



Minnesota
Pollution
Control
Agency

Inventory Control for Underground Storage Tanks

Tanks/Underground #3-20 • September 2008

Minnesota law requires Underground Storage Tank (UST) systems to have leak detection.

Inspections conducted nationwide indicate that many facilities are not performing leak detection in a way that is likely to find leaks or complies with state and federal requirements.

If inventory control is part of your leak detection program, then this fact sheet will provide guidance to perform leak detection properly.

When is inventory control allowed?

Since it is less accurate than other methods of leak detection, inventory control may only be used on a temporary basis and only in combination with tank tightness testing. For a tank installed prior to March 24, 2008, inventory control may be used as the primary leak detection method for up to ten years. A one-time tank tightness test must be performed within five years of installation. After ten years, a permanent leak detection method must be selected, either statistical inventory reconciliation (SIR) or an automatic tank gauge (ATG). For a tank installed after March 24, 2008, inventory control may not be used as the primary leak detection method.

Note: The use of inventory control, even if combined with other methods, does not meet your tank system's leak detection requirements for the piping. Pressurized piping systems and suction piping systems without a safe suction design, must use a separate method of leak detection.

How does inventory control work?

Inventory control involves daily manual measurements of tank contents, recording fuel deliveries, metering of fuel pumped, and monthly math calculations that compare the stick inventory (what you have measured) to the book inventory (what your meters and delivery receipts indicate that you should have). If the difference between the two is too large, your tank may be leaking.

For inventory control to be successful, three important elements must be present:

- good sticking
- good math
- good record keeping

Do you have the right equipment?

Gauge stick

The gauge stick used to measure the depth of liquid in an underground storage tank must be marked to the 1/8 of an inch (with zero at the bottom end). Check your stick to be sure that the end is not worn, broken, or shortened, and that the stick is not warped. The stick should be made of non-sparking material such as wood or fiberglass. Wooden sticks should be varnished to keep the fuel from soaking into the stick and causing false readings. Instead of using a gauge stick, you may use an ATG for daily inventory readings and to verify delivery amounts. Whatever measuring device is used, it must be capable of measuring the entire volume of the tank to the nearest 1/8 of an inch.

of product. It is important to make sure that the correct gauge chart from the manufacturer is used when converting tank volumes.

Pastes for finding water or fuel

Many operators improve their stick readings by smearing a fuel-finding paste on the stick. Fuel-finding paste changes color when it comes in contact with fuel.

Sudden changes in tank water level may indicate that water is entering the tank through a hole. You must check for water in the bottom of the tank at least once each month by smearing a water-finding paste along the bottom six inches or so of the gauge stick. The paste changes color when it comes in contact with water. Most ATGs can also measure water level.

Tank chart for converting inches to gallons

You must have an inches-to-gallons conversion chart for each tank. A tank chart is specific to a given tank model and capacity. If you do not have a conversion chart for your tank, contact the company that manufactured the tank or the contractor who installed it. An ATG may be able to perform this conversion.

Drop tube

Each tank must have a drop tube for deliveries which extends to within one foot of the tank bottom. Stick measurements are made through the drop tube. The drop tube ensures that the stick is straight up and down when measuring and minimizes static buildup and the release of flammable vapors from splashing.

Calibrated dispensing meters

All meters must be calibrated according to industry and state standards.

Forms

The forms at the end of this fact sheet should be copied and used to record data and perform the monthly reconciliation. One *Daily Inventory Worksheet* is used each day for all the tanks. Use a separate *Monthly Inventory Record* each month for each tank.

If you have manifolded tanks

Manifolded tanks must be considered a one tank system because they share a common inventory of stored fuel. As you follow the directions for conducting inventory control, you will need to combine your measurements

and calculations for all manifolded tanks into one system.

What are the steps to performing proper inventory control?

Step 1 – Measure the tank contents

At the end of each operating day, obtain the tank volume by sticking all tanks or reading the ATG. Convert inches to gallons using the tank chart and record both inches and gallons in the rows labeled End Stick Inches and End Stick Gallons on a new copy of the *Daily Inventory Worksheet*. **Do not measure when fuel is being added to or removed from the tank. The stick should be read to the nearest 1/8 of an inch.** To assist employees who measure tank inventory, copy and post the “*Tips for Measuring Tanks*” page found at the end of this fact sheet.

Step 2 – Record the amount pumped

At the end of each operating day, record the amount of fuel pumped from each tank. The easiest way to determine how much fuel was pumped on a given day is to look at the daily register data. If you do not know how to get this data, contact your tank contractor. Record the data in the Gallons Pumped Today section of the Daily Inventory Worksheet.

If your register does not provide a summary of gallons sold, you will have to manually calculate the total gallons pumped. Read all the dispenser totalizers and record the readings in the appropriate column for each tank. Add the totalizer readings to determine Today's Sum of Totalizers for each tank. Subtract the Previous Day's Sum of Totalizers for each tank and record the result in the Gallons Pumped Today section.

Be sure to read the register or the totalizers at the same time as sticking the tanks or reading the ATG, and make sure no fuel was dispensed during this time.

Step 3 – Record fuel deliveries

Fuel deliveries must be recorded when they are made. The tank must be gauged by stick or by ATG, both before and after the delivery. Convert inches to gallons using the tank chart and record both inches and gallons in the Delivery Record section of the *Daily Inventory Worksheet*. Subtract the initial gauge from the end gauge to determine the Gallons Delivered (Stick). Record the

amount on the delivery receipt from the fuel supplier in the Gross Gallons Delivered (Receipt). These numbers should roughly match.

Step 4 – Calculate daily changes in inventory

After the initial sticking day, you can start to calculate the daily changes to inventory on the *Monthly Inventory Record*. It is best if the same person performs all calculations. Using the numbers from the *Daily Inventory Worksheet*, first calculate the Book Inventory by adding the Start Stick Inventory (which is the previous day's End Stick Inventory) and the Gallons Delivered for the day, if any, and then subtracting the Amount Pumped for the day. Next subtract the End Stick Inventory from the Book Inventory and record the difference in the Daily Over and Short (End Book) column. Initial the sheet.

Step 5 – Calculate monthly changes in inventory

At the end of each month, the overages and shortages must be calculated on the *Monthly Inventory Record* to determine if the shortages are too great. Again, it is always best if the same person performs all calculations. The following steps will explain how to determine if there could be a leak.

- 1) Add all of the month's Gallons Pumped numbers and write this total at the bottom of the column in the box labeled Total Gallons Pumped.
- 2) Add all the month's Daily Over or Short numbers: Pay careful attention to positive and negative numbers to get an accurate total. Enter the total at the bottom of the column in the box labeled Total Gallons Over or Short.
- 3) Fill out the Leak Check line as follows:
Take the Total Gallons Pumped number and drop the last two digits to get one percent (for example: 6594 becomes 65). Add 130 (for example: $65 + 130 = 195$). Enter the result of this calculation at the end of the Leak Check line. This number is the maximum change in inventory allowed by federal regulations (one percent of throughput plus 130 gallons).
- 4) At the bottom of the *Monthly Inventory Record*, circle "Yes" or "No" depending whether your Total Gallons Over or Short number is larger than the Leak Check number you identified in the previous item. Even if your Total Gallons Over or Short is a negative number, treat it as a positive number for the purpose of this comparison. For example, -74 would become +74.

Do I have to report a possible leaking tank based on the inventory control results?

If you circle "Yes" one month, you should pay careful attention to your sticking technique and inventory control calculations in the subsequent month. *If you circle "Yes" for two months in a row, you may have a leaking tank and you must immediately call the Minnesota Duty Officer at 651-649-5451 or 800-422-0798.*

The Minnesota Duty Officer will then relay the information to the Minnesota Pollution Control Agency (MPCA) so they can give guidance about what actions should be taken. You must immediately investigate and resolve all suspected leaks.

What about water in the tank?

There is normally a small amount of water in any tank, which may slowly increase over time due to condensation. However, a sudden change in water level, either up or down, may indicate a leaking tank. If you notice a change of more than one inch, you should arrange to remove the water and conduct further tests to ensure the tank is not leaking.

What records must be kept on file?

Without written records, there is no way to verify that leak detection is being performed. Owners and operators are required to maintain certain written records. These records must be kept at the facility where the tanks are located, or if kept elsewhere, must be immediately submitted to the MPCA upon request.

The following records must be kept for at least **ten years**:

- daily inventory worksheets
- monthly inventory records

Need more information?

Visit the UST Program at <http://www.pca.state.mn.us/cleanup/ust.html>. The site has forms, fact sheets, and other information about USTs and UST requirements.

You can also call the MPCA at 651-296-6300 or 800-657-3864

Example Daily Inventory Worksheet

Facility Name: Last Chance #2

Your Name: John Doe

Date: 9/22/06

Tank Identification	1	2	3	4
Type of Fuel	Reg Unl	Prem Unl	Diesel	Mid Unl
Tank Size (in gallons)	6000	6000	6000	10,000
End Stick Inches	41 ¼	58 7/8	69	86 ½
End Stick Gallons	2672	3755	4432	9423
Gallons Pumped				
Dispenser #1 Totalizer Reading	24383	30798	92485	44013
Dispenser #2 Totalizer Reading	55138	11017	70178	38974
Dispenser #3 Totalizer Reading				
Dispenser #4 Totalizer Reading				
Dispenser #5 Totalizer Reading				
Dispenser #6 Totalizer Reading				
Dispenser #7 Totalizer Reading				
Dispenser #8 Totalizer Reading				
Today's Sum of Totalizers	79521	41815	162663	82487
Previous Day's Sum of Totalizers	78271	40260	161663	82584
Gallons Pumped Today	1250	1555	1000	403
Delivery Record				
Inches of Fuel Before Delivery	13 7/8			49 7/8
Gallons of Fuel Before Delivery (from tank chart)	537			5246
Inches of Fuel After Delivery	41 ¼			86 ½
Gallons of Fuel After Delivery (from tank chart)	2672			9423
Gallons Delivered (Stick) = Gallons "After" minus Gallons "Before"	2135 = 2672 - 537			4177
Gross Gallons Delivered (Receipt)	2100			4200

Example Monthly Inventory Record

Tank ID & Type of Fuel: 4 Midgrade Unl

Month/Year: 9/93

Facility Name: Last Chance #2

Date of Water Check: 9/1 Level of Water (Inches): 0

Date	Start Stick Inventory (Gallons)	Gallons Delivered	Gallons Pumped	Book Inventory (Gallons)	End Stick Inventory Inches/Gallons		Daily Over (+) Or Short (-) (End – Book)	Initials
1	4047 +	-	333 =	3714	38 ¼	3690	-24	JD
2	3690 +	-	44 =	3646	38	3658	+12	JD
3	3658 +	-	329 =	3329	35 3/8	3323	-6	JD
4	3323 +	-	60 =	3263	35	3275	+12	JD
5	3275 +	-	145 =	3130	33 ¾	3117	-13	JD
6	3117 +	-	238 =	2879	31 1/8	2790	-89	JD
7	2790 +	6134 -	117 =	8807	80	8844	+37	JD
8	8844 +	-	127 =	8717	78 7/8	8732	+15	JD
9	8732 +	-	182 =	8550	77 ½	8591	+41	JD
10	8591 +	-	205 =	8386	75 ½	8379	-7	JD
11	8379 +	-	204 =	8175	73 5/8	8173	-2	JD
12	8173 +	-	166 =	8007	72	7991	-16	JD
13	7991 +	-	320 =	7671	69 ¾	7730	+59	JD
14	7730 +	-	307 =	7423	67	7402	-21	JD
15	7402 +	-	76 =	7326	66 ½	7342	+16	JD
16	7342 +	-	224 =	7118	64 1/8	7050	-68	JD
17	7050 +	-	390 =	6660	61	6657	-3	JD
18	6657 +	-	296 =	6361	58 5/8	6354	-7	JD
19	6354 +	-	78 =	6276	58 1/8	6290	+14	JD
20	6290 +	-	424 =	5866	54 5/8	5869	+3	JD
21	5869 +	-	205 =	5664	53 1/8	5639	-25	JD
22	5639 +	4177 -	403 =	9413	86 ½	9423	+10	JD
23	9423 +	-	87 =	9336	85 ½	9343	+7	JD
24	9343 +	-	311 =	9032	82	9036	+4	JD
25	9036 +	-	239 =	8797	79 1/8	8757	-40	JD
26	8757 +	-	256 =	8501	76 7/8	8526	+25	JD
27	8526 +	-	264 =	8262	74 ½	8270	+8	JD
28	8270 +	-	263 =	8007	72	7991	-16	JD
29	7991 +	-	185 =	7806	69	7811	+5	JD
30	7811 +	-	116 =	7695	68	7690	-5	JD
31	+	-	=					

(W) Total Gallons Pumped > **6594**

Total Gallons Over or Short > **-74**

(X)

Drop the Last Two Digits from the Pumped number and enter on the

Total Gallons line below

Compare these numbers

Leak Check: $\begin{array}{r} 65 \\ 195 \end{array} + 130$ gallons

=

Is "Total Gallons Over or Short" larger than "Leak Check" result?

☒ YES ☐ NO (circle one)

If answer is "YES" for two months in a row, notify the State Duty Officer at 651-649-5451 or 800-422-0798 as soon as possible.

Keep This Record on File for at Least Ten Years

Daily Inventory Worksheet

Facility Name: _____

Your Name: _____

Date: _____

Tank Identification					
Type of Fuel					
Tank Size (in gallons)					
End Stick Inches					
End Stick Gallons					
Gallons Pumped	↓	↓	↓	↓	↓
Dispenser #1 Totalizer Reading					
Dispenser #2 Totalizer Reading					
Dispenser #3 Totalizer Reading					
Dispenser #4 Totalizer Reading					
Dispenser #5 Totalizer Reading					
Dispenser #6 Totalizer Reading					
Dispenser #7 Totalizer Reading					
Dispenser #8 Totalizer Reading					
Today's Sum of Totalizers					
Previous Day's Sum of Totalizers					
Gallons Pumped Today					
Delivery Record	↓	↓	↓	↓	↓
Inches of Fuel Before Delivery					
Gallons of Fuel Before Delivery (from tank chart)					
Inches of Fuel After Delivery					
Gallons of Fuel After Delivery (from tank chart)					
Gallons Delivered (Stick) = Gallons "After" – Gallons "Before"					
Gross Gallons Delivered (Receipt)					

Monthly Inventory Record

Tank ID & Type of Fuel: _____

Month/Year: _____

Facility Name: _____

Date of Water Check: _____ Level of Water (Inches): _____

Date	Start Inventory (Gallons)	Stick	Gallons Delivered	Gallons Pumped	Book Inventory (Gallons)	End Inventory (Gallons)	Stick	Daily Over (+) Or Short (-) (End – Book)	Initial
1		+	-	=					
2		+	-	=					
3		+	-	=					
4		+	-	=					
5		+	-	=					
6		+	-	=					
7		+	-	=					
8		+	-	=					
9		+	-	=					
10		+	-	=					
11		+	-	=					
12		+	-	=					
13		+	-	=					
14		+	-	=					
15		+	-	=					
16		+	-	=					
17		+	-	=					
18		+	-	=					
19		+	-	=					
20		+	-	=					
21		+	-	=					
22		+	-	=					
23		+	-	=					
24		+	-	=					
25		+	-	=					
26		+	-	=					
27		+	-	=					
28		+	-	=					
29		+	-	=					
30		+	-	=					
31		+	-	=					

Total Gallons Pumped >

Total Gallons Over or Short >

Drop the last two digits from the pumped number and enter on the total gallons line below

Compare these numbers

Leak Check: _____ + 130 = _____ gallons

Is “Total Gallons Over or Short” larger than “Leak Check” result? YES NO (circle one)

If answer is “YES” for two months in a row, notify the Minnesota State Duty Officer at (651) 649-5451 or (800) 422-0798 as soon as possible.

Keep This Record on File for at Least Ten Years

Tips for Measuring Tanks!

1. Measure each tank each operating day.
2. Use gauge sticks that are:
 - marked to the 1/8 of an inch
 - not worn or broken at the “0” end
 - varnished and not warped
3. Measure through the same drop tube each time.
4. Use good stick practices:
 - slowly lower stick
 - gently touch stick on tank bottom
 - quickly pull stick out
 - read to the nearest 1/8 of an inch
5. Measure before and after each delivery. Remember to wait at least five minutes after delivery to measure again.
6. Check for water at least once a month using water-finding paste.

