

DAILY INVENTORY & STATISTICAL INVENTORY ANALYSIS

Daily Inventory and Statistical Inventory Analysis (SIA) are inventory control procedures for determining how much fuel is going into and out of your fuel tank to determine if there is a leak. Daily Inventory with SIA is a leak detection option used for single-walled tanks, single-walled piping, and double-walled tanks and piping without electronic monitoring installed before September of 1991.

To meet Maine's leak detection requirements, daily inventory must be used with annual SIA. SIA is a mathematical process that analyzes daily inventory data to more accurately assess whether or not a leak exists in the tank(s) or piping. The SIA is conducted by statisticians who must be approved by the DEP.

The SIA provider uses a computer program to look more closely at the inventory data to determine if you might have a leak. The SIA company then provides you with a report of whether the records pass, fail, or are inconclusive.

Maine DEP can provide you with a list of approved SIA providers. Call 207-287-2651, or mail a request to: 17 State House Station, Augusta, ME 04333. The list is also available on the Internet at www.maine.gov/dep/rwm/ust/siavendors.doc

Fuel inventory control involves four essential steps:

1. **Take daily measurements** of fuel in the tank, fuel dispensed, and fuel delivered.
2. **Reconcile the daily measurements** to determine the daily variance.
3. **Calculate the monthly variance** to determine whether your monthly variance is within regulatory guidelines.
4. **Submit a month's worth of daily inventory data** once a year to an approved SIA provider.

Inventory control is probably the oldest form of fuel-storage leak detection. It is also an essential UST-system management practice. Inventory records reflect everything that happens to the fuel in your storage system between the fill cap and the dispenser meter, allowing you to identify leaks from many different components of the fuel-storage system. But the reliability of this information is only as good as the care you take in carrying out the inventory-control procedures.

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WHAT DO YOU DO EACH DAY?

To perform daily inventory, there are four things you must keep track of on a daily basis:

- **The amount of fuel in the tank**
- **The amount of water in the tank**
- **The amount of fuel sold or dispensed**
- **The amount of fuel delivered**

Make separate inventory measurements for each product that you store. All of these measurements must be made at the same time, so that no dispensing or deliveries take place between the time when the volume dispensed and the volume in the tank are measured. You must make these measurements each day that fuel is added or removed from the storage system. You do not need to conduct inventory on days when your business is not open.

Make all your inventory measurements at the same time.

Measuring the Fuel in the Tank

The traditional way of measuring the amount of fuel in an underground tank is with a long wooden stick known as a gauge stick. For accurate measurements, the gauge stick must be straight and marked in 1/8-inch increments with clearly legible numbers.

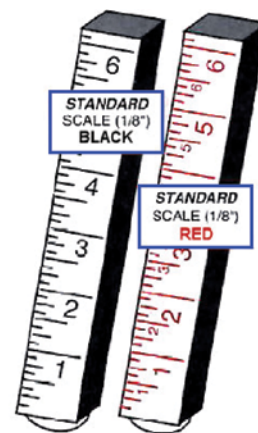
To take a reading, lower the stick gently to the bottom of the tank and raise it quickly. Locate the line where the stick is wet and record the number of inches to the nearest 1/8 inch.

Use a tank chart to convert the depth measurement to gallons. Be sure you have the correct tank calibration with 1/8-inch increments that corresponds to your tank. Record the number of gallons on the inventory reconciliation report.

Tank charts may be available from the tank manufacturer. If you need assistance in determining how to contact the tank manufacturer, write or call the DEP at 17 State House Station, Augusta, ME 04333, 207-287-2651. Some tank charts can also be retrieved from the Internet:

For steel tanks:

<http://gaugecharts.highlandtank.com:592/fmi/iwp/cgi?-db=HT%20Gauge%20Charts%20NEW&-loadframes>



STICK READING	GALLONS
21-5/8"	586
21-3/4"	591
21-7/8"	596
22"	601
22-1/8"	606
22-1/4"	611
22-3/8"	616
22-1/2"	621
22-5/8"	626

For fiberglass tanks manufactured by Xerxes:
www.xerxes.com/document-library/xerxes.html

For fiberglass tanks manufactured by Containment Solutions, Fluid Containment, and Owens Corning Fiberglas:
www.containmentsolutions.com/library/?sub=calibrationcharts&cat=field-services&class=LIT&rid=73

Tank charts can also be constructed by your SIA vendor. This is especially useful when unusual situations, such as a severely tilted tank, are encountered.

If you have an automatic tank gauge (ATG), you can get the gallon readings directly from the ATG display or printout. Check the operator's manual to find out how to get this information from your ATG.



Photos courtesy of Marcel Moreau Associates, Portland Maine.

If you use a gauge stick to measure inventory levels, be sure to measure carefully.

Gauge sticks should be clearly legible and in good condition. This stick is missing 5 inches from the bottom, but it was still in service when the picture was taken. This caused serious problems with the inventory records.



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The best way to measure water is to use water-finding paste that is applied to the bottom of a gauge stick.

Measuring the Water in the Tank

The best way to measure water is to use water-finding paste that is applied to the bottom of a gauge stick. Almost all gasoline in Maine today contains ethanol, so be sure to use a water paste that is formulated for use with ethanol-blend gasoline. Follow the paste manufacturer's directions for using the water paste, paying particular attention to the amount of time the stick needs to stay in the tank and what color change indicates the presence of water.

Automatic tank gauges have water sensors but they should not be relied upon to detect water in tanks that contain gasoline blended with any amount of ethanol.



Courtesy of Marcel Moreau Associates, Portland Maine.

Check for water on a daily basis. Pastes from different manufacturers are different colors and will exhibit different color changes when they come in contact with water. Use the appropriate paste for the fuel you are storing and follow the manufacturer's instructions on how to use it.

Measuring Dispensed Fuel

The amount of fuel dispensed can be read from the totalizer meters located on your dispensers. Totalizers look and work just like your automobile odometer. They track the total amount of fuel that passes through your meter. Subtract the previous totalizer reading from the current reading to get the number of gallons pumped.

You may also get your sales volume from a point-of-sale system (computerized cash register) report that tells you how much of each grade of fuel you sold.

Whether you read totalizers or get reports from your point-of-sale system to determine the amount of fuel dispensed, it is important that the meters that measure the fuel be properly calibrated. Calibrating meters annually is recommended to maintain the accuracy of inventory records.

Recording the Amount of Fuel Delivered

You should receive a bill of lading or other form of delivery receipt from the fuel delivery driver. The bill of lading may indicate both a “net” and a “gross” volume. Use the gross volume as the number of gallons delivered for inventory record-keeping purposes. The net volume is corrected for temperature and should not be used for inventory record keeping.

Doing the Math

Once you have these three numbers (sales, tank inventory, and delivery volume), you must calculate the book inventory balance, the daily over or short (also known as the daily variance), and the cumulative over or short (also known as the cumulative variance). Refer to the Sample Inventory Report on the next page for detailed instructions on how to perform these calculations. You can make your job a lot easier and reduce math errors by developing a worksheet using computer software such as Microsoft® Excel to perform these calculations for you.

Your daily variance will rarely be zero because none of the measurements you are taking are exact. BUT your daily variance should not be too large either. If you have a large daily variance and it is not a math or measurement error, then PAY ATTENTION!!! Facilities have operated for months with losses of hundreds of gallons a day that were clearly indicated in their inventory records. Don't let this happen to you!

NOTE: There are several methods of calculating inventory control that may be used to meet Maine regulatory requirements. The method presented here is the most commonly used, but other methods consistent with regulatory requirements are acceptable.

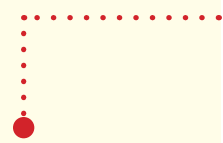
What If You Have a Blended Mid-Grade Fuel?

Normally, you would keep separate inventory records for each grade of fuel that you dispense. The exception to this is if you blend a mid-grade gasoline from your high- and low-grade products. If you have a blended mid-grade product, you may add together the sales, tank inventory, and delivery volumes for the high- and low-grade products and treat them as a single product for inventory purposes.

WHAT DO YOU DO AT THE END OF THE MONTH?

At the end of each month, you must check to see how large your variances for the month are relative to your sales volume. In Maine, your total variance at the end of the month (the cumulative variance) must be less than 1% of the amount of fuel dispensed during the course of the month. Refer to the Sample Inventory Report on the page 7 for detailed instructions on how to determine

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this. If the cumulative variance at the end of the month is more than 1% of your sales volume, this is evidence of a possible leak that must be reported to the DEP within 24 hours.

Another useful check is to count the number of positive and negative daily variances. Over a month's time, the number of positive daily variances should approximately equal the number of negative daily variances. If this is not true, something other than random error is likely to be influencing your inventory measurements. If you notice that the positive daily variances tend to be delivery days and the negative variances on non-delivery days (or vice versa) then the problem may be an incorrect tank chart, a stick that is missing a piece off the bottom, or a tank gauge that is not correctly calibrated. If you notice that the numbers in the cumulative variance column tend to grow larger as the month goes on, then you may have a leak or a meter that is not properly calibrated and is giving away fuel.

Report evidence of a possible leak to the DEP's Tanks Unit

207-287-2651

or call the 24-hour Spill Hotline

1-800-482-0777

WHAT DO YOU DO EACH YEAR?

To provide a check on the quality of your inventory data and to help identify problems that are hard to see in the raw data, Maine DEP rules require that once a year you send one month's worth of inventory data to a company that conducts an SIA and sends a report back to you. You must submit a copy of the SIA report to the DEP before July 1 of each year.

Your SIA results will indicate one of the following results:

- **Pass** – Your data quality is good and the inventory record does not indicate that a leak is present.
- **Inconclusive** – The data quality is not good enough to determine whether a leak is present. This result is most often due to careless measurements or taking measurements of gallons dispensed and closing tank inventory at different times.
- **Fail** – Your data indicate that a leak may be present. You have a problem that must be investigated! It may not be a leak but you must investigate it. This is also evidence of a possible leak that must be reported to the DEP within 24 hours. **DO NOT IGNORE A FAILED SIA RESULT!**

SAMPLE INVENTORY REPORT

This is a sample inventory record which should help you to understand how inventory information is recorded. The bold letters in the following paragraphs are keyed to the marked items on the sample inventory reconciliation report.

A. Opening Inventory is the actual gallons of product (closing stick inventory – column E) from the previous day. On the first of the month, this number is the closing stick inventory from the last day of the previous month.

B. Gallons Delivered should be recorded in this column each day product is delivered to the tank.

C. Gallons Pumped should be read and recorded each day from the meter readings on the tank's dispenser(s) or from your point of sale system. No fuel should be pumped between the time closing stick reading and the gallons pumped readings are made.

D. Book Inventory Balance is calculated not measured. It is equal to the Opening Inventory (A) plus the Gallons Delivered (B) minus the Gallons Pumped (C).

E. Closing Stick Inventory should be taken at approximately the same time every day. Read the height of the product on the stick to the nearest 1/8". Use a tank chart to convert the stick measurement to gallons and record the number of gallons.

F. Daily Over or Short is equal to the Closing Stick Inventory (E) minus the Book Inventory Balance (D).

G. Cumulative Over or Short is equal to the previous day cumulative over or short total (G) plus the daily over or short of the present day (F). This produces the over or short for the month to date. On the first of the month, the cumulative over or short is equal to the daily over or short.

H. Inches Water is the depth of any water in the bottom of the tank. It must be recorded each day, even if there is none. Apply water finding paste to the bottom inch or two of the gauge stick when measuring the closing stick inventory.

I. Enter the **Initials** of who entered today's information.

J. Math Check. Copy the **Opening Inventory** figure for the first day of the month in this box.

K. Enter the sum of **Gallons Delivered** for the month in this box.

L. Enter the sum of **Gallons Pumped** for the entire month in this box.

M. Take **Opening Inventory** (J), add **Gallons Delivered** (K), subtract **Total Gallons Pumped** (L) to get M.

N. Copy the **Closing Stick Inventory** from the last day of the month in this box.

O. Copy the answer from the **Math Check** (M) in this box.

P. Subtract (O) from (N) to get (P). The result (P) should be equal to the last number in the **Cumulative Over or Short** column (G). If the numbers are not the same, there is a math error somewhere on the page.

Q. Enter the **Total Gallons Pumped** (L). Multiply by .01 (move the decimal two places to the left) to determine the **Leak Check Result** (R).

R. Compare R and P. If **Cumulative Over or Short** (P) is greater than **Leak Check Result** (R), you have evidence of a possible leak and must notify DEP within 24 hours. If R is greater than P, then the tank passes the leak detection test for this month. If your **Cumulative 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.

MONTHLY INVENTORY RECONCILIATION REPORT									
Month / year February 2010									
Facility & Location: Magi Oil, Ft. Kent					DEP Reg # 00000				
Tank Size and Fuel Type: 6000 Super NL					Certified by: Tom Smith				
Date	A	B	C	D	E	F	G	H	I
	Opening Inventory	Gallons Delivered	Gallons Pumped	Book Inventory Balance	Closing Stick Inventory	Daily Over or Short	Cumulative Over or Short	Inches Water	Initials
1	2556		143	2413	2441	28	28	0	TS
2	2441		227	2214	2118	-96	-68	0	ES
3	2118		259	1859	1955	96	28	0	ES
4	1955		225	1730	1733	3	31	0	TS
5	1733		372	1361	1270	-91	-60	0	ES
6	1270	2000	194	3076	3175	99	39	0	ES
7	3175		147	3028	3000	-28	11	0	ES
8	3000		164	2836	2843	7	18	0	TS
9	2843		406	2437	2320	-117	-99	0	TS
10	2320		361	1959	2053	94	-5	0	TS
11	2053		187	1866	1860	-6	-11	0	ES
12	1860		273	1587	1608	21	10	0	ES
13	1608		489	1119	1118	-1	9	0	ES
14	1118		97	1021	1000	-21	-12	0	TS
15	1000		132	868	835	-33	-45	0	TS
16	835		177	658	605	-53	-98	0	ES
17	605	3000	154	3451	3590	139	41	0	ES
18	3590		99	3491	3490	-1	40	0	ES
19	3490		292	3198	3210	12	52	0	TS
20	3210		477	2733	2711	-22	30	1/4"	TS
21	2711		25	2686	2711	25	55	1/4"	TS
22	2711		107	2604	2588	-16	39	1/4"	ES
23	2588		254	2334	2320	-14	25	1/4"	ES
24	2320		303	2017	2085	68	93	1/4"	ES
25	2085	2000	192	3893	3851	-42	51	1/4"	TS
26	3851		284	3567	3544	-23	28	1/4"	TS
27	3544		490	3054	3075	21	49	1/4"	TS
28	3075		166	2909	2898	-11	38	1/4"	TS
29									
30									
Math Check	J	K	L	M		N	O	P	
	2556	+ 7000	- 6696	= 2860		2898	- 2860	= 38	
LEAK CHECK: Total Gallons Pumped Q 6696 X .01 = R 66.96 IF THE CUMULATIVE OVER OR SHORT AT THE END OF THE MONTH IS GREATER THAN THE LEAK CHECK RESULT, IT IS EVIDENCE OF A POSSIBLE LEAK AND YOU MUST NOTIFY MAINE DEP WITHIN 24 HOURS AT (207) 287-2851.									

WHAT OTHER REQUIREMENTS ARE THERE?

- **You must keep your inventory records and SIA results for 3 years.**
- **You must also have a device called a drop tube installed in your fill pipe.**
A drop tube is an aluminum sleeve that extends from the top of your fill pipe to near the bottom of the tank. Most gasoline tanks in Maine have drop tubes, but they are less common on diesel tanks. If you don't know whether you have a drop tube, ask your service technician to check whether one is present.

MONTHLY INVENTORY RECONCILIATION REPORT

Month / year _____

Facility & Location: _____ DEP Reg # _____

Tank Size and Fuel Type: _____ Certified by: _____

Date	Opening Inventory (closing stick from previous day)	Gallons Delivered	Gallons Pumped	Book Inventory Balance	Closing Stick Inventory	Daily over or <short>	Cumulative over or <short>	Inches Water	Initials
1									
2									
3									
4									
5									
6									
7									
8									
9									
10									
11									
12									
13									
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Math Check - + =

LEAK CHECK: Total Gallons Pumped (_____) X .01 = _____ IF SUM OF "CUMULATIVE OVER OR SHORT" IS GREATER THAN LEAK CHECK RESULT, IT IS CONSIDERED EVIDENCE OF A POSSIBLE LEAK AND YOU MUST NOTIFY MAINE DEP AS SOON AS POSSIBLE AT (207) 287-7655.