WHAT IS INVENTORY CONTROL?

IN 1992 THE EPA PUBLISHED “DOING INVENTORY RIGHT” BOOKLET FOR UNDERGROUND STORAGE TANKS.

THE EPA DESCRIBES INVENTORY CONTROL AS:

“inventory control requires daily measurements of tank contents and math calculations that let you compare your "stick" inventory (what you've measured) to your "book" inventory (what your recordkeeping indicates you should have). Some people call this process "inventory reconciliation." If the difference between your "stick" and "book" inventory is too large, your tank may be leaking.”
WHY DO INVENTORY CONTROL?

Why should an operator be concerned about inventory verification?

- It may indicate a failure in a method of leak detection or leak detection equipment
- It may indicate potential fuel quality issues
- It may be used as evidence to document and resolve fuel quality issues discovered by field screening or lab testing

WHY DO INVENTORY CONTROL?

Why should an operator be concerned about inventory verification?

- It may be used to ensure that delivery drivers are following proper delivery methods
- It may be used to discover theft of product from employees or the public as well as short deliveries.
- Inventory control is required by ATCP 93.503
INVENTORY CONTROL IS REQUIRED BY ATCP 93.503

ATCP 93.503

(2) Inventory control.

(a) General methodology. Inventory control that is used as the leak detection method shall be conducted in accordance with API 1621 and with this subsection.

(b) Prescriptive requirements. Product inventory control shall be conducted monthly and reconciled to detect a leak rate of at least 0.5 percent of throughput on a monthly basis, in the following manner:

Note: A leak rate of 0.5 percent is equal to 5 gallons out of every 1000 gallons of throughput.

ATCP 93.503 (2)(b)

1. Inventory volume measurements for inputs, withdrawals, and the amount still remaining in the tank shall be recorded each operating day.

2. The equipment used shall be capable of measuring the level of product over the full range of the tank’s height, to the nearest one-eighth of an inch.

3. a. The inputs shall be reconciled with delivery receipts by measurement of the tank inventory volume before and after delivery.

   b. Where tanks are interconnected by a manifold, reconciliation may address all of the interconnected tanks as a group rather than as individual tanks.
INVENTORY CONTROL IS REQUIRED BY ATCP 93.503

ATCP 93.503 (2)(b)

4. The measurement of any water level in the bottom of the tank shall be electronically or manually gauged to the nearest one-eighth of an inch at least once a month and recorded.

(c) Product losses. Tank systems that exceed the losses allowed under par. (b) for 2 consecutive months shall follow the requirements in ss. ATCP 93.575 to 93.585 for assessing and responding to a release.

ATCP 93.503 (2)

(d) Precision tightness test. A precision tightness test shall be performed within 10 business days of notification from the authorized agent or the department for any of the following reasons:

1. Failure to provide monthly inventory control data for the past 12 months.

2. Incomplete or inconsistent data entry reflected during any 2 months of data entry out of the most recent 3 months of inventory control record keeping.
REQUIREMENTS OF INVENTORY CONTROL?

A tank gauge stick or automatic tank gauge capable of reading to 1/8 inch.

As part of inventory control the tanks should be checked for water with water finding paste if using a tank gauging stick or with the automatic tank gauge. The water levels should be noted on the inventory forms.
REQUIREMENTS OF INVENTORY CONTROL: INVENTORY FORMS

- Inventory forms for logging results can be manually recorded with pen and paper, or electronic with a spreadsheet program to do calculations automatically.
- Electronic forms can be found on the DATCP website:
  - https://datcp.wi.gov/Pages/Programs_Services/InventoryVerificationReconciliationForms.aspx Or https://bit.ly/2QKMFuW
  - From the DATCP site select the API 1621 forms based on how many tanks in use and if blending.

  NOTE: If you do not have a copy of Excel the free and open source project LibreOffice can be downloaded from www.libreoffice.org and has been tested with the DATCP forms.

INVENTORY FORMS

Electronic Inventory Forms come in two types:

1) Non-Blended Systems where Midgrade is its own tank
2) Blended systems where midgrade is blended from a regular 87 and a Premium 93 or 91.
Electronic Inventory Forms come in two types:

1) **Non-Blended Systems**—where midgrade is its own tank

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
<th>H</th>
<th>I</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Station:</td>
<td>Tank:</td>
<td>1</td>
<td>Product:</td>
<td>Reg Uni</td>
<td>Month:</td>
<td>January</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Water Check Date:</td>
<td>Level of Water</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Data entries into the shaded areas are automatically calculated by the program. Do not type in shaded areas.

<table>
<thead>
<tr>
<th>9</th>
<th>Date</th>
<th>Beginning Inventory</th>
<th>Product Sales</th>
<th>Receipts Deliveries</th>
<th>Beginning book Inventory minus (-) sales (+) receipts</th>
<th>End Inventory from monitor or stick</th>
<th>Daily Over (+) or Short (-) &quot;Book&quot;</th>
<th>Daily Accumulative Over/short</th>
</tr>
</thead>
<tbody>
<tr>
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<td>01/01/09</td>
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<td>0</td>
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<td>0</td>
<td>0</td>
<td>0</td>
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</tr>
<tr>
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<td>01/02/09</td>
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<td>0</td>
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<td></td>
</tr>
<tr>
<td>12</td>
<td>01/03/09</td>
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<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>01/04/09</td>
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<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>

2) **Blended Systems**—where regular and premium octanes are blended to make midgrade 89.

Spreadsheet will include a column for entering midgrade sales.
INVENTORY FORMS

Electronic Inventory Forms for Blended Systems also come in two types:

1. 65/35 Form
   Stations with 87 regular and 93 premium will blend midgrade using 65% regular and 35% premium.

2. 50/50 Form
   Stations with 87 regular and 91 premium will blend midgrade using 50% regular and 50% premium.

If you are unsure of your blend ratios contact your petroleum service company for guidance.

STEP 1: MEASURE THE TANK’S CONTENTS

- At the beginning of the first day of month, get the starting inventory reading from the previous month’s end or from the Tank Gauge slip.
- Use the gross volume from the ATG slip not the temperature corrected
- Enter the amount of product in gallons in the tank to the “Beginning Inventory Gallons” of the Inventory Form
STEP 2: RECORD THE AMOUNT PUMPED

• At the end of the day it is crucial to collect these at the same time:
  • “Product Sales”
  • “Midgrade Sales” (if blending)
  • “End Inventory”

Most errors in inventory are caused by “Product Sales” collected at a different time than “End Inventory.”

Customers filling up overnight, or late night/early morning product deliveries will make overages and shortages appear larger than they are if not collected at same time.

STEP 2: RECORD THE AMOUNT PUMPED

• Enter the Amount Pumped into the “Product Sales” column. Product sales is from the Point of Sale system, not from the Automatic Tank Gauge.
STEP 2: RECORD THE AMOUNT PUMPED

- If blending for midgrade, enter the Midgrade Pumped into the “Midgrade Total Sales” column. Midgrade sales is from the Point of Sale system, not from the Automatic Tank Gauge.

<table>
<thead>
<tr>
<th>Date</th>
<th>Beginning Inventory (gallons)</th>
<th>Product Sales (gallons)</th>
<th>Receipts Deliveries (gallons)</th>
<th>Beginning Inventory minus (-) sales (+) receipts</th>
<th>End Inventory monitor or stick</th>
<th>Inches</th>
<th>Gallons</th>
<th>Daily Over (+) or Short (-) &quot;End - &quot;Book&quot;</th>
<th>Daily Accumulative Over short</th>
<th>Midgrade Total Sales</th>
<th>Midgrade 50% Sub from Beginning Book</th>
</tr>
</thead>
<tbody>
<tr>
<td>01/01/18</td>
<td>8000</td>
<td>2000</td>
<td>1000</td>
<td>6750</td>
<td>6745</td>
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<td>500</td>
<td>0</td>
</tr>
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<td>-45760</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
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</table>

STEP 3: RECORD FUEL DELIVERIES

- When a delivery occurs the transport company will leave a Bill of Lading (“BOL”) with the station. The BOL will show the amount of product delivered. It will also show both gross and net volume. Use the gross volume for delivery inventory readings.
STEP 3: RECORD FUEL DELIVERIES

- Use the amount of product in gallons from the BOL to fill in the “Receipts and Deliveries” column.

<table>
<thead>
<tr>
<th>Date</th>
<th>Beginning Inventory gallons</th>
<th>Product Sales (gallons)</th>
<th>Receipts Deliveries (gallons)</th>
<th>Beginning book inventory minus (-) sales (+) receipts</th>
<th>End Inventory (from monitor or stick) Gallons</th>
<th>Daily Over (+) or Short (-) “[End” “Book”]</th>
<th>Daily Accumulative Over short</th>
<th>Midgrade Total Sales</th>
<th>Midgrade 50% Sub from Beginning Book</th>
</tr>
</thead>
<tbody>
<tr>
<td>01/01/18</td>
<td>8000</td>
<td>2000</td>
<td>1000</td>
<td>7000</td>
<td>-7000</td>
<td>-7000</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>01/02/18</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>-7000</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

STEP 4: RECORD END OF DAY STICK READINGS

- This will be from the automatic tank gauge printed at the end of day and taken at same time as the end of day sales.

<table>
<thead>
<tr>
<th>Date</th>
<th>Beginning Inventory gallons</th>
<th>Product Sales (gallons)</th>
<th>Receipts Deliveries (gallons)</th>
<th>Beginning book inventory minus (-) sales (+) receipts</th>
<th>End Inventory (from monitor or stick) Gallons</th>
<th>Daily Over (+) or Short (-) “[End” “Book”]</th>
<th>Daily Accumulative Over short</th>
<th>Midgrade Total Sales</th>
<th>Midgrade 50% Sub from Beginning Book</th>
</tr>
</thead>
<tbody>
<tr>
<td>01/01/18</td>
<td>8000</td>
<td>2000</td>
<td>1000</td>
<td>7000</td>
<td>6745</td>
<td>-255</td>
<td>-255</td>
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<tr>
<td>01/02/18</td>
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<td>-6745</td>
<td>-7000</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>
STEP 5: CALCULATE THE DAILY CHANGES IN INVENTORY

When all the daily sales, deliveries, beginning and ending stick readings are entered correctly into the Inventory form the form will make two calculations:

1. **Daily over and short** is the amount of product over or short for the day.
2. **Daily Accumulative** is the running total for the month so far.

<table>
<thead>
<tr>
<th>Date</th>
<th>Beginning Inventory (gallons)</th>
<th>Product Sales (gallons)</th>
<th>Receipts</th>
<th>Deliveries (gallons)</th>
<th>Beginning book inventory</th>
<th>Invoices Sales (+)</th>
<th>Sales (-) receipts</th>
<th>End Inventory (from monitor or stick)</th>
<th>Daily Over (+) or Short (&quot;End - &quot;Book&quot;)</th>
<th>Daily Accumulative Over short</th>
<th>Midgrade 50% Sub from Beginning Book</th>
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<tbody>
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<tr>
<td>01/02/18</td>
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<td>6748</td>
<td>6748</td>
<td>-500</td>
<td>200</td>
<td>0</td>
</tr>
</tbody>
</table>

**NOTE:** It is normal to have over and shortages on inventory, it is not normal to have repeated “0” over or short.

END OF MONTH LEAK CALCULATION OLD METHOD

The EPA Guide “Doing Inventory Right” has an end of month calculation using 1% of product throughput and plus 130 gallons to give allowable over and short.

**TECHNICAL NOTE:**

- **LEAK CHECK:**
  - **TOTAL GALLONS PUMPED:**
  - **TOTAL GALLONS OVER OR SHORT:**
  - **COMPARISION:**
  - **OVER CHECK:**
  - **SHORT CHECK:**
  - **TOTAL GALLONS OVER OR SHORT - "LEAK CHECK" RESULT:**
  - **YES/NO**
  - **TOTAL GALLONS OVER OR SHORT:**
  - **TOTAL GALLONS OVER OR SHORT:**
  - **TOTAL GALLONS OVER OR SHORT:**
  - **TOTAL GALLONS OVER OR SHORT:**
  - **TOTAL GALLONS OVER OR SHORT:**

**KEEP THIS PIECE OF PAPER ON FILE FOR AT LEAST 1 YEAR**
END OF MONTH LEAK CALCULATION

Wisconsin has adopted the API 1621 method where 0.5% of the monthly throughput is used to calculate the allowable over and short of the tank.

<table>
<thead>
<tr>
<th>Date</th>
<th>Throughput</th>
<th>API 1621 Calculation</th>
<th>Leak Test</th>
<th>End of Month Accumulative Total</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>10/22/18</td>
<td>9638</td>
<td>1899</td>
<td>7892</td>
<td>7942</td>
<td>30</td>
</tr>
<tr>
<td>10/23/18</td>
<td>7642</td>
<td>1919</td>
<td>5729.5</td>
<td>5731</td>
<td>1.5</td>
</tr>
<tr>
<td>10/24/18</td>
<td>8737</td>
<td>2100</td>
<td>3876</td>
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</tr>
<tr>
<td>10/25/18</td>
<td>9674</td>
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<td>9614</td>
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<tr>
<td>10/26/18</td>
<td>7642</td>
<td>2100</td>
<td>7451</td>
<td>7451</td>
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<td>10/27/18</td>
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<tr>
<td>10/28/18</td>
<td>8600</td>
<td>1800</td>
<td>3640</td>
<td>3620</td>
<td>-20</td>
</tr>
<tr>
<td>10/29/18</td>
<td>9638</td>
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<tr>
<td>10/31/18</td>
<td>8281</td>
<td>1912</td>
<td>3279</td>
<td>3221</td>
<td>-148</td>
</tr>
</tbody>
</table>

Total Throughput: 63630.0

If using the DATCP spreadsheet, the form will automatically do the leak calculation. The spreadsheet will calculate the total over or short for the month.

<table>
<thead>
<tr>
<th>Date</th>
<th>Throughput</th>
<th>API 1621 Calculation</th>
<th>Leak Test</th>
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<tr>
<td>10/31/18</td>
<td>8281</td>
<td>1912</td>
<td>3279</td>
<td>3221</td>
<td>-148</td>
</tr>
</tbody>
</table>

Total Throughput: 63630.0

Leak Test: 318.1520

End of Month Accumulative Total: PASS
END OF MONTH LEAK CALCULATION

The spreadsheet will add up the total sales for the product for the month and then calculate the 0.5% giving an allowable over or short for the month. In the example below the Leak Test gallons is 318.1525.

END OF MONTH LEAK CALCULATION

The spreadsheet will check the Leak Test allowable over and short (318.1525 Gallons) and compare it to the total over or short for month (-148.5 Gallons) and determine if the Leak Test is PASS or FAIL for the month.
END OF MONTH LEAK CALCULATION

The spreadsheet below we have a shortage of -120.5 Gallons and we have 20,894.5 in sales for the month. Using the 0.5% from the sales the sheet calculates we have a allowable variance of 104.4725. In this example the tank shortage is greater than the Leak Test and the test is a **FAIL!**

What to do in the event of a Failed Leak Test:

1) The most common reason for a failed leak test is an error in data input. Check for obvious signs of transposed numbers and date.

2) Go back into the Bills of Lading and make sure gross volume is being used and not the net volume.

3) Check the ATG slips and make sure the gross volume is being used and not temp corrected.
**END OF MONTH LEAK CALCULATION**

What to do in the event of a Failed Leak Test: (cont.)

4) Look for patterns of overages or shortages, do shortages happen on the days of getting a delivery, if so the truck may not be delivering all the product purchased.

5) If failed leak tests occur two month in a row, investigate further. A tank tightness test and line tightness test may be required.

6) Finished inventory forms must be kept for a minimum of 10 years.

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**INVENTORY CONTROL**

- Use the correct forms for blend or not blended and for the correct blend ratio
- Collect the end of day data at the same time, total sales for day and ending stick readings
- If doing manually, make sure to do the end of month calculations
- Look at the completed forms for trends in over or short, it could show a water intrusion or tank leak issue before a leak test
- Unexplained over and shortages could be caused by meter calibration issues
- Keep completed forms for a minimum of 10 years