OVERFILL PREVENTION?

Kevin Henderson

22nd NATIONAL TANKS CONFERENCE & EXPO
SEPTEMBER 20, 2010
BOSTON, MASSACHUSETTS
ARE WE EFFECTIVELY PREVENTING OVERFILLS?

Figure 3. One of the sedans and the pickup after emergency responders extinguished the blaze. The Premium cargo tank truck is in the background.
DEFINITIONS

- **OVERFILL** - Occurs when any tank top fitting is wetted.

- **OVERFILL PREVENTION** – Prevent any tank top fitting from being wetted.

- **OVERFILL RELEASE** – Release to the environment that occurs when a tank is filled beyond its capacity.
Causes of Overfills

Most overfills occur because of human error and not because the overfill prevention equipment fails.

Not
Installed correctly
Maintained correctly
Operated correctly
Causes of Overfills

Are overfills occurring when equipment is installed, maintained and operated in accordance with instructions even if no human error occurs?
Causes of Overfills

How did this staining occur?
Two Kinds of Overfills

1. “VISIBLE” = Above ground – Product visible on top of the ground
Two Kinds of Overfills

2. “HIDDEN” = Underground - Probably would not realize it is occurring – Not seen by most leak detection methods
Sources of Hidden Overfills

Non-operational Components

Unused Tank bungs
Tank risers (Fill, STP, ATG, Vapor Recovery, etc.)
Vent piping
Stage 2 vapor recovery piping

These components typically are not required to be secondarily contained or monitored since they do not routinely contain product.
UNUSED TANK BUNGS
VAPOR RECOVERY RISERS
ATG RISERS
VENT PIPING
ARE WE EFFECTIVELY PREVENTING HIDDEN OVERFILLS?
OVERFILL PREVENTION RULES

(1) Alert @ 90% tank capacity
   (a) Restrict flow
   (b) Trigger alarm

(2) Shut off flow @ 95% tank capacity
Environmental Fact Sheet

Technical Standards And Corrective Action Requirements For Owners And Operators Of Underground Storage Tanks: Final Amendment Of The Overfill Requirements

Background

On September 22, 1988, the Environmental Protection Agency promulgated technical requirements (53 FR 37082) under Subtitle C of the Resource Conservation and Recovery Act (RCRA) for underground storage tanks containing petroleum or substances defined as hazardous under the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) except any substance defined as hazardous waste under Subtitle C of RCRA. Those rules went into effect 90 days later on December 22, 1988. The final rule remains unchanged; this amendment adds to the UST overfill prevention requirements by allowing alternative uses of overfill prevention equipment located closer to the tops of larger tanks as long as specified minimum levels of performance are achieved.

Overfilling UST systems is a common source of petroleum released onto the surface of the ground. EPA studies have found that UST owners and operators without overfill prevention equipment on their USTs often inadvertently force product into the environment through tank bung holes, vent lines, or fill ports when the volume of liquids delivered exceeds the tank's storage capacity. Sections 280.20(c) and 250.36 of the final regulations provide requirements for spill and overfill prevention that mandate UST owners and operators use prevention equipment as well as follow procedures for preventing spillage and overfill into the environment during each tank in-filling operation. More specifically, section 280.20(c)(1)(ii) of the existing rule requires that owners and operators prevent overfills by installing equipment with a design that will either alert the operator when the tank is up to 90 percent full or stop the transfer operation when the tank is full.
OVERFILL PREVENTION RULES

1991 Addition to Federal Rules

Applies Only to Tanks > 4000 Gallons

(3) Restrict flow 30 minutes prior to overfilling

(4) Alarm 1 minute prior to overfilling

(5) Shut off flow before any tank top fittings are wetted
Many states adopted 40 CFR 280 after it was promulgated but before 1991 addition.

Not every state has the 1991 overfill prevention alternatives in their state specific rules.

NFPA 30 does not have 1991 alternatives.
- (actually requires both 90% alert and 95% shut off)
OVERFILL PREVENTION DEVICES

RESTRICT

ALARM

SHUT OFF
SOME HAVE MINIMUM CLEARANCE REQUIREMENTS

Figure 24
CROWED SUMPS ARE IN VOGUE
Remote Fill – Trap Door
Pressurized Deliveries
To stop the flow or passage of; cut off

Generally thought of as 95% tank capacity
– Alternative rule allows filling beyond 95% as long as tank top fittings are not wetted.
The Auto Limiter II® overfill protection system is an automatic shut-off valve designed to be installed in the 4" riser pipe of underground storage tanks with tight fill adaptor to reduce the flow by 90% at first stage (approximately 92% of tank capacity) and shut down the gravity flow at 95% tank capacity. It is designed to be installed in a spill containment manhole, which makes it unnecessary to break concrete or add a new manhole. The anodized cast aluminum valve body and aluminum drop tubes make the Auto Limiter II virtually maintenance free.

- Two stage flow shut down provides reduced line shock compared to competitive models:
  - First stage reduces flow by 90%
  - Second stage shuts off remaining 10%
- Models for both coaxial installations and dual point systems
- Accommodates all tank sizes
- Easy field installation without breaking concrete
- Enables manual stick gauging of tank after a complete shut-off

**Size**
- Valve Body Length: 18"/ 459mm
- Upper Drop Tube Std: 4" Dia. x 60" Long (102mm x 1.5m)
- Lower Drop Tube Std: 4" Dia. x 96" Long (102mm x 2.4m)

**Materials**
- Valve Body: Aluminum
- Floats: Polylethylene
- Upper & lower tube: Aluminum
- 1st Stage flapper: Zinc
- 2nd Stage flapper: Acetal
- Guide Rod: Stainless Steel
• Certain devices are marketed as providing precision repeatability - allowing tank to be filled up to 99% capacity
  – 99% capacity is taken to represent the maximum allowable fill level that will satisfy the alternate rule requirements that no tank top fittings are wetted
The 61TNG operates using a venturi mechanism similar to an automatic gasoline nozzle. Product flow through a suction tube generates a vacuum that is initially supplied through a sensor tube that extends into the tank. The sensor tube is cut at the desired shut-off level. Once the product level reaches the tip of the sensor tube, the vacuum is redirected behind a diaphragm. Diaphragm movement, in turn, operates a cam that moves the poppet into the flow stream. The product flow then closes the valve. The valve remains closed until the head pressure is relieved. The shut-off process is repeated each time delivery into a full tank is attempted.
The Auto Limiter II® overfill protection system is an automatic shut-off valve designed to be installed in the 4” riser pipe of underground storage tanks with tight fill adaptor to reduce the flow by 90% at first stage (approximately 92% of tank capacity) and shut down the gravity flow at 95% tank capacity. It is designed to be installed in a spill containment manhole, which makes it unnecessary to break concrete or add a new manhole. The anodized cast aluminum valve body and aluminum drop tubes make the Auto Limiter II virtually maintenance free.

Features

- Faster deliveries with less restriction
- Can be set up to 99% of tank capacity
- Overfill protection at a field-set level
- Two stage flow shut down provides reduced line shock compared to competitive models:
  - First stage reduces flow by 90%
  - Second stage shuts off remaining 10%
- Models for both coaxial installations and dual point systems
- Accommodates all tank sizes
- Easy field installation without breaking concrete
- Enables manual stick gauging of tank after a complete shut-off

Size

Valve Body Length............18”/ 459mm
Upper Drop Tube Std....4” Dia. x 60” Long (102mm x 1.5m)
Lower Drop Tube Std... 4” Dia. x 96” Long (102mm x 2.4m)

Materials

Valve Body..................Aluminum
Floats......................Polyethylene
Upper & lower tube......Aluminum
1st Stage flapper........Zinc
2nd Stage flapper.......Acetal
Guide Rod...............Stainless Steel
HOW DO DROP TUBE DEVICES WORK?

All of these function as “two point” shut off devices

Initially, flow is restricted (point 1)

Subsequently, flow is shut off (point 2)

Some devices do this with one float, others two floats
Some devices do this with one valve. others two valves
HOW DO DROP TUBE DEVICES WORK?

1\textsuperscript{st} Stage “shut off” intended to relieve hydraulic shock should 2\textsuperscript{nd} stage shut off occur

No manufacturer recognizes these as restriction devices – Shut off devices only
# DROP TUBE SHUT OFF DEVICES

4 U.S. Manufacturers

<table>
<thead>
<tr>
<th>Manufacturer</th>
<th>Model</th>
<th>Part Numbers</th>
</tr>
</thead>
<tbody>
<tr>
<td>EBW</td>
<td>Auto Limiter II</td>
<td></td>
</tr>
<tr>
<td>Emco Wheaton</td>
<td>Guardian A1100</td>
<td></td>
</tr>
<tr>
<td>OPW</td>
<td>61-SO / 71-SO</td>
<td></td>
</tr>
<tr>
<td>Universal</td>
<td>Model 39</td>
<td></td>
</tr>
</tbody>
</table>
Manufacturers give “standard” installation instructions

Auto Limiter II®
Automatic Shutoff for USTs
Installation Instructions
490 Series

PEI RP-100 requires that these devices must be installed according to the manufacturers instructions
Where these devices actually shut off depends on where the installer actually cuts the drop tube and several other factors:

- specific gravity
- tank deflection
- tank tilt
What is the “standard” restriction point (R) and shut off point (SO)?

<table>
<thead>
<tr>
<th>EBW Auto Limiter II</th>
<th>Emco Wheaton Guardian A1100</th>
<th>OPW 61-SO / 71-SO</th>
<th>Universal Model 39</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1" alt="EBW Auto Limiter II" /></td>
<td><img src="image2" alt="Emco Wheaton Guardian A1100" /></td>
<td><img src="image3" alt="OPW 61-SO / 71-SO" /></td>
<td><img src="image4" alt="Universal Model 39" /></td>
</tr>
<tr>
<td>R = 92%</td>
<td>R = 93%?</td>
<td>R = 96%</td>
<td>R = ?</td>
</tr>
<tr>
<td>SO = 95%</td>
<td>SO = 95%</td>
<td>SO = 99%</td>
<td>SO = 95%</td>
</tr>
</tbody>
</table>
How can you tell which one you have?
How can you tell which one you have?

OPW 61-SO

Old Style

New Style
How can you tell which one you have?

EBW

EMCO WHEATON
EXAMPLE:

“TYPICAL” 10,000 GALLON STEEL TANK
8’ X 27’  Total Capacity = 10026 gallons

Two options to meet shut off rules

1) 95% = 9525 gallons = 86.5” (9.5” ullage)

2) 99% = 9926 gallons = 93” (3” ullage)
ASSEMBLY AND INSTALLATION INSTRUCTIONS FOR STANDARD TWO-POINT OPW 81-SC AND 61-SOM OVERFILL PREVENTION VALVES.

IMPORTANT:
Please read these assembly and installation instructions completely and carefully before starting.

Standard Two-Point Valves
GENERAL INSTRUCTIONS

The main 61SO valve normally closes when liquid level is within 8” of the top of the tank. (The actual shut-off points are a function of where the valve is positioned in the tank, which is determined by the length of the upper tube). A small bypass valve remains open to allow the delivery hose to drain at 5 gallons per minute. If the delivery truck valve is not closed after initial shut-off, the bypass valve will close when the liquid level is within 3” of the top of the tank.

3 inches ullage = 99% capacity
Shuts Off @ “Standard” 3 Inches

Tank is perfectly level

Does this meet the overfill prevention requirements?

A. 95% - NO
B. 99% - YES
What if the tank is tilted?

“Positive Tilt”

Overfill device installed on the low end of the tank
What if the tank is tilted?

“Negative Tilt”

Overfill device installed on the high end of the tank
How can tank tilt be determined?

Gage fuel level at both ends of the tank

Tilt = “Negative” 3 inches

STP end of tank

Fill end of tank

71 1/2”

68 1/2”
How can tank tilt be determined?

Gage fuel level at one end and the middle then double difference

Tilt = “Negative” 3 inches (70 – 68.5 = 1.5 x 2 = 3 inches)
How can tank tilt be determined?

Tank inclinometer
How can tank tilt be determined?

Transit Level
Shuts off @ “standard” 3 inches

Does this tank meet overfill prevention requirements?

A. 95% - NO

B. 99% – NO (ullage is less than 1% capacity)
DEVICE INSTALLED AT HIGH END OF TANK

3 inches Negative Tilt

Shuts off @ “standard” 3 inches

Potential for Hidden Overfill to Occur
What About Secondarily Contained Tanks?

300 degree wrap
= 6 inches ullage

Double-walled tank
8 foot diameter
300 degree wrap

Should overfill prevention requirements consider single-walled portion of secondarily contained tanks?
Overfill Prevention Device Shuts off @ 3 inches

Double-walled tank
8 foot diameter
300 degree wrap

Does this meet the overfill prevention requirements?
Yes?

Does this meet the secondary containment requirements?
No?
ARE WE EFFECTIVELY PREVENTING HIDDEN OVERFILLS?
OVERFILL RELEASES

• Many releases do not have a known source
• How many of these unknown sources could be from hidden overfills?
• Could hidden overfills explain unknown sources of MTBE releases?
• How many hidden overfill releases have occurred but have not been discovered yet?
12,000 gallon 8’ diameter tank

Actual Fuel Level
Approx 68 inches = 3000 gallons ullage

Stick Reading
50.5 inches = 5600 gallons ullage

“NEW” NESHAP STAGE 1 VAPOR RECOVERY RULES
So What Do We Do?

1. Status quo
2. Require that device be installed so that it meets either the 90% restriction or 95% shut off.
3. Allow alternatives (30 minute restriction or 99% shut off) only if tank tilt is documented.
4. Confirm that devices are installed during routine compliance inspections.
5. Require overfill device is periodically inspected and functionality confirmed.
STANDARD PROCEDURE NEEDED

PEI/RP1200

MISSISSIPPI DEPARTMENT OF ENVIRONMENTAL QUALITY

ANNUAL OVERFILL PREVENTION DEVICE INSPECTION

- This form may be utilized to document inspection of UST overfill prevention devices.
- Inspection of all overfill devices is required at least once every 12 months.
- In the absence of a recognized industry procedure or manufacturer’s recommended practice the “MDEQ Overfill Device Inspection Procedure” outlined below may be utilized.

<table>
<thead>
<tr>
<th>UST Facility</th>
<th>Person Conducting Inspection</th>
</tr>
</thead>
<tbody>
<tr>
<td>Facility Name</td>
<td>MDEQ Facility ID #</td>
</tr>
<tr>
<td>Physical Address</td>
<td>Company</td>
</tr>
<tr>
<td>City</td>
<td>State</td>
</tr>
<tr>
<td>City</td>
<td>State</td>
</tr>
<tr>
<td>County</td>
<td>Inspector’s Signature</td>
</tr>
<tr>
<td>Date</td>
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</tbody>
</table>

Overfill Prevention Device Inspection

- Type of Overfill Device
  - □ Ball Float Valve
  - □ Drop Tube Shutoff
  - □ Electronic Alarm

MDEQ Overfill Prevention Device Inspection Procedure

- **Ball Float Valve**
  1. Remove fitting/cap and visually confirm that ball float valve is present and in good condition.
  2. Ensure that ball float valve is at proper height within the tank (restricts flow at 90% tank capacity).
  3. Ensure all tank top fittings are in good condition and appear to be vapor tight.
  4. If there is any question about functionality, remove, inspect, and reinstall device (see note below).

- **Drop Tube Shutoff**
  1. Remove tank fill cap and visually confirm that drop tube shutoff device is present and not obstructed.
  2. Ensure that the drop tube shutoff is at proper height within the tank (shuts-off flow at 95% tank capacity).
  3. Ensure that tight-fill adapter on fill riser is in good condition.
  4. If there is any question about functionality, remove, inspect, and reinstall (see note below).

- **Electronic Alarm**
  1. Remove the electronic alarm device from the tank and visually inspect for damage or corrosion.
  2. Ensure the device functions correctly by causing an alarm condition (e.g. submerge in fluid).
  3. Reinstall the electronic alarm device in the tank (see note below) at the proper height within the tank.
  4. Ensure that alarm is audible and identifiable by the delivery person as an overfill alarm.

Note: MDEQ certification as a UST installer is required to install overfill prevention devices.

<table>
<thead>
<tr>
<th>Inspection Results for the Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tank ID (product stored)</td>
</tr>
<tr>
<td>Device present (yes/no)</td>
</tr>
<tr>
<td>In good condition (yes/no)</td>
</tr>
<tr>
<td>Set at correct height (yes/no)</td>
</tr>
<tr>
<td>Tank top fittings tight (yes/no)</td>
</tr>
<tr>
<td>Alarm audible (yes/no)</td>
</tr>
<tr>
<td>Inspection result (Pass/Fail)</td>
</tr>
<tr>
<td>Comments:</td>
</tr>
</tbody>
</table>

PRODUCED BY THE MISSISSIPPI DEPT. OF ENVIRONMENTAL QUALITY, OFFICE OF POLLUTION CONTROL, UST BRANCH
PO BOX 2201 JACKSON, MS 39225 PHONE (001) 901-0171 FAX (001) 901-0083 http://www.deq.state.ms.us 10/08
**MISSISSIPPI DEPARTMENT OF ENVIRONMENTAL QUALITY**

**ANNUAL OVERFILL PREVENTION DEVICE INSPECTION**

- **Type of UST Device**: DROP TUBE DEVICE
- **Device Status**: NOT ACCESSIBLE

---

**Inspection Results for the Year 2019**

<table>
<thead>
<tr>
<th>Device present (yes/no)</th>
<th>Inspect result (Pass/Fail)</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>Pass</td>
<td>All data sheets are stuck in fill pipes.</td>
</tr>
</tbody>
</table>

---

**Note:** MDDEQ certification as a UST installer is required to install overfill prevention devices.
MISSISSIPPI DEPARTMENT OF ENVIRONMENTAL QUALITY
ANNUAL OVERFILL PREVENTION DEVICE INSPECTION

This form may be utilized to document inspection of UST overfill prevention devices. Inspection of all overfill devices is required at least once every 12 months. In the absence of a recognized industry procedure or manufacturer's recommended practice the "MDEQ Overfill Prevention Device Inspection Procedure" outlined below may be utilized.

**Person Conducting Inspection**

Louisville Kiosk 12647  
Company: Ellis Enterprises, LLC  
City: Louisville  
State: MS  
County: Winston  
Date: 0-14-09

**Type of Overfill Device:** Ball Float Valve, Drop Tube Shut-off, Electronic Alarm

**MDEQ Overfill Prevention Device Inspection Procedure**

**Ball Float Valve**
1. Remove fitting cap and visually confirm that ball float valve is present and in good condition.
2. Ensure that ball float valve is at proper height within the tank (restricts flow at 95% tank capacity).
3. Ensure all tank top fittings are in good condition and appear to be vapor tight.
4. If there is any question about functionality, remove, inspect, and reinstate device (see note below).

**Drop Tube Shut-off**
1. Remove tank fitting and visually confirm that drop tube shut-off device is present and not obstructed.
2. Ensure that the drop tube shut-off is at proper height within the tank (shuts-off flow at 95% tank capacity).
3. Ensure that tarp/shovel rop/s in good condition.
4. If there is any question about functionality, remove, inspect, and reinstate (see note below).

**Electronic Alarm**
1. Remove the electronic alarm device from the tank and visually inspect for damage or corrosion.
2. Ensure the device functions correctly by causing an alarm condition (e.g., submerge in fluid).
3. Reinstall the electronic alarm device in the tank (see note below) at the proper height within the tank.
4. Ensure that alarm is audible and identifiable by the delivery person as an overfill alarm.

**Note:** MDEQ certification as a UST installer is required to install overfill prevention devices.

<table>
<thead>
<tr>
<th>Tank ID (product traded)</th>
<th>N/A</th>
<th>N/A</th>
<th>N/A</th>
<th>N/A</th>
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</thead>
<tbody>
<tr>
<td>Inspection Results for this Year</td>
<td>2009</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Device present (yes/no)</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>In good condition (yes/mo)</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Set at correct height (yes/mo)</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Tank tap fitting tight (yes/mo)</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Alarm audible (yes/no)</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Inspection result (Pass/Fail)</td>
<td>Fail</td>
<td>Fail</td>
<td>Fail</td>
<td>Fail</td>
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<tr>
<td>Comments: All Tanks Have 6&quot; Drop Tube and 14&quot;</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**ALL TANKS HAVE 6" DROP TUBE AND 14"**
MISSISSIPPI DEPARTMENT OF ENVIRONMENTAL QUALITY

ANNUAL OVERFILL PREVENTION DEVICE INSPECTION

- This form may be utilized to document inspection of UST overfill prevention device.
- Date of Inspection
- Inspection of all overfill devices is required at least once every 12 months.
- In the absence of a recognized industry standard or manufacturer's recommended practice, the "MDEQ Overfill Device Inspection Procedure" outlined below may be utilized.

Overfill Prevention Device Inspection

Type of Overfill Device: [ ] Ball Float Valve [ ] Drop Tube Shutoff [ ] Electronic Alarm

MDEQ Overfill Prevention Device Inspection Procedure

1. Remove fitting top and visually confirm that fill extent valve is present and in good condition.
2. Ensure that fill extent valve is at proper height within the tank (not restricted flow at 50% tank capacity).
3. Ensure all tank top fittings are in good condition and accessible to be vacuumed.
4. If there is any question about functionality, remove, inspect, and reinstall device (see note below).

Drop Tube Shutoff

1. Remove tank fill cap and visually confirm that drop tube shutoff device is present and not obstructed.
2. Ensure that the drop tube shutoff is at proper height within the tank ( shuts off flow at 50% tank capacity).
3. Ensure that light is on and is in good condition.
4. If there is any question about functionality, remove, inspect, and reinstall device (see note below).

Electronic Alarm:

1. Remove the electronic alarm device from the tank, and visually inspect for damage or corrosion.
2. Ensure the device functions properly by causing an alarm condition (e.g., submerge light fluid).
3. Reinstall the electronic alarm device in the tank (see note below). If not within height within the tank.
4. Ensure that alarm is not triggered and identifiable by the delivery person as a overfill alarm.

Note: MDEQ certification as a UST is needed to install overfill prevention devices.

Inspection Results for the Year

<table>
<thead>
<tr>
<th>Tank ID (product stored)</th>
<th>Reg</th>
<th>Prem</th>
<th>Diesel</th>
</tr>
</thead>
<tbody>
<tr>
<td>Device present (yes/no)</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>In good condition (yes/no)</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Set at correct height (yes/no)</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Tank top fittings in place (yes/no)</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Alarm activated (yes/no)</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
</tr>
</tbody>
</table>

Inspection result (Pass:Fail) | Fail/Pass from Regular Truck

Comments: 61-50 missing from Regular Truck

PRODUCED BY THE MISSISSIPPI DEPT. OF ENVIRONMENTAL QUALITY OFFICE OF POLLUTION CONTROL JUNE 2021
PO BOX 3261 JACKSON, MS 39205 PHONE (601) 496-2031 FAX (601) 496-2041 http://www.dq.state.ms.us 2011
Reason for Two Stage Shutoff - Hydraulic Hammer

Tremendous stress placed on delivery system when 400 gpm flow rate is suddenly interrupted
OTHER POTENTIAL ISSUES

- Aluminum compatibility with ethanol
- Long term performance of elastomeric seals
  - Compatibility
  - Mechanical Wear
- Effectiveness of 100% shutoff is questionable
Kevin Henderson
601-961-5283
Kevin_Henderson@deq.state.ms.us