

# Breakout Tanks: Design, Construction & Inspection (API Standard 650 Tanks)

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# Atmospheric and Low-Pressure Steel Above-Ground Breakout Tank Issues (API Standard 650 Tanks)

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# Typical Large Crude Breakout Tank



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# More Large Crude Breakout Tanks



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# Applicable PHMSA Regulations

Breakout tanks subject to 49 CFR Part 195 must comply with requirements that apply specifically to breakout tanks and, to the extent applicable, with requirements that apply to pipeline systems and pipeline facilities. If a conflict exists between a requirement that applies specifically to breakout tanks and a requirement that applies to pipeline systems or pipeline facilities, the requirement that applies specifically to breakout tanks prevails.

(49 CFR §195.1(c))



# Inspection Requirements

49 CFR §195.432(b)

“Each operator must inspect the physical integrity of in-service atmospheric and low-pressure steel above-ground breakout tanks according to **API Std 653** (except section 6.4.3, Alternative Internal Inspection Interval)”

“The risk- based internal inspection procedures in API Std 653, section 6.4.3 cannot be used to determine the internal inspection interval.”



# API Std 653

API Standard 653, “Tank Inspection, Repair, Alteration, and Reconstruction,” 3rd edition, December 2001, (including addendum 1 (September 2003), addendum 2 (November 2005), addendum 3 (February 2008), and errata (April 2008))

API 653 applies to steel storage tanks built to API 650 and its predecessor API 12C.

**BUT**



# API Std 650

API Standard 650, Welded Tanks for Oil Storage, 13th edition, March 2020, including Errata 1 (January 2021)

API 650 establishes minimum requirements for material, design, fabrication, erection, and testing for vertical, cylindrical, aboveground, closed- and open-top, welded storage tanks in various sizes and capacities for internal pressures approximating atmospheric pressure. . .  
(emphasis added)





# QUERIES

Does PHMSA apply API 653 to breakout tanks that are not welded?

You better believe it!!

Will the recent SCOTUS Chevron ruling regarding agency deference make any difference?

Do you believe in fairy tales?



# Definition

***Breakout tank*** means a tank used to:

- (a) relieve surges in a hazardous liquid pipeline system **or**
- (b) receive and store hazardous liquid transported by a pipeline for reinjection and continued transportation by pipeline.

(49 CFR §195.2)



# Surge Protection

Any tank directly connected to a pipeline that is jurisdictional under 49 CFR Part 195 will almost certainly be considered a form of surge protection and therefore a breakout tank.

The direction of flow in the pipeline does not matter.



# Receipt and Storage Tanks

Tanks that receive and store hazardous liquid transported by a pipeline for reinjection and continued transportation by pipeline are breakout tanks.

Translation: If a molecule of hazardous liquid in a tank has ever moved through a jurisdictional pipeline and could ever again move through a jurisdictional pipeline, that tank is a breakout tank.

“Daisy Chaining” will not exempt interconnected tanks.



# Interconnected Tanks

Some operators have tried to avoid breakout tank regulations by designating a single tank connected to one or more jurisdictional pipelines as a breakout tank and one or more other interconnected tanks as process or terminal tanks not subject regulation under Part 195.

If the contents of any of the interconnected tanks can ever reach (i.e., return to) the “designated” breakout tank, all the interconnected tanks will be considered breakout tanks.



# “Idle” Tanks

If a tank ever has been used as a breakout tank, unless it has been abandoned under 49 CFR §195.59, it is still subject to all the breakout tank requirements contained in Part 195.

If a tank has never been used as a breakout tank but is connected such that it COULD be used as a breakout tank, it is ALSO subject to all the breakout tank requirements contained in Part 195.



# API Std 653

API 653 requires breakout tank performed by certified (“Authorized”) inspectors.

Certification requires passing a two-part exam based on API’s 653 “Body Of Knowledge.” A 348 page “quick guide” to the API syllabus is available at [www.matthews-training.co.uk](http://www.matthews-training.co.uk).

Authorized Inspectors must be recertified at least once every 3 years.

Let’s just say API 653 inspections are incredibly complex!!



# API Std 653 Ten Essential Elements

1. External Inspection	6. Cathodic Protection Inspection
2. Internal Inspection	7. Environmental Considerations
3. Thickness Measurements	8. Documentation & Record Keeping
4. Non-Destructive Testing (NDT)	9. Risk Assessment
5. Soil & Foundation Evaluation	10. Reporting & Recommendations





# External Inspection (§195.573(d))

You must inspect each cathodic protection system used to control corrosion on the bottom of an aboveground breakout tank to ensure that operation and maintenance of the system are in accordance with API RP 651.

**BUT**

If you can document in your §195.402(c)(3) O&M Manual that the API RP 651 corrosion inspection requirements are not necessary for the safety of the tank, you can use alternative methods.

**GOOD LUCK WITH THAT!!**



# API Std 653 - External Inspection

API 653 section 6.3.2 requires a visual in-service external inspection by an API Std 653 Authorized Inspector. The interval shall be the lesser of:

- i. At least every 5 years or
- ii. At a time period equal to one quarter the measured shell thickness less the required shell thickness (RCA) divided by the corrosion rate in mils per year (N).
- iii. Insulation only needs to be removed to the extent necessary to determine the condition of the tank walls or roof.



# API Std 653 - External Inspection

API Std 653 External Inspection involves a thorough visual examination of the tank's external components, including the shell, roof, and foundation.

Signs of corrosion, pitting, dents, bulges, leaks, and other damage that may compromise structural integrity must be investigated and corrected.



# Internal Inspection (§195.432(b))

Each operator must inspect the physical integrity of in-service atmospheric and low-pressure steel above-ground breakout tanks according to API Std 653 (except section 6.4.3, Alternative Internal Inspection Interval).

**BUT**

If you can document in your §195.402(c)(3) O&M Manual that the API RP 651 tank bottom inspection requirements are not necessary for the safety of the tank, you can use alternative methods.

**GOOD LUCK WITH THAT!!**



# Internal Inspection (§195.432(b))

Internal inspections are conducted to assess the condition of the tank's internal components, such as the bottom, floor, welds, and appurtenances.

If the tank is out of service, this should include entering the tank and using equipment to inspect surfaces for corrosion, cracking, or other defects.



# Internal Inspection (§195.432(b))

API 653 section 6.4 requires an out-of-service internal inspection, by an API Std 653 Authorized Inspector. The interval shall be the lesser of:

- i. If the corrosion rate is known based on actual measurements or similar service condition, the interval shall be set to insure the bottom plate minimum thickness at the next inspection is not less than the values listed in table 6.1 of API 653. The interval shall not exceed 20 years.

(PHMSA Enforcement Guidance)



# API Std 653 - Internal Inspection

Internal inspections are conducted to assess the condition of the tank's internal components, such as the bottom, floor, welds, and appurtenances. This may include entering the tank and using equipment to inspect surfaces for corrosion, cracking, or other defects.

The interval from initial service date (or refurbishment date) until the first internal inspection shall not exceed 10 years unless a tank has one or more of the leak prevention, detection, corrosion mitigation or containment safeguards listed in Table 6.1. (Worth looking into!)



# API Std 653 – Risk-Based Internal Inspection

The interval from initial service date (or refurbishment date) until the first internal inspection may also be extended using risk-based inspection (RBI) procedures in accordance with API RP 580 **IF** the “RBI assessment [is] performed by a team including inspection and engineering expertise knowledgeable in the proper application of API RP 580 principles, tank design, construction and modes of deterioration.”

Comment: PHMSA does NOT appear to be enthusiastic with respect to RBI procedures for breakout tanks.



# API Std 653 – Risk-Based Internal Inspection

There are several limitations:

- i. Documentation is especially critical – particularly with respect to all factors contributing to both likelihood and consequence of tank leakage or failure.
- ii. All the key elements defined in API 580 must be addressed.
- iii. Corrosion rates from low inspection effectiveness such as spot UT shall not be used in the RBI process.
- iv. A tank shall be removed from service when the risk exceeds the acceptable risk criteria established per the owner-user procedure.

API does NOT recommend running tank bottoms to failure. or operating tanks indefinitely with known or suspected bottom leaks.

# Thickness Measurements

49 CFR Part 195 does not particularly focus on thickness measurements as related to breakout tanks. If the accuracy can be documented, any thickness measurement should be acceptable.

API 653, however, appears to encourage the use of ultrasonic techniques to determine the thickness of the tank's shell, bottom, and roof plates. Caveat – document that an adequate number of measurements have been taken at locations potentially at greatest risk.

# Non-Destructive Testing (NDT)

49 CFR Part 195 does not particularly focus on NDT as related to breakout tanks. If the accuracy can be documented, any non-destructive testing techniques should be acceptable.

API 653 recognizes NDT techniques, such as magnetic particle testing, radiography, and dye penetrant testing, as useful to detect defects in welds, seams, and other critical areas without causing damage to the tank. Caveat – document that an adequate number locations have been evaluated.

# Soil and Foundation Evaluation

49 CFR Part 195 does not particularly focus on soil and foundation issues as related to breakout tanks. If the original design adequately considered soil and foundation issues and no significant changes have occurred, an inspector should accept documentation to that effect.

An API 653 inspector, however, should include a current assessment of the tank's foundation and surrounding soil conditions to ensure stability and prevent issues such as settlement or corrosion due to soil interaction.

# Cathodic Protection Inspection (§195.563)

§195.563(a): “Each buried or submerged pipeline that is constructed, relocated, replaced, or otherwise changed after the applicable date in §195.401(c) must have cathodic protection. The cathodic protection must be in operation not later than 1 year after the pipeline is constructed, relocated, replaced, or otherwise changed, as applicable.”

§195.563(d): “Bare pipelines, **breakout tank areas**, and buried pumping station piping must have cathodic protection in places where regulations in effect before January 28, 2002 required cathodic protection as a result of electrical inspections.”

# Cathodic Protection Inspection (§195.565)

§195.565: . . . cathodic protection [installed] under §195.563(a) to protect the bottom of an aboveground breakout tank of more than 500 barrels . . . capacity built to . . . API Std 620,. . . must [be installed] in accordance with API RP 651.

**However**, you don't need to comply with API RP 651 when installing any tank for which you note in the corrosion control procedures established under §195.402(c)(3) [your O&M Manual] why complying with all or certain provisions of API RP 651 is not necessary for the safety of the tank.

# Cathodic Protection Inspection (Part 195 Subpart H)

Do NOT forget about §195.1(c): Breakout tanks. Breakout tanks subject to this Part [195] must comply with requirements that apply specifically to breakout tanks and, to the extent applicable, with requirements that apply to pipeline systems and pipeline facilities. If a conflict exists between a requirement that applies specifically to breakout tanks and a requirement that applies to pipeline systems or pipeline facilities, the requirement that applies specifically to breakout tanks prevails.

For purposes of corrosion, breakout tanks are just like any other pipeline – buried or not.

# API Std 653 - Cathodic Protection Inspection

API 653 is far more specific with respect to cathodic protection of portions of breakout tanks in contact with the soil (i.e., tank bottoms).

API 653 states that “A selection basis for cathodic protection systems is covered by API 651.”

Further discussion of API Std 653 cathodic protection requirements is beyond the scope of this presentation.



# Environmental Considerations (Part 195)

There is very little in 49 CFR Part 195 regarding environmental considerations specific to breakout tanks.

However, environmental considerations are inherent in §195.452 pipeline integrity management in high consequence areas.

A basic requirement of the pipeline safety regulations is protection of people, property, and the environment.

# Environmental Considerations

From PHMSA's Liquid Integrity Management Rule Frequently Asked Questions:

2.1 Does the [Liquid IMP] rule apply to more than line pipe?

Yes. The continual evaluation and information analysis requirements of the rule apply to pipelines as defined in 49 CFR 195.2. This includes, but is not limited to, line pipe, valves and other appurtenances connected to line pipe, metering and delivery stations, pump stations, storage field facilities, **and breakout tanks**. The baseline integrity assessment and periodic re-assessment requirements apply only to line pipe. (emphasis added)

# Environmental Considerations (Part 195)

Risks associated with breakout tanks that could affect a §195.450 high consequence area must be evaluated and considered as part of your Hazardous Liquid Integrity Management Program. (§195.452(a))

Such risks include, but are not limited to, product transported (highly volatile, highly flammable and toxic liquids present a greater threat for both people and the environment) and location related to potential ground movement (e.g., seismic faults, rock quarries, and coal mines); climatic (permafrost causes settlement - Alaska); geologic (landslides or subsidence)

# API 653 Environmental Considerations

API 653 inspections must consider environmental factors that may impact the tank, such as exposure to harsh weather conditions, seismic activity, and proximity to water bodies or sensitive ecosystems.

An adequate API 653 inspection should document the original environmental considerations as well as the presence or absence of any changed conditions.

# Documentation and Record Keeping

**MUST BE TRACEABLE, VERIFIABLE AND COMPLETE!!**

Cite all potentially applicable codes and/or industry standards.

If not applicable, document why not applicable. If using an alternate form of compliance, document what is being done and why it provides an equal or better level of protection.

Keep all records for the life of the facility!!

# Risk Assessment

49 CFR Part 195 requires risk assessment as part of integrity management. PHMSA requires operators to “connect the dots.” If you have an issue with any asset, you are expected to address that same issue with every other similar asset in your system – IMP or non-IMP.

API 653 mentions risk over 20 times.

Agency inspector can be VERY CREATIVE in identifying risks – real or imagined. BE PREPARED. If a risk or a threat is mentioned in Part 195 or API 653, address it and DOCUMENT!!

# Reporting and Recommendations

API 653 Certified Inspectors are required to provide written reports (see section 6.9). PHMSA inspectors will typically not provide written reports UNLESS an enforcement action results.

KEEP COPIES of all API 653 inspection reports and FOLLOW UP with respect to any concerns or recommendations.

Return-to-service documentation is especially important.

# PHMSA Inspection Protocol Questions

(Screening)

TDC - New Breakout Tanks (API 650) - Regulatory Requirements	1. New Breakout Tanks (API 650 Atmospheric) Are any new aboveground atmospheric (API 650) breakout tank(s) being planned/constructed?
TDC - New Breakout Tanks (API 620 Low Pressure) - Regulatory Requirements	1. New Breakout Tanks (API 620 Low Pressure) Are any new low pressure (API 620) breakout tank(s) being planned/constructed?



# PHMSA Inspection Protocol Questions

(Screening)

TDC - New Breakout Tanks (API 2510 High Pressure)	1. New Breakout Tanks (API 2510 High Pressure) Are any new high pressure (API 2510) breakout tank(s) being planned/constructed?
TDC - New Breakout Tanks (API 12F Shop-Fabricated)	1. New Breakout Tanks (API 12F Shop-Fabricated) Are any new shop fabricated (API Spec 12F) breakout tank(s) being planned/constructed?

# PHMSA Inspection Protocol Questions

(Screening)

<p>TDC - New Tank Piping - Construction</p>	<p>1. New Tank Piping - Construction What new tank piping, manifolds, and other related piping are being planned in conjunction with any new breakout tank(s) construction?</p>
<p>FS - Tanks and Storage - Inspection</p>	<p>1. Tanks and Storage - Inspection What are the types of breakout tank deficiencies that have been found as a result of inspections over the last 5 years?</p>

# PHMSA Inspection Protocol Questions

(Screening)

FS - Tanks and Storage	2. Tank Overfill Protection What is the process for ensuring that breakout tank overfill protection, safety devices, and emergency shutdowns are installed where needed and inspected?
FS - Tanks and Storage	3. Pressurized Breakout Tanks Where there are pressurized breakout tanks containing highly volatile liquids (HVLs), how are these treated differently?

# PHMSA Inspection Protocol Questions

(Screening)

TD - External Corrosion - Breakout Tank Cathodic Protection	1. External Corrosion - Breakout Tanks Have there been tank repairs, or any tank floors replaced, due to external corrosion in the last 5 years?
TD - Internal Corrosion - Preventive Measures	1. Internal Corrosion - Preventive Measures What, if any, internal corrosion issues have been discovered, including breakout tank bottoms, in the last 5 years?

# PHMSA Inspection Protocol Questions

(API 653)

<p>New API 650 Tanks - Part 195 Requirements Procedure</p>	<p>7. Breakout Tank Repair, Alteration, and Reconstruction Are breakout tanks required to be repaired, altered, or reconstructed in compliance with the requirements of 195.205(b)(1)?</p>
<p>New API 650 Tanks - Part 195 Requirements Field Observation</p>	<p>8. Breakout Tank Repair, Alteration, and Reconstruction Do field observations confirm breakout tanks are being repaired, altered, or reconstructed in compliance with the requirements of 195.205(b)(1)?</p>

# PHMSA Inspection Protocol Questions

(API 653)

<p>New API 620 Tanks (Low Pressure) - Part 195 Requirements Procedures</p>	<p>1. Breakout Tank Inspection - Non-Standard Tanks In-Service For breakout tanks not being inspected to API 653 or API 510, does the process describe the interval and method for performing tank inspections?</p>
<p>Tanks and Storage – Inspection Records</p>	<p>2. Breakout Tank Inspection - Non-Standard Tanks In-Service For breakout tanks not being inspected to API 653 or API 510, do the records verify the interval and method used for performing tank inspections?</p>

# PHMSA Inspection Protocol Questions

(API 653)

<p>Tanks and Storage – Inspection Records</p>	<p>6. Breakout Tank Inspection - External In-Service Do records document that steel atmospheric or low pressure breakout tanks have received API 653 external inspections at the required intervals and that deficiencies documented during inspections have been corrected within a reasonable time frame?</p>
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# PHMSA Inspection Protocol Questions

(API 653)

<p>Tanks and Storage – Inspection Procedures</p>	<p>7. Breakout Tank Inspection - External UT Does the process describe the interval and method for performing external, ultrasonic shell thickness inspections of breakout tanks that are steel (atmospheric or low pressure) tanks in accordance with API 653, Section 6.3.3?</p>
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# PHMSA Inspection Protocol Questions

(API 653)

<p>Tanks and Storage – Inspection Records</p>	<p>8. Breakout Tank Inspection - External UT Do records document that steel atmospheric or low pressure breakout tanks have received ultrasonic shell thickness inspections, in accordance with API 653, at the required intervals and that deficiencies found during inspections have been documented?</p>
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# PHMSA Inspection Protocol Questions

(API 653)

<p>Tanks and Storage – Inspection Procedures</p>	<p>9. Breakout Tank Inspection - Internal (Out of Service) Does the process describe the interval and method for performing internal (out of service) inspections of breakout tanks that are steel (atmospheric or low pressure) tanks in accordance with API 653, Section 6.4?</p>
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# PHMSA Inspection Protocol Questions

(API 653)

<p>Tanks and Storage – Inspection Procedures</p>	<p>11. Breakout Tank Inspection - Records (Sect. 6.8) Does the operator's process require that all tank construction records, inspection history and repair/alteration history is maintained for the life of the tank?</p>
<p>Tanks and Storage – Inspection Records</p>	<p>12. Breakout Tank Inspection - Records (Sect. 6.8) Does the operator have all of the construction records, inspection history, and repair/alteration history associated with each breakout tank?</p>

# PHMSA Inspection Protocol Questions

(API 653)

<p>Tanks and Storage – Inspection Procedures</p>	<p>13. Breakout Tank Inspection - Reports (Sect. 6.9) Does the operator's process require that all Reports required by API 653 certified inspectors, the repair recommendations, and the disposition of the recommendations are to be maintained for the life of the tank?</p>
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# PHMSA Inspection Protocol Questions

(API 653)

<p>Tanks and Storage – Inspection Records</p>	<p>14. Breakout Tank Inspection - Reports (Sect. 6.9) Does the operator have all of the inspection reports, repair recommendations, and repair/alteration history associated with each breakout tank?</p>
<p>Tanks and Storage Observation (Field)</p>	<p>11. Tank Condition Inspection - Observations Do field observations indicate the condition of the breakout tank(s) is acceptable?</p>

# PHMSA Inspection Protocol Questions

(API 653)

Tanks and Storage Observation (Field)	11. Tank Condition Inspection - Observations Do field observations indicate the condition of the breakout tank(s) is acceptable?
Tanks and Storage – Procedure	18. Breakout Tank Pressure Testing After Repair, Alteration For all breakout tanks that have been repaired, altered, or reconstructed, have written test procedures been developed for testing?

# PHMSA Inspection Protocol Questions

(Summary)

There are 10 Screening Protocol Questions.

There are 15 Protocol Questions that specifically mention API 653.

There are 111 other Protocol Questions that include the words  
“Breakout Tank.”

<https://www.phmsa.dot.gov/forms/pipeline-compliance-forms>

(The January 2024 PHMSA Hazardous Liquid IA Question set is 221 pages in MS Word format)

# PHMSA Enforcement (General)

1. Usually plenty of notice.
2. Screening, Procedure (Process) Review, Records Review, Observations.
3. Exit Interview
4. Wait
5. Appeal



# PHMSA Enforcement (API 653)

(2002 through June 2024)

- 520 actions contained the word “breakout”
- 181 contained the words “API 653” and “Breakout”
- 128 contained the words “195.432”, “API 653” and “Breakout”
- Only 48 resulted in civil penalties
- Only 17 of the 48 with civil penalties had civil penalties attributed to a violation of §195.432

# PHMSA Enforcement (API 653)

(2002 through June 2024)

- §195.432 *Inspection of in-service breakout tanks* was the most often code section cited regarding breakout tanks (largest civil penalty - \$302,200 associated with a spill. One of \$102,900, numerous ~\$50,000)
- §195.132 *Design and construction of aboveground breakout tanks* was cited in 20 cases with only 4 civil penalties proposed and assessed (one of \$616,200 and one of \$297,200)
- Civil penalties associated with other breakout tank requirements were less numerous and less costly.

# PHMSA Enforcement (API 653)

## Comments

1. PHMSA civil penalties are significant but do not consider the cost of repairs and/or correction.
2. Even if there are no civil penalties, any enforcement action will result in future scrutiny and may be used to enhance future civil penalties.
3. It often takes years before an enforcement action is communicated to the operator and the resources necessary to deal with an enforcement action can be substantial.

# PHMSA Enforcement (API 653)

4. It is critical that your §195.402 O&M manual adequately addresses all issues associated with your breakout tanks. If your O&M manual does not, you could be cited for a §195.402 violation as well as the underlying code violations.
5. If your §195.402 O&M manual goes beyond the code, you **MUST** meet your §195.402 O&M manual requirements or you may get cited.
6. Inspectors are not allowed to “read between the lines.” Keep it as simple as possible.
7. **DOCUMENTATION IS CRITICAL!!** If it isn’t documented, it **DID NOT HAPPEN!!**

# Response Plans for Onshore Oil Pipelines (49 CFR Part 194)

Part 194 only applies to oil pipelines.

*Pipeline* means all parts of an onshore pipeline facility through which oil moves including, but not limited to, line pipe, valves, and other appurtenances connected to line pipe, pumping units, fabricated assemblies associated with pumping units, metering and delivery stations and fabricated assemblies therein, and breakout tanks. (emphasis added)

*Oil* means oil of any kind or in any form, including, but not limited to, petroleum, fuel oil, vegetable oil, animal oil, sludge, oil refuse, oil mixed with wastes other than dredged spoil.

# Response Plans for Onshore Oil Pipelines (49 CFR Part 194)

Part 194 applies to an operator of an onshore oil pipeline that, because of its location, could reasonably be expected to cause substantial harm, or significant and substantial harm to the environment by discharging oil into or on any navigable waters of the United States or adjoining shorelines. Emphasis added)

# Response Plans for Onshore Oil Pipelines (49 CFR Part 194)

## 49 CFR 194.105 Worst Case Discharge

(b)(4) Operators may claim prevention credits for breakout tank secondary containment and other specific spill prevention measures as follows: (next slide)

# Response Plans for Onshore Oil Pipelines (49 CFR Part 194)

Prevention measure	Standard	Credit (percent)
Secondary containment > 100%	NFPA 30	50
Built/repaired to API standards.	API STD 620/650/653	10
Overfill protection standards.	API RP 2350	5
Testing/cathodic protection.	API STD 650/651/653	5
Tertiary containment/drainage/treatment	NFPA 30	5
Maximum allowable credit.	-	75



# Response Plans for Onshore Oil Pipelines (49 CFR Part 194)

49 CFR §194.105 Worst Case Discharge was mentioned in only four enforcement actions and no civil penalties were assessed based on §194.105.

# EPA and OSHA

If you have a release into the environment or an injury associated with maintaining a breakout tank, you will most likely end up dealing with state and/or federal environmental authorities and employee safety issues.

# Bottom Line

If you recognize the possibility that you might have breakout tanks, you probably do.

Is it worth the effort to try to convince PHMSA (or PHMSA's state agent) that you have OSHA PSM tanks or just admit that you have 49 CFR Part 195 breakout tanks and deal with it?

The choice is yours.

# Questions?



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