers from Figure 6. If this new total (Line 3) is higher than the action number (recorded on Line 4) for the period, a routine daily loss may exist.

Inventory Review for Tanks without Metered Dispensing Pumps

For underground storage tanks without metered dispensing pumps, such as many farm tanks and other small tanks, the problem of using inventory review to identify fuel losses is complicated by knowing only imperfectly how much fuel is pumped from a tank. This means that the inventory review must be based on stick readings alone. One answer to this problem is to install a dispensing meter. However, EPA has developed the following inventory review method for use with tanks that do not have

meters on the dispensing pumps. In order to use this method, the tank owner or operator will need a dipstick (or gauge stick) and the correct inches-to-gallons conversion chart for the specific type of tank.

The steps involved in the inventory review method for tanks without metered dispensing pumps are as follows:

Step 1: Stick the tank for a beginning reading. The method for sticking the tank is the same as described for sticking a tank with a metered pump (see Step 2 under Inventory Review for Tanks with Metered Dispensing Pumps). The beginning (start) reading will be used to figure out the first measurement of loss. The tank stick reading can be done at any time. Enter the "start" stick reading on the Inventory Review Chart for Tanks Without Metered Dispensing Pumps (see sample, Figure 7) in the column marked "Dipstick Reading (inches) After."

Step 2: Stick the tank immediately before and after each withdrawal. Record on the Inventory Review Chart the number of inches and gallons of motor fuel in the tank before and after the withdrawal. This step should also be done each time before and after the tank is filled.

Step 3: Determine the loss between withdrawals. Subtract the number of gallons in the tank immediately before the present withdrawal from the number of gallons present immediately after the previous withdrawal and record the number on the Inventory Review Chart. The difference represents a volume loss or gain of liquid in the tank during the period between withdrawals, plus any measurement error. If the amount of liquid actually in the tank is greater than what has been calculated, it may be the result of dipstick reading errors, or of water leaking into the tank.

Step 4: Determine the total loss. Determine the total gain or loss in motor fuel by adding the present loss between withdrawals to the last recorded total loss. Enter this number in the total loss column.

Step 5: Compare the total loss with the action number. If the number in the total loss column is greater than the

Figure 7. Sample inventory review chart for tanks without metered dispensing pumps.

WITHDRAWAL OR FILL		DIPSTICK READING (INCHES)		DIPSTICK READING (GALLONS)		LOSS BETWEEN WITHDRAWALS[1]	TOTAL LOSS	ACTION NUMBER[2]	IS THERE A LEAK?[3]	
Number	Date	Before	After	Before	After				Yes	No
Start	6-2-84	XX	54½	XX	708	XX	XX	XX	XX	XX
1	6-4-84	54¼	52¾	704	680	4	4	14		X
2	6-10-84	52	50½	668	643	12	16	20		X
3	6-18-84	49½	48⅜	626	607	17	33	25	X	
4										
5										
6										
7										
8										
9										
10										
11										
12										

[1]Gallons after last withdrawal or fill minus gallons before this withdrawal or fill.

[2]From Action Number Table for Tanks without metered pumps.

[3]There is a leak if the total loss for the given number of withdrawals and fills is greater than the action number.

Figure 8: Action numbers for tanks without metered dispensing pumps.

Withdrawal Number	Action Number
1	14
2	20
3	25
4	29
5	32
6	35
7	38
8	40
9	43
10	45
11	47
12	49

appropriate action number (Figure 8), there has very likely been an actual loss in fuel.

For best results with this inventory review method, there should be several days between withdrawals. If any sign of a problem is seen, action must be taken to identify and correct the problem. A blank Inventory Review Chart is included in the back of this booklet as Appendix B.

Automatic Inventory Systems

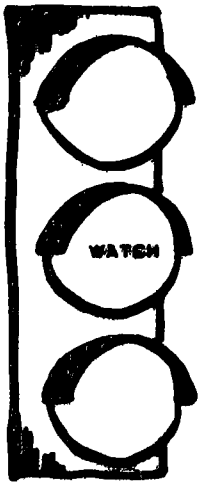
In addition to the above simple inventory review methods which are accomplished manually, there are inventory testing methods which are automated and usually operate continuously. Automatic inventory systems can serve many functions. Some systems are available which electronically check the motor fuel level in the tank continuously, record deliveries made to the underground storage tank, and check for leaks and other sudden large losses.

Another type of automatic system checks for the presence of motor fuel in the ground outside the tank and alerts the tank owner or operator if motor fuel appears. Automatic systems that are placed outside the tank only provide information when a leak is detected, and do not provide daily information on fuel levels in the tank.

Automatic systems have the advantage of reducing human error in leak identification. Automatic inventory systems can more easily identify long-term changes in the tank environment, such as those caused by a slow leak, since they are continuously checking the tank. However, these systems are generally more expensive than other leak detection methods and may have continuing costs, such as electrical costs, that other methods do not.

Computerized Inventory Review Methods

Computerized reviews of inventory records can also be done. This computerized review considers a number of factors, including environmental factors, that can be used in deciding whether an underground storage tank is leaking.



WATCH FOR ENVIRONMENTAL AND MECHANICAL SIGNS

When motor fuel is lost from an underground storage tank, serious environmental and safety hazards may be created. These hazards caused by leaking underground storage tanks or piping may not be detected for months or even years. If the leak is not properly taken care of, it may become widespread, making it more difficult and expensive to clean up. A careful watch for environmental and mechanical signs is helpful in identifying a leak.

Environmental Signs

As a part of the everyday operation of an underground storage tank, the owner or operator of the tank should watch for certain signs which would identify a tank leak. It may be possible to identify leaks at an early stage by regularly inspecting the piping and pumping equipment, and by watching for signs of leaking motor fuel in the surrounding area. The following are some environmental signs that may indicate that a tank is leaking:

- Odors of gasoline, or other motor fuel, in the soil near the tank may be a sign of a leaking tank or piping. These odors may also be caused by motor fuel spills that happened during deliveries or when filling up vehicles.
- The odor or presence of motor fuels in underground structures such as basements and sewers is a sign that an underground storage tank may be leaking.
- Careful watch of the plant life located near an underground tank is another way to identify a leak. Plants located on property near the underground tank may not grow, may look sickly, or may even die. In particular, the owner or operator should watch for clumps of plants showing these signs.

- Motor fuel found in drinking water wells of neighboring properties is a sign that a tank is leaking somewhere. Reports of motor fuel in a neighboring drinking water well should start the owner or operator looking for other signs of a leaking tank.
- Motor fuels found as a sheen on the surface of the water found in streams, rivers, and lakes can be a sign of a leaking underground storage tank.

Mechanical Signs

Leaks can also be identified by observing the way the dispensing system is working. A few common dispensing system problems and their probable causes are listed below.

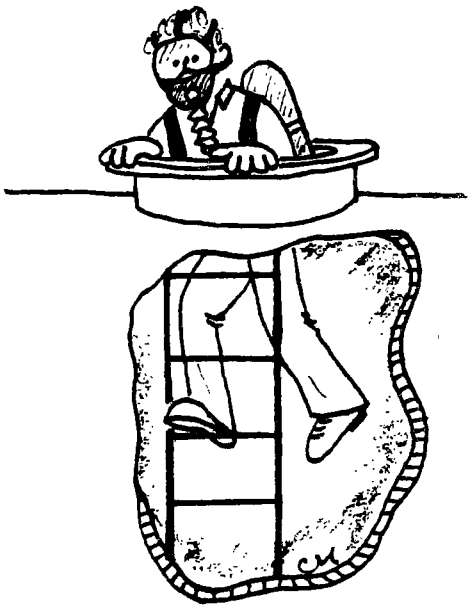
- Hesitation in delivery of motor fuel dispensed by the suction pump located at the dispenser may be a sign of a leak in the piping. This hesitation may also be caused,

however, by a leaking valve or, in warm weather, by vapor lock.

- A rattling sound and irregular fuel flow in a suction pumping system are signs that air is entering the dispensing system and mixing with the motor fuel. Air could be entering the system through a loose fitting or a hole in the piping.
- In a remote (submerged) pumping system, meter spin without motor fuel delivery may be a sign of a piping leak.
- Less motor fuel in a tank than the records show (a shortage) is a sign of a number of problems. Besides being a sign of a leaking tank, it could be a sign of problems in bookkeeping, problems in the metering of the motor fuel, theft, large decreases in the temperature of the motor fuel in the tank temperature, under-deliveries, cross-pumping to another tank, or piping leaks.
- More motor fuel in a tank than records show (an overage) is also a sign of a number of problems. It could be a sign of water leaking into the tank. It could also be a sign of problems in bookkeeping, problems in the metering of the motor fuel, large increases in the temperature of the motor fuel in the tank, over-deliveries, or cross-pumping from another tank.
- Continuing differences between the recorded amount of motor fuel received and motor fuel dispensed may be a sign of an inaccurate meter, theft, a leak in tanks or piping, use of the wrong inches-to-gallons conversion chart, or a consistent delivery error.
- Large differences appearing only and regularly between the delivered amount of fuel noted on the invoice and the measured amount in the tank after delivery may be a sign of a leak in the fillpipe, a delivery error, or a dipstick reading error.

Manway Inspections

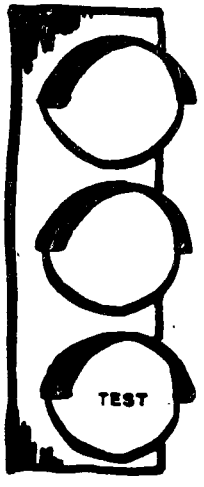
Underground storage tanks can also be watched for signs of leaks by doing manway inspections. A manway is an opening in a tank that is large enough for a person to enter the tank. Some tanks are made with manways, others must have manways put into existing tanks. The following general steps must be taken to put a manway in an existing tank: empty the tank, remove the concrete or asphalt pads and backfill material, cut a hole in the tank top, and weld an entrance cover on the tank. Once this has been done, the tank is cleaned and then a person can enter the tank to inspect it.



A manway is generally put into a leaking existing tank that will be repaired rather than replaced. However, once the manway is installed it can be used in a routine cleaning and inspection program.

TEST the TANK AND PIPING

When any of the various inventory review methods or environmental or mechanical indicators suggest that an underground storage tank may be leaking, tank and piping tests should be considered. The choice of a tank and piping test method requires the owner or operator to make a number of decisions. The owner or operator generally makes these decisions based on what is learned from checking the inventory, watching for



environmental and mechanical signs of a leak, and knowledge of the tank and piping system.

EPA is looking for tank testing methods that are best suited for the national survey of underground fuel storage facilities. In finding the best tank testing methods for the survey, different questions and different needs face EPA than face the owner or operator of a tank. It would be difficult, if not impossible, to name one method that would be the best method for all situations. However, the factors EPA considered in evaluating the methods for the EPA national survey of underground storage tanks containing motor fuels are listed below:

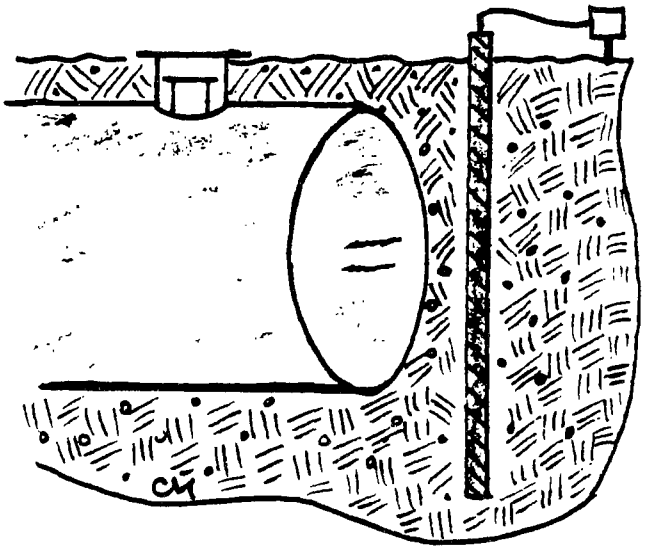
- Versatility. Is the method designed to identify leaks in tanks only, piping only, or both tanks and piping?
- Nuisance factor. How much will the test method disrupt facility operations? Will the fuel pump have to be shut down? What is the possibility of property damage? Will the tank have to be completely full (or empty) before the test can be run?
- Performance. Is the test accurate enough to identify small leaks consistently? Can the equipment be operated under various weather conditions (for example, very high or very low temperatures)?
- Cost. How much does the method cost per test? Are there special labor costs? Is the equipment easy to transport to many locations?
- Equipment and staff requirements. Is the equipment to conduct the test available when it is needed? Are there special training requirements? Is the equipment safe to use? What are the capabilities and experience of the testing crew?
- Quality assurance. Are the results of the tests reliable?
- Legal requirements. What are the Federal, state, and local requirements concerning leak identification?

In general, tank testing can be costly and inconvenient. Tank testing, however, can be very helpful in identifying a leak before it becomes a bigger problem. While there is not one

"perfect" method for tank testing, there are a great number of test methods that each identify motor fuel losses in slightly different ways. It is not possible to list and evaluate all known methods in this booklet. However, what follows is an explanation of the various characteristics of a number of different kinds of tank tests. EPA has divided these tests into two broad categories: external tests and in-tank tests.

External Tests

Some tank tests are run outside of the tank and piping to look for leaked motor fuel. There are a number of types of external tests; but the groundwater monitoring wells are the most common type of external test. These wells are also called observation wells or in-well monitoring.



The number and location of groundwater monitoring wells and the equipment used to keep a check on these wells depend on several factors, including the soil conditions, the movement of the groundwater, and costs of drilling and materials. A typical monitoring well will reach 2 feet below the bottom of an underground storage tank. Samples are collected from the wells and checked for motor fuel. These wells may also be checked using automatic sensors. In addition, a simple and effective way to check wells for leaked motor fuel is to coat the measuring end of a dipstick with hydrocarbon detection paste. The pasted end of the stick is then inserted into the monitoring well. If the paste changes color, motor fuel is in the well.

External tests are designed to tell only if there is a leak; they do not determine the leak rate. The costs for external tests are similar to the costs for other types of tests, but the disruption to normal operations for external tests may be much less than for other types of tests.

Another method which has been used to look for motor fuel outside of the tank is soil core analysis which requires the drilling of a hole much like the drilling for monitoring wells. The soil core is analyzed by a laboratory for motor fuel entrapped in the soil. Another method looks for motor fuel vapors that have traveled from a leak to the soil surface.

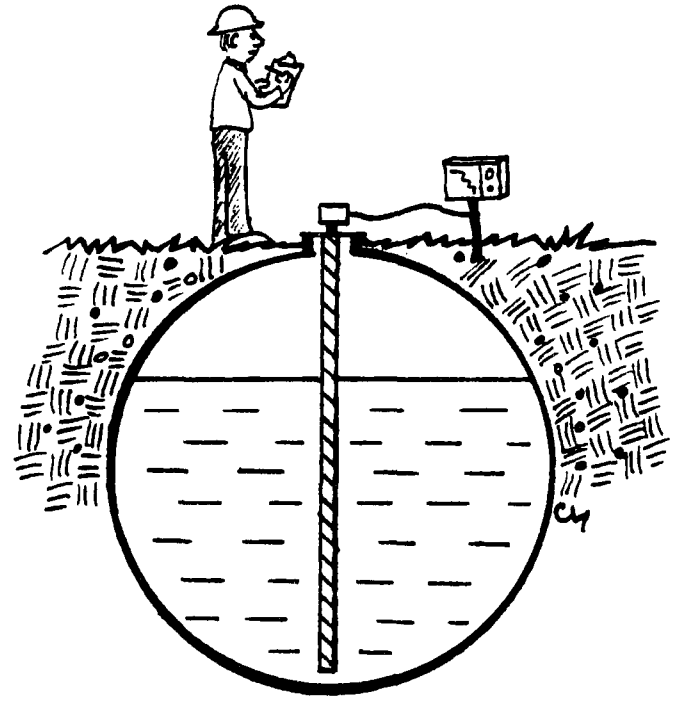
Other methods include surface geophysical methods. Generally experimental and very technical, these methods include: ground penetrating radar, seismic determination, electromagnetic induction, resistivity, metal detectors, magnetometers, and X-ray fluorescence.

Some external tests add freon tracers to underground storage tanks. If a leak is present in the tank or piping, it escapes into the ground where it is easily detected by special instruments called gas chromatographs. A similar method pressurizes the tank with helium. As the helium escapes through a hole or crack, it is detected on the surface by an instrument called a mass spectrometer.

Automatic, or continuous electronic, tests generally use permanently installed leak identification sensors. These sensors regularly check for fuel vapors or liquid that comes in contact with the sensor after fuel has leaked from the tank.

The costs for external tests vary widely. The basic cost of digging a well, for example, will depend on the drilling depth and the diameter of the well. When monitoring wells are installed during construction of new facilities, the installation is easy to do and the cost is low. Permanently installed equipment provides the advantage of ongoing tests for leaks.

In-tank tests



Most of the in-tank tests are done by outside companies. This is because the equipment to run these tests is generally very expensive to purchase and often requires trained technicians to run the test. In-tank tests can be done on a routine basis or only when other factors suggest that there is a leak.

In-tank tests use equipment that is placed directly inside the tank or piping. These tests differ in the information that is obtained. Some tests can determine how fast the tank is leaking; others can only tell whether the tank or piping is leaking. Some may be continuous if installed in a separate tank opening; others can tell only the condition of the tank on the day it is tested. In spite of all the differences among in-tank tests, there are some similarities. Most in-tank tests can identify a leak in a relatively short period of time--generally 2 to 4 hours. Most in-tank tests also require some set-up time, which can be longer than the test period. This time means a major shutdown for some owners or operators.

All these tests are subject to such factors as evaporation, condensation, and changes in temperature in the motor fuel in the tank; changes in the shape of the tank as a result of adding motor fuel for the test; and changes in level caused by air pockets, vibrations from traffic, and groundwater or soil

moisture. In addition to shutdown time, these tests can increase an existing leak, affect the quality of the motor fuel, create an explosion hazard if done improperly, or even fail to identify a leak.

Quantitative in-tank leak tests measure the changes in the volume of fluid in the tank due to a leak. These tests can determine how many gallons of motor fuel are leaking from a tank in an hour. Most of these quantitative leak tests measure either the level of motor fuel in the tank or changes in pressure within the tank. There are a number of ways to test the fuel level or pressure.

Some devices are still in the experimental stage or have not been used on a widespread basis. One such test method is the laser interferometer which measures the change in the height of the motor fuel in the tank with lasers. Other new techniques use acoustics, or sound waves, to identify holes or cracks in the walls of the tank. Other acoustic methods can measure the sound of fuel escaping or entering the tank.

The tank tests discussed above cost anywhere from several hundred to a few thousand dollars per tank. The cost varies depending on such factors as travel time for testing technicians, availability of equipment, whether and how long the facility must be closed to run the test, whether a full tank is required to run the test, and the conditions under which the test must be done.

Test requirements vary. Some need full tanks; others can operate at any fuel level. Some use equipment that is easily movable from tank to tank; others require specially equipped trucks for transportation from site to site. All quantitative leak tests, however, need electricity to run the testing equipment.

A Few Words About the Safety of In-tank Test Methods

The National Fire Prevention Association (NFPA) does not recommend pressure testing with air or explosive gases. This is because of the chance of causing a tank rupture or an

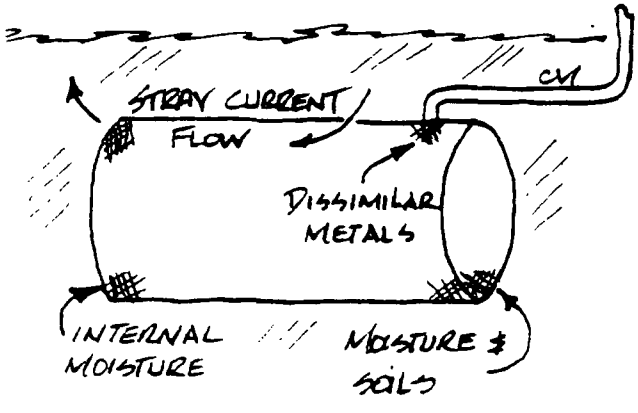
explosion. However, there are some safe in-tank tests that use gases without using pressure to identify a leak. Consult a local fire official if there are any questions concerning the safety of a tank test method.

The major cause of leaks from tanks and piping may be the improper installation and maintenance of the equipment. That is why the proper installation and maintenance of tanks and piping is essential to prevent leaks.

The other major cause of leaks in underground storage tanks may be corrosion of the tank and piping. Therefore, if corrosion can be slowed or stopped, many leaks from steel underground tanks can be prevented. The two most common ways of preventing corrosion are: (1) cathodic protection of steel tanks, and (2) the construction of tanks with corrosion resistant materials. These are discussed in this chapter.

If a tank or piping system leaks, it should be replaced or repaired. Replacement alternatives include using double-walled tanks and other tanks constructed of a number of materials, such as fiberglass-reinforced plastic and fiberglass-coated steel. In some cases, a leaking tank may be repaired instead of being replaced. Tank replacement and repair is also discussed in this chapter.

CORROSION



CORROSION

Corrosion is an electrochemcial change in metal. Corrosion occurs when an electrical current flows from the metal of the underground storage tank or piping into the surrounding soil, carrying with it particles of metal (called ions) so small that they cannot be seen. The visible results of corrosion are rusted areas or holes in the metal. The rate of corrosion

depends on factors such as soil characteristics, the presence of other metals nearby, the presence of other underground electrical systems, characteristics of the tank and piping system, and high soil moisture or high groundwater.

STEEL TANKS

Unprotected Steel and Asphalt-coated Steel Tanks

The most common type of tank used for underground storage has been the unprotected "bare" steel tank. Bare steel tanks have been known to leak in as little as two years, depending on factors such as soil conditions and installation practices.

In order to help protect steel tanks from corrosion, steel tanks may be coated with a thin coating of a material such as asphalt, coal tar epoxy, urethane, or resin. This coating interrupts the small electrical current flowing from the tank to the soil and thereby prevents corrosion. However, pinholes or cracks in these coatings will lead to areas of pinpoint corrosion on the tank. These coatings may also be damaged during shipping or installation or, in some cases, from contact with motor fuel.

Cathodic Protection

Two types of systems are available to provide cathodic protection to steel underground storage tanks. These are impressed current systems and sacrificial anode systems.

In the impressed current system, AC current from the site electrical system is converted to DC current by a rectifier. Current flows from the rectifier to a metal anode, through the soil, to the tank or pipe, and back to the rectifier. Impressed current systems can protect both the tank and piping from corrosion.

The required amount of current can be adjusted to the local conditions and the facilities to be protected. This system can be used on existing as well as new tanks. Maintenance involves a periodic check of the current meter to be sure that the system is operating properly. Impressed current systems must be supplied with power and operating at all times.

A sacrificial anode system is another way to prevent corrosion by inducing an electrical current flow from the anode to the tank (this system does not use an external power supply). A sacrificial anode, usually made of magnesium or zinc, is connected or attached to the tank. The metals in the sacrificial anode have a higher electrical potential than the steel tank. Therefore, an electrical current will flow from these anodes to the tank, causing the anodes rather than the tank to corrode. As the name suggests, the anode sacrifices itself to protect the tank.

This system may be used to protect the tank and the piping from corrosion. The advantage of the sacrificial anode system is that an external power supply is not required. However, the anodes must be monitored and replaced as they corrode. Also, the anodes may not be able to produce an adequate electrical current to prevent tank corrosion under some soil conditions.

Proper installation and maintenance of any cathodic protection system is important to protect the tank and piping from corrosion. A check of the cathodic protection system should be made by a qualified corrosion engineer when the system is installed to make sure that the system is providing adequate protection. Periodic checks should be made to be sure that the tank and piping are continuously protected from corrosion.

Steel Tank Repair

Most steel tank repairs are done by lining the interior of the tank with epoxy-based resins or some other coating that is compatible with fuel products. Before the tank can be repaired, all fuel must be removed, and the tank must be completely emptied

of all vapors. An entry hole must be cut into the tank so that workers can get inside to thoroughly clean the inside tank surface and mend any holes or cracks. These procedures are necessary to make sure that the lining material will adhere to the interior surface of the tank. Before putting the tank back into service, the tank should be tested to be sure that all leaks are repaired.

Lining a tank is often done to extend a tank's life; however, there are cases in which tanks should be replaced rather than repaired. For instance, API does not recommend the lining of a tank that has open seams more than 3 inches long, perforations larger than about 1-1/2 inches in diameter, more than 5 perforations per square foot of surface area, or more than 20 perforations per 500 square feet of surface area. Some localities have certain restrictions on repairing tanks. The local fire official can be consulted to find out what these restrictions are.

Repair of the tank and piping equipment may involve some hazard and may require special training and equipment. In some localities, only specially licensed mechanics can work on motor fuel storage equipment.

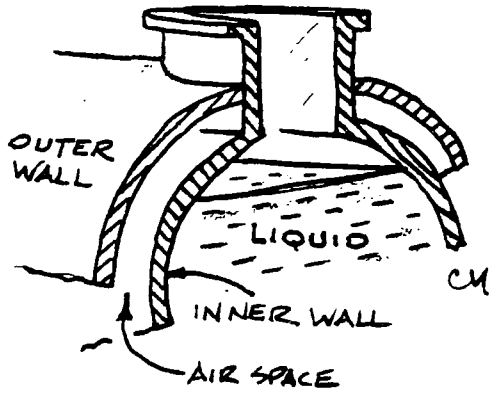
FIBERGLASS TANKS

Fiberglass is resistant to electrochemical changes. Therefore, fiberglass tanks eliminate external corrosion without the need for special corrosion prevention systems. However, careful attention should be paid to fiberglass tank installation to avoid tank rupture from uneven soil loading. In general, underground storage tanks, especially fiberglass tanks, can be forced upward as the water table rises. Tanks have been known to rupture when placed under this kind of pressure.

Recently, concerns have been raised that the fiberglass materials originally used in tanks are not suited for use with alcohol-blended fuels, particularly methanol. However, with the

recent trend in the gasoline industry to boost octane levels with alcohol blends, fiberglass tanks lined with a resin resistant to alcohol blends are now available.

DOUBLE-WALLED TANKS



CUT-AWAY VIEW
DOUBLE WALLED
STORAGE TANK

Double-walled tanks consist of one tank nested inside another tank. In addition, an automatic leak identification system may be placed between the inner and outer tanks to signal the presence of any water or hydrocarbons in the cavity between the tanks. Double-walled tanks are subject to the same problems described for fiberglass and steel tanks; however, the risk of leakage is reduced by the inner tank and by the leak identification system.

There are three basic types of double-walled tanks: double-walled steel tanks, double-walled coated steel tanks, and double-walled fiberglass tanks. Double-walled fiberglass and double-walled steel tanks are the most common types of tanks; the double-walled fiberglass-coated steel tank has only recently been introduced.

PIPING

Underground storage tank piping may present a higher potential for leaking than the tank itself. Piping leaks can be caused by corrosion, misalignment, stresses from temperature change, freezing and thawing, loads from traffic, and settlement

of backfill. The same factors that lead to corrosion in tanks lead to corrosion in the piping. That is why preventing and identifying leaks in the piping is just as important as preventing and identifying leaks in the underground storage tank.

A number of pipes made of corrosion-resistant materials are now available. For example, fiberglass-reinforced plastic pipes are available that are flexible as well as corrosion resistant. Piping may also be cathodically protected. Double-walled pipes are also available, and some of these are equipped with monitoring devices between the inner and outer walls.

COST AND WARRANTY INFORMATION

Figure 9 presents cost information for underground storage tanks by material of construction. To these costs are added transportation and installation costs of $5,000 to $10,000 per tank. On this basis, the total installed cost of fiberglass tanks ranges from 20 to 25 percent higher than that of steel tanks. The fiberglass-coated double-walled steel tank costs approximately $11,000 more than an unprotected steel tank.

In addition to the cost of the tank, the warranty on the tank should be considered when selecting a tank. Every warranty has its own limitations and conditions, so the warranty should be read carefully before the tank is purchased. Some warranties offer a prorated refund, some warranties refund the original purchase price, and others replace the tank.

However, these warranties have some features in common. In general, fiberglass tanks are warranted against defects in materials and workmanship for one year and against rust for 30 years. Structural failure is not generally covered under the terms of the warranty.

Steel tanks manufactured under the specifications of the Steel Tank Institute (sti-P_3®) are warranted against external corrosion for 20 years, against defects in materials and workmanship for one year, and against structural failure for the

Figure 9: Underground storage tank costs.

Tank	Average Cost for new 10,000 gallon tank[1]
Asphalt-coated steel	$3,000
Fiberglass-coated steel	6,000
Fiberglass-coated, double-walled steel	14,000
Epoxy-coated steel, sacrificial anode	4,500
Fiberglass (regular)	4,500
Fiberglass (alcohol blends)	5,000
Tank relining (all steel tanks)	5,000

[1]Most common size; does not include installation.

life of the installation. Fiberglass-coated steel tanks have a warranty period ranging from 20 to 30 years.

FINANCING FOR REPAIR AND REPLACEMENT

Small businesses can apply to a number of lending sources for long-term loans to cover the cost of pollution control equipment. These sources include: nationally administered Federal programs; locally administered Federal, state, and local programs; and private sources. Upon approval, these loans may be used for underground storage tank replacement and repair.

EPA has assembled fact sheets describing the sources of financing for pollution control loans. These fact sheets answer commonly asked questions about each of the financing programs, such as eligibility criteria, loan limits and conditions, and application procedures. Copies of the fact sheets can be obtained by calling EPA's toll-free Small Business Hotline at 800-368-5888 and asking for "Assistance Programs for Pollution Control Financing."

FEDERAL REGULATIONS

Two sets of Federal regulations deal with storage of petroleum in underground tanks. EPA has included underground motor fuel storage tanks in regulations issued for oil pollution prevention under the Clean Water Act. The Occupational Safety and Health Administration (OSHA) has included underground motor fuel storage tanks in its regulations dealing with flammable and combustible liquids.

Under EPA's Oil Pollution Prevention regulation (40 CFR Part 112), owners or operators of facilities that have an underground storage tank containing 42,000 gallons or more of oil (including motor fuel), and that, due to their locations, could release oil on navigable waters in quantities that could cause a sheen, must prepare and carry out a Spill Control and Countermeasures Plan (SPCC). Owners or operators of these facilities must also install corrosion protection systems for underground storage tanks and test the underground tanks for leaks at least every 5 years. Any releases of oil from leaking underground storage tanks reaching navigable waters and causing a sheen on those waters must be reported to the National Response Center at (800) 424-8802 toll-free, the nearest U.S. EPA Regional Office, or the nearest U.S. Coast Guard district office as required by the oil discharge regulation (40 CFR 110).

Under OSHA regulations (29 CFR 1910.106), standards have been issued for the control of flammable and combustible liquids in underground storage tanks. Among these regulations are standards for the installation of underground tanks. OSHA regulations require that underground tanks be set on firm foundations and surrounded with at least 6 inches of noncorrosive, inert material such as clean sand, earth, or gravel that has been tamped in place. In addition, tanks must be covered with at least 2 feet of earth or must be covered with at least 1 foot of earth and

covered with a slab of reinforced concrete at least 4 inches thick. The regulations state that at a minimum underground storage tanks must: use protective coatings or wrappings; use cathodic protection; or be constructed of corrosion-resistant materials.

OSHA testing requirements for underground petroleum (including motor fuels) storage tanks state that all tanks must be tested for strength before they are placed in service. The American Society of Mechanical Engineers (ASME) code stamp, the American Petroleum Institute (API) monogram, or the listing mark of the Underwriters' Laboratories, Inc. (UL) on a tank show that the tank meets the strength test requirement. OSHA regulations also require that before being used, underground tanks must be tested for tightness. In addition, OSHA regulations require that accurate inventory records be maintained and reviewed for possible signs of leakage from tanks or piping.

STATE AND LOCAL REGULATIONS

A number of states and localities have passed legislation or issued regulations for the storage of motor fuels in underground tanks. Approximately 30 states have legislation and regulations for the control of storage of hazardous materials including motor fuels in underground tanks. Although state standards vary widely, they are generally at least as strict as those practices recommended by the National Fire Protection Association (NFPA).

The NFPA recommends practices for handling underground leakage of flammable and combustible liquids in Standard 329. While the practices recommended for handling flammable and combustible liquids (Class I liquids) are not law in their own right, many states and localities have adopted these recommendations as a framework in the development of their regulations.

The following paragraphs describe in a general way the NFPA and/or current state standards for the underground storage of motor fuel.

Permit Requirements. There are no NFPA recommended mandatory permits for owners of new motor fuel storage tanks. However, the Uniform Fire Code (UFC), used in eight states, does require permits to store, remove, abandon, or temporarily place out-of-service tanks storing flammable liquids.

Typical state standards for permits include the submission of the following information by owners of tanks: a description of construction plans; a list of substances to be stored; a description of the monitoring program; and names and addresses of owners and operators. Some state regulations, such as those in Kansas, include requirements for: the submission of information on the location of leak detector connections to monitor any loss of product from the piping or dispenser; the type of impervious material to be used on the bottom of the excavation; and a description of the natural soil or bedrock conditions in the immediate vicinity.

Equipment Requirements. The NFPA recommends that tanks be of sound engineering design and built in accordance with recognized standards of design, such as Underwriters' Laboratories, the American Petroleum Institute, and the American Society for Testing and Materials. If corrosion is anticipated beyond that provided for in design formulas, additional metal thickness or suitable protective coatings must be provided. Requirements for corrosion protection are provided in the NFPA standards for flammable and combustible liquids (NFPA Code 30).

Tank Installation Requirements. The NFPA recommends that: steel underground tanks be set on firm foundations and surrounded with at least six inches of noncorrosive inert material; steel underground storage tanks be covered with a minimum of two feet of earth, or be covered with at least one foot of earth and covered with a slab of reinforced concrete that is at least four inches thick; and nonmetallic underground storage tanks have the same burial depth requirements and should be installed in

accordance with the manufacturer's instructions. Several state regulations require that tanks be anchored where the tanks are in areas of high groundwater or where a portion of the tank would be submerged at maximum flood stage.

Secondary Containment Requirements. There are no NFPA recommendations for secondary containment. Few states have requirements for secondary containment. In those states that do have secondary containment requirements, liners, double-walled tanks, vaults, or other devices are generally used to prevent leaked material from contaminating groundwater.

Replacement Requirements. There are no NFPA recommendations for the replacement of existing tanks, but the Uniform Fire Code does call for the immediate removal of leaking tanks from service. Reinstallation is permitted after repair. Few states have promulgated final regulations with tank replacement requirements. However, Florida has issued regulations for a phased approach to bring all existing underground storage tanks into compliance with new tank requirements.

Inventory Review Requirements. NFPA recommendations for inventory review include a provision that accurate inventory records must be maintained on all flammable and combustible (Class I) liquid storage tanks for indication of possible leakage from underground storage tanks or associated piping. Typical state regulations, such as the Ohio regulation, require daily dipstick readings and record reconciliation, and weekly dipstick tests for water content in the tank.

Testing Requirements. NFPA recommends that all underground storage tanks, whether shop-built or field-erected, must be tested before being placed in service in accordance with the applicable sections of the code under which they were built. The ASME code stamp, API monogram, or the listing mark of Underwriters Laboratories, Inc. on a tank is evidence of compliance with the test.

Typical state standards require testing only for tanks with indicated product losses. Maryland requires tightness tests for all systems: where a product loss is indicated or suspected; the

tanks are more than 10 years old or tanks are of unknown age; prior to a change of ownership; and upon completion of installation and prior to operation.

Monitoring Requirements. The NFPA recommends that, instead of maintaining an inventory record, a leak identification program be provided on all flammable and combustible (Class I) liquid storage tanks for monitoring leakage from tanks or associated piping. Several states require monitoring in addition to that recommended by the NFPA. For example, the Kansas regulations require that leak detectors be installed on all new storage systems where underground pressure piping exists between the pump and a dispenser. Tanks located on farms with less than 50 feet of delivery pipe are exempt from this requirement. Piping monitoring systems must be located to provide access for inspection.

Recordkeeping Requirements. The NFPA recommends that accurate inventory records or a leak detection program must be maintained on all flammable and combustible (Class I) liquid storage tanks for indications of possible leakage from the tanks or associated piping. Most state regulations require that records of daily inventory measurements be maintained at the facility for a period of at least one year and be made available upon request to representatives of the state and local agencies upon request.

The number of states and localities that are taking action to regulate underground storage tanks is growing rapidly. It is very important that owners and operators be aware of all state and local regulations that apply to their tanks and piping. For information on these regulations, owners and operators should contact the state or local office of environmental protection or office of natural resources. The local fire marshal can also provide details concerning local fire ordinances that deal with underground motor fuel storage tanks.

INSURANCE

As described in the Chemical Advisory and in the introduction to this booklet, leaks of motor fuel from underground storage tanks can cause damage to nearby property and contaminate drinking water supplies. The tank owner or operator may be held responsible for these situations, which can be extremely expensive to correct and clean up. Therefore, tank owners and operators should consider obtaining insurance that covers such potentially large liabilities. Rhode Island has enacted legislation that requires owners or operators of petroleum storage tanks to purchase liability insurance to protect against risks from underground, as well as above-ground, tank leaks. Other states are considering such requirements.

Many firms with underground storage tanks, including commercial gasoline stations, have comprehensive general liability (CGL) policies. These policies cover pollution claims resulting from "sudden and accidental" occurrences, but typically contain a "pollution exclusion" clause which excludes "non-sudden" pollution losses from coverage. Gradual leaks from underground motor fuel storage tanks and piping may not be covered under the firm's insurance policies.

A number of insurance companies offer an addition to a firm's existing CGL policy to cover gradual pollution, including tank leaks. The Pollution Liability Insurance Association (PLIA) consists of 49 insurance companies which offer policies that will cover gradual pollution. Information about PLIA may be obtained by calling them at (312) 467-4034.

Another type of pollution insurance is a separate environmental impairment liability policy. Currently, there are less than 10 companies that will write an environmental impairment liability policy. These policies generally are written to cover only gradual pollution incidents.

Finally, several specific underground storage tank leak insurance policies have been offered to petroleum marketers

through state petroleum marketing trade associations. Specific coverage of these pollution policies vary and should be discussed with the broker.

Premiums, deductibles, and limits of liability vary greatly, and may depend on an assessment of the probability that the applicant's tanks will leak, including an examination of factors such as the age, construction, and location of the tank. Also, an applicant may be required to demonstrate that the firm's tanks are not leaking.

HELPFUL REFERENCES

PUBLICATIONS

Groundwater: Information Pamphlet, Department of Public Affairs, American Chemical Society, 1983. For copies, phone (202) 872-8725 or write the Office of Federal Regulatory Programs, ACS Department of Public Affairs, 1155 16th Street NW, Washington, DC 20036.

Ground-Water Protection Strategy, US-EPA, Office of Ground-Water Protection, August 1984.

Technology for the Storage of Hazardous Liquids: A State-of-the-Art Review, New York State Department of Environmental Conservation, January 1983. This manual is available by calling (518) 457-4351 or writing the Bureau of Water Resources, New York State Department of Environmental Conservation, 50 Wolf Road, Albany, New York 12233.

The following publications have been prepared by the American Petroleum Institute (API). They are available by calling API at (202) 682-8375 or by writing API at 1220 L Street NW, Washington, DC 20005.

Cathodic Protection of Underground Petroleum Storage Tanks and Piping Systems, Publication 1632, 1983.

Installation of Underground Petroleum Storage Systems, Publication 1615, 1979.

Manual of Petroleum Measurement Standards. Chapter 6--Metering Assemblies, Section 3--Service Station Dispensing Metering Systems, 1983.

Recommended Practice for Abandonment or Removal of Used Underground Service Station Tanks, API Bulletin 1604, 1981.

Recommended Practice for Bulk Liquid Stock Control at Retail Outlets, Publication 1621, 1977.

Recommended Practice for the Interior Lining of Existing Steel Underground Storage Tanks, Publication 1631, 1983.

Recommended Practice for Underground Petroleum Product Storage Systems at Marketing and Distribution Facilities, API Recommended Practice 1635, 1984.

Standard Method for Measurement and Calibration of Horizontal Tanks, API Standard 2551, 1965.

Underground Spill Cleanup Manual, Publication 1628, 1980.

TELEPHONE CONTACTS

For questions not answered by this booklet, call EPA toll-free at (800) 424-9346, or in the Washington, D.C. at 382-3000.

For EPA fact sheets describing the sources of financing pollution control loans, call EPA's toll-free Small Business Hotline at (800) 368-5888.

To report releases of oil reaching navigable water and causing a sheen, call the National Response Center at (800) 424-8802.

For information about insurance, contact the Pollution Liability Insurance Association (PLIA) at (312) 467-4034.

APPENDIX A: INVENTORY REVIEW FOR TANKS WITH METERED DISPENSING PUMPS

INVENTORY REVIEW SHEET FOR TANKS WITH METERED DISPENSING PUMPS

TANK NO._____

DISPENSING METER NO(S). _____
OR, TANK SYSTEM NO(S). _____
IF MANIFOLDED TANKS, _____

PROVING CAN _____
METER CHECK

PART A

	Dipstick Inventory								
Column 1	Column 2	Column 3	Column 4	Column 5	Column 6	Column 7	Column 8	Column 9	Column 10
Date	Opening Dipstick Inventory (gallons)	Deliveries (in gallons)	Total [Column 2] plus [Column 3]	Closing Dipstick Inventory (inches)	Closing Dipstick Inventory (gallons)	Gone from Tank [Column 4] minus [Column 6]	Meter Sales* (gallons) (from meter sheet)	Column 8 less than (-) or greater than (+) Column 7	Columns 7 & 8: Subtract Smaller from Larger

* Transferred from Line 1 of Dispenser Meter Recording Sheet.

PART B

1. NUMBER OF MINUSES (-) IN COLUMN 9, PART A . . . . . _____

2. CUMULATIVE NUMBER OF MINUSES RECORDED FOR PREVIOUS 30-DAY PERIOD(S). COPY FROM LINE 3, PART B OF PRECEDING 30-DAY SHEET, OR ENTER ZERO (0) IF CURRENTLY THE FIRST PERIOD . . . _____

3. ADD LINES 1 AND 2 . . . . . _____

4. ACTION NUMBER FROM TABLE FOR TANKS WITH METERED DISPENSING PUMPS . . . . . _____

5. IS LINE 3 GREATER THAN LINE 4? . . . . . ☐ YES ☐ NO

IF "YES", CONCLUDE THAT DAILY INVENTORIES ARE SHORT. IF "NO", CONTINUE WITH INVENTORY TO COMPLETE 1-YEAR EVALUATION.

Instructions for Completing the Inventory

Review Sheet

Part A: **To be completed each day; preferably at about the same time, i.e., before closing or opening every day. Dipstick and meter readings must be taken together while pump(s) is (are) closed.**

Write in the columns, as numbered:

1. The date.

2. The opening dipstick inventory in gallons. This number is the previous day's closing dipstick inventory in Column 6.

3. The day's deliveries (in gallons).

4. The sum of Column 2 plus Column 3 -- the total of fuel in tank.

5. The closing dipstick reading in inches.

6. The closing dipstick reading converted to gallons from tank chart.

7. Gone from tank -- gallons of fuel leaving the tank since last dipstick inventory.

8. The day's sales (in gallons).

9,10. If Column 8 is less than Column 7, enter a minus (-) in Column 9 to show that the closing dipstick inventory is "short" (shows an underage) compared to deliveries and sales. Also, subtract Column 8 from Column 7 and enter the difference in Column 10.

9,10. If Column 8 is larger than Column 7, enter a plus (+) in Column 9 to show that the closing dipstick inventory is "over" (shows an overage). Also, subtract Column 7 from Column 8, and enter the difference in Column 10.

9,10. If Column 8 is equal to Column 7, enter a zero (0) in Column 9 to show that the closing dipstick inventory is neither over or short. Place a zero (0) in Column 10.

Part B: To be completed at the end of each 30-business-day period.

Step 1. Count the total number of minuses (-) in Column 9 of Part A and enter on line 1.

2. On Line 2, write the cumulative number of short daily inventories that occurred during the previous 30-day period(s) (this is the number in line 3, Part B of the previous 30-day inventory sheet).

3. Add lines 1 and 2 and enter the total on line 3.

4. Enter on line 4 the critical value shown in Table 1 for the current 30-day period.

5. Compare lines 3 and 4. If line 3 is greater than line 4, a continuing daily loss is presumed to exist.

MANIFOLDED TANK SYSTEM RECORDING SHEET

Manifolded Tank System I.D. Number _____.

Type of Fuel _____.

Day	Date	Physical Inventory Measurements	Tank # 1	Tank # 2	Tank # 3	Tank # 4	Tank # 5	Tank # 6	Tank # 7	Tank # 8	Line F* Totals
1		A. Opening stick (gals.) (Yesterday's line E)									
		B. Deliveries (gals.)									
		C. Total of fuel in tank (A+B)									
		D. Closing stick (inches)									
		E. Closing stick (gals.)									
		F. Fuel gone from tank (gals.) (C-E)									
2		A. Opening stick (gals.) (Yesterday's line E)									
		B. Deliveries (gals.)									
		C. Total of fuel in tank (A+B)									
		D. Closing stick (inches)									
		E. Closing stick (gals.)									
		F. Fuel gone from tank (gals.) (C-E)									
3		A. Opening stick (gals.) (Yesterday's line E)									
		B. Deliveries (gals.)									
		C. Total of fuel in tank (A+B)									
		D. Closing stick (inches)									
		E. Closing stick (gals.)									
		F. Fuel gone from tank (gals.) (C-E)									
4		A. Opening stick (gals.) (Yesterday's line E)									
		B. Deliveries (gals.)									
		C. Total of fuel in tank (A+B)									
		D. Closing stick (inches)									
		E. Closing stick (gals.)									
		F. Fuel gone from tank (gals.) (C-E)									

*Transfer Line F totals to the correct Inventory Review Sheet for this Tank System.

MANIFOLDED TANK SYSTEM RECORDING SHEET (Sheet 2 of 8)

Manifolded Tank System I.D. Number_____. Type of Fuel_____.

Day	Date	Physical Inventory Measurements	Tank # 1	Tank # 2	Tank # 3	Tank # 4	Tank # 5	Tank # 6	Tank # 7	Tank # 8	Line F* Totals
5		A. Opening stick (gals.) (Yesterday's line E)									
		B. Deliveries (gals.)									
		C. Total of fuel in tank (A+B)									
		D. Closing stick (inches)									
		E. Closing stick (gals.)									
		F. Fuel gone from tank (gals.) (C-E)									
6		A. Opening stick (gals.) (Yesterday's line E)									
		B. Deliveries (gals.)									
		C. Total of fuel in tank (A+B)									
		D. Closing stick (inches)									
		E. Closing stick (gals.)									
		F. Fuel gone from tank (gals.) (C-E)									
7		A. Opening stick (gals.) (Yesterday's line E)									
		B. Deliveries (gals.)									
		C. Total of fuel in tank (A+B)									
		D. Closing stick (inches)									
		E. Closing stick (gals.)									
		F. Fuel gone from tank (gals.) (C-E)									
8		A. Opening stick (gals.) (Yesterday's line E)									
		B. Deliveries (gals.)									
		C. Total of fuel in tank (A+B)									
		D. Closing stick (inches)									
		E. Closing stick (gals.)									
		F. Fuel gone from tank (gals.) (C-E)									

*Transfer Line F totals to the correct Inventory Review Sheet for this Tank System.

MANIFOLDED TANK SYSTEM RECORDING SHEET

Manifolded Tank System I.D. Number_____. Type of Fuel_____.

Day	Date	Physical Inventory Measurements	Tank # 1	Tank # 2	Tank # 3	Tank # 4	Tank # 5	Tank # 6	Tank # 7	Tank # 8	Line F* Totals
9		A. Opening stick (gals.) (Yesterday's line E)									
		B. Deliveries (gals.)									
		C. Total of fuel in tank (A+B)									
		D. Closing stick (inches)									
		E. Closing stick (gals.)									
		F. Fuel gone from tank (gals.) (C-E)									
10		A. Opening stick (gals.) (Yesterday's line E)									
		B. Deliveries (gals.)									
		C. Total of fuel in tank (A+B)									
		D. Closing stick (inches)									
		E. Closing stick (gals.)									
		F. Fuel gone from tank (gals.) (C-E)									
11		A. Opening stick (gals.) (Yesterday's line E)									
		B. Deliveries (gals.)									
		C. Total of fuel in tank (A+B)									
		D. Closing stick (inches)									
		E. Closing stick (gals.)									
		F. Fuel gone from tank (gals.) (C-E)									
12		A. Opening stick (gals.) (Yesterday's line E)									
		B. Deliveries (gals.)									
		C. Total of fuel in tank (A+B)									
		D. Closing stick (inches)									
		E. Closing stick (gals.)									
		F. Fuel gone from tank (gals.) (C-E)									

*Transfer Line F totals to the correct Inventory Review Sheet for this Tank System.

MANIFOLDED TANK SYSTEM FUEL MEASUREMENTS

Manifolded Tank System I.D. Number _____. Type of Fuel _____.

Day	Date	Physical Inventory Measurements	Tank # 1	Tank # 2	Tank # 3	Tank # 4	Tank # 5	Tank # 6	Tank # 7	Tank # 8	Line F* Totals
13		A. Opening stick (gals.) (Yesterday's line E)									
		B. Deliveries (gals.)									
		C. Total of fuel in tank (A+B)									
		D. Closing stick (inches)									
		E. Closing stick (gals.)									
		F. Fuel gone from tank (gals.) (C-E)									
14		A. Opening stick (gals.) (Yesterday's line E)									
		B. Deliveries (gals.)									
		C. Total of fuel in tank (A+B)									
		D. Closing stick (inches)									
		E. Closing stick (gals.)									
		F. Fuel gone from tank (gals.) (C-E)									
15		A. Opening stick (gals.) (Yesterday's line E)									
		B. Deliveries (gals.)									
		C. Total of fuel in tank (A+B)									
		D. Closing stick (inches)									
		E. Closing stick (gals.)									
		F. Fuel gone from tank (gals.) (C-E)									
16		A. Opening stick (gals.) (Yesterday's line E)									
		B. Deliveries (gals.)									
		C. Total of fuel in tank (A+B)									
		D. Closing stick (inches)									
		E. Closing stick (gals.)									
		F. Fuel gone from tank (gals.) (C-E)									

*Transfer Line F totals to the correct Inventory Review Sheet for this Tank System.

MANIFOLDED TANK SYSTEM RECORDING SHEET

Manifolded Tank System I.D. Number_____.

Type of Fuel_____.

Day	Date	Physical Inventory Measurements	Tank # 1	Tank # 2	Tank # 3	Tank # 4	Tank # 5	Tank # 6	Tank # 7	Tank # 8	Line F* Totals
17		A. Opening stick (gals.) (Yesterday's line E)									
		B. Deliveries (gals.)									
		C. Total of fuel in tank (A+B)									
		D. Closing stick (inches)									
		E. Closing stick (gals.)									
		F. Fuel gone from tank (gals.) (C-E)									
18		A. Opening stick (gals.) (Yesterday's line E)									
		B. Deliveries (gals.)									
		C. Total of fuel in tank (A+B)									
		D. Closing stick (inches)									
		E. Closing stick (gals.)									
		F. Fuel gone from tank (gals.) (C-E)									
19		A. Opening stick (gals.) (Yesterday's line E)									
		B. Deliveries (gals.)									
		C. Total of fuel in tank (A+B)									
		D. Closing stick (inches)									
		E. Closing stick (gals.)									
		F. Fuel gone from tank (gals.) (C-E)									
20		A. Opening stick (gals.) (Yesterday's line E)									
		B. Deliveries (gals.)									
		C. Total of fuel in tank (A+B)									
		D. Closing stick (inches)									
		E. Closing stick (gals.)									
		F. Fuel gone from tank (gals.) (C-E)									

*Transfer Line F totals to the correct Inventory Review Sheet for this Tank System.

MANIFOLDED TANK SYSTEM RECORDING SHEET (Sheet 6 of 8)

Manifolded Tank System I.D. Number _____. Type of Fuel _____.

Day	Date	Physical Inventory Measurements	Tank # 1	Tank # 2	Tank # 3	Tank # 4	Tank # 5	Tank # 6	Tank # 7	Tank # 8	Line F* Totals
21		A. Opening stick (gals.) (Yesterday's line E)									
		B. Deliveries (gals.)									
		C. Total of fuel in tank (A+B)									
		D. Closing stick (inches)									
		E. Closing stick (gals.)									
		F. Fuel gone from tank (gals.) (C-E)									
22		A. Opening stick (gals.) (Yesterday's line E)									
		B. Deliveries (gals.)									
		C. Total of fuel in tank (A+B)									
		D. Closing stick (inches)									
		E. Closing stick (gals.)									
		F. Fuel gone from tank (gals.) (C-E)									
23		A. Opening stick (gals.) (Yesterday's line E)									
		B. Deliveries (gals.)									
		C. Total of fuel in tank (A+B)									
		D. Closing stick (inches)									
		E. Closing stick (gals.)									
		F. Fuel gone from tank (gals.) (C-E)									
24		A. Opening stick (gals.) (Yesterday's line E)									
		B. Deliveries (gals.)									
		C. Total of fuel in tank (A+B)									
		D. Closing stick (inches)									
		E. Closing stick (gals.)									
		F. Fuel gone from tank (gals.) (C-E)									

*Transfer Line F totals to the correct Inventory Review Sheet for this Tank System.

MANIFOLDED TANK SYSTEM RECORDING SHEET

Manifolded Tank System I.D. Number_____.

Type of Fuel_____.

Day	Date	Physical Inventory Measurements	Tank # 1	Tank # 2	Tank # 3	Tank # 4	Tank # 5	Tank # 6	Tank # 7	Tank # 8	Line F* Totals
25		A. Opening stick (gals.) (Yesterday's line E)									
		B. Deliveries (gals.)									
		C. Total of fuel in tank (A+B)									
		D. Closing stick (inches)									
		E. Closing stick (gals.)									
		F. Fuel gone from tank (gals.) (C-E)									
26		A. Opening stick (gals.) (Yesterday's line E)									
		B. Deliveries (gals.)									
		C. Total of fuel in tank (A+B)									
		D. Closing stick (inches)									
		E. Closing stick (gals.)									
		F. Fuel gone from tank (gals.) (C-E)									
27		A. Opening stick (gals.) (Yesterday's line E)									
		B. Deliveries (gals.)									
		C. Total of fuel in tank (A+B)									
		D. Closing stick (inches)									
		E. Closing stick (gals.)									
		F. Fuel gone from tank (gals.) (C-E)									
28		A. Opening stick (gals.) (Yesterday's line E)									
		B. Deliveries (gals.)									
		C. Total of fuel in tank (A+B)									
		D. Closing stick (inches)									
		E. Closing stick (gals.)									
		F. Fuel gone from tank (gals.) (C-E)									

*Transfer Line F totals to the correct Inventory Review Sheet for this Tank System.

MANIFOLDED TANK SYSTEM RECORDING SHEET (Sheet 8 of 8)

Manifolded Tank System I.D. Number_____. Type of Fuel_____.

Day	Date	Physical Inventory Measurements	Tank # 1	Tank # 2	Tank # 3	Tank # 4	Tank # 5	Tank # 6	Tank # 7	Tank # 8	Line F* Totals
29		A. Opening stick (gals.) (Yesterday's line E)									
		B. Deliveries (gals.)									
		C. Total of fuel in tank (A+B)									
		D. Closing stick (inches)									
		E. Closing stick (gals.)									
		F. Fuel gone from tank (gals.) (C-E)									
30		A. Opening stick (gals.) (Yesterday's line E)									
		B. Deliveries (gals.)									
		C. Total of fuel in tank (A+B)									
		D. Closing stick (inches)									
		E. Closing stick (gals.)									
		F. Fuel gone from tank (gals.) (C-E)									

*Transfer Line F totals to the correct Inventory Review Sheet for this Tank System.

DISPENSING METER RECORDING SHEET

[FOR TANKS WITH METERED DISPENSING PUMPS]

Tank No. _____;

or, if manifolded tanks, tank system no. _____ Type of fuel _____

Day	Date	Meter Recordings in Gallons	Meter #1	Meter #2	Meter #3	Meter #4	Meter #5	Meter #6	Meter #7	Meter #8	Line I* Totals
		G. Today's Closing Meter									
1		H. Yesterday's Closing Meter									
		I. Gallons dispensed (G-H)									
		G. Today's Closing Meter									
2		H. Yesterday's Closing Meter									
		I. Gallons dispensed (G-H)									
		G. Today's Closing Meter									
3		H. Yesterday's Closing Meter									
		I. Gallons dispensed (G-H)									
		G. Today's Closing Meter									
4		H. Yesterday's Closing Meter									
		I. Gallons dispensed (G-H)									
		G. Today's Closing Meter									
5		H. Yesterday's Closing Meter									
		I. Gallons dispensed (G-H)									
		G. Today's Closing Meter									
6		H. Yesterday's Closing Meter									
		I. Gallons dispensed (G-H)									

* Transfer Line I totals to Column 8 of Inventory Review Sheet

DISPENSING METER RECORDING SHEET

[FOR TANKS WITH METERED DISPENSING PUMPS]

Tank No. _____;

or, if manifolded tanks, tank system no. _____ Type of fuel _____

Day	Date	Meter Recordings in Gallons	Meter #1	Meter #2	Meter #3	Meter #4	Meter #5	Meter #6	Meter #7	Meter #8	Line I* Totals
		G. Today's Closing Meter									
7		H. Yesterday's Closing Meter									
		I. Gallons dispensed (G-H)									
		G. Today's Closing Meter									
8		H. Yesterday's Closing Meter									
		I. Gallons dispensed (G-H)									
		G. Today's Closing Meter									
9		H. Yesterday's Closing Meter									
		I. Gallons dispensed (G-H)									
		G. Today's Closing Meter									
10		H. Yesterday's Closing Meter									
		I. Gallons dispensed (G-H)									
		G. Today's Closing Meter									
11		H. Yesterday's Closing Meter									
		I. Gallons dispensed (G-H)									
		G. Today's Closing Meter									
12		H. Yesterday's Closing Meter									
		I. Gallons dispensed (G-H)									

* Transfer Line I totals to Column 8 of Inventory Review Sheet

DISPENSING METER RECORDING SHEET

[FOR TANKS WITH METERED DISPENSING PUMPS]

Tank No. _____;

or, if manifolded tanks, tank system no. _____ Type of fuel _____

Day	Date	Meter Recordings in Gallons	Meter #1	Meter #2	Meter #3	Meter #4	Meter #5	Meter #6	Meter #7	Meter #8	Line I* Totals
		G. Today's Closing Meter									
13		H. Yesterday's Closing Meter									
		I. Gallons dispensed (G-H)									
		G. Today's Closing Meter									
14		H. Yesterday's Closing Meter									
		I. Gallons dispensed (G-H)									
		G. Today's Closing Meter									
15		H. Yesterday's Closing Meter									
		I. Gallons dispensed (G-H)									
		G. Today's Closing Meter									
16		H. Yesterday's Closing Meter									
		I. Gallons dispensed (G-H)									
		G. Today's Closing Meter									
17		H. Yesterday's Closing Meter									
		I. Gallons dispensed (G-H)									
		G. Today's Closing Meter									
18		H. Yesterday's Closing Meter									
		I. Gallons dispensed (G-H)									

* Transfer Line I totals to Column 8 of Inventory Review Sheet

DISPENSING METER RECORDING SHEET

[FOR TANKS WITH METERED DISPENSING PUMPS]

Tank No. _____;

or, if manifolded tanks, tank system no. _____ Type of fuel _____

Day	Date	Meter Recordings in Gallons	Meter #1	Meter #2	Meter #3	Meter #4	Meter #5	Meter #6	Meter #7	Meter #8	Line I* Totals
		G. Today's Closing Meter									
19		H. Yesterday's Closing Meter									
		I. Gallons dispensed (G-H)									
		G. Today's Closing Meter									
20		H. Yesterday's Closing Meter									
		I. Gallons dispensed (G-H)									
		G. Today's Closing Meter									
21		H. Yesterday's Closing Meter									
		I. Gallons dispensed (G-H)									
		G. Today's Closing Meter									
22		H. Yesterday's Closing Meter									
		I. Gallons dispensed (G-H)									
		G. Today's Closing Meter									
23		H. Yesterday's Closing Meter									
		I. Gallons dispensed (G-H)									
		G. Today's Closing Meter									
24		H. Yesterday's Closing Meter									
		I. Gallons dispensed (G-H)									

* Transfer Line I totals to Column 8 of Inventory Review Sheet

DISPENSING METER RECORDING SHEET

[FOR TANKS WITH METERED DISPENSING PUMPS]

Tank No. _____;

or, if manifolded tanks, tank system no. _____ Type of fuel _____

Day	Date	Meter Recordings in Gallons	Meter #1	Meter #2	Meter #3	Meter #4	Meter #5	Meter #6	Meter #7	Meter #8	Line I* Totals
		G. Today's Closing Meter									
25		H. Yesterday's Closing Meter									
		I. Gallons dispensed (G-H)									
		G. Today's Closing Meter									
26		H. Yesterday's Closing Meter									
		I. Gallons dispensed (G-H)									
		G. Today's Closing Meter									
27		H. Yesterday's Closing Meter									
		I. Gallons dispensed (G-H)									
		G. Today's Closing Meter									
28		H. Yesterday's Closing Meter									
		I. Gallons dispensed (G-H)									
		G. Today's Closing Meter									
29		H. Yesterday's Closing Meter									
		I. Gallons dispensed (G-H)									
		G. Today's Closing Meter									
30		H. Yesterday's Closing Meter									
		I. Gallons dispensed (G-H)									

* Transfer Line I totals to Column 8 of Inventory Review Sheet

APPENDIX B: INVENTORY REVIEW FOR TANKS WITHOUT METERED DISPENSING PUMPS

INVENTORY REVIEW CHART FOR TANKS WITHOUT METERED DISPENSING PUMPS

WITHDRAWAL OR FILL		DIPSTICK READING (INCHES)		DIPSTICK READING (GALLONS)		LOSS BETWEEN WITHDRAWALS[1]	TOTAL LOSS	ACTION NUMBER[2]	IS THERE A LEAK?[3]	
Number	Date	Before	After	Before	After				Yes	No
Start		XX		XX		XX	XX	XX	XX	XX
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										
11										
12										

[1]Gallons after last withdrawal or fill minus gallons before this withdrawal or fill.

[2]From Action Number Table for Tanks without metered pumps.

[3]There is a leak if the total loss for the given number of withdrawals and fills is greater than the action number.