

**AFPM & API
ADVANCING
PROCESS SAFETY**

**ANSI API RP-754
Quarterly Webinar**

February 28, 2017

*Process Safety Performance
Indicators for the Refining and
Petrochemical Industries*



Purpose of RP 754 Quarterly Webinars

- To support broad adoption of RP-754 (2nd Edition) throughout the Refining and Petrochemical industries
- To ensure consistency in Tier 1 and 2 metrics reporting in order to establish credibility and validity
- To share learning's regarding the effective implementation of Tier 1-4 lagging/leading metrics

Today's Agenda

1. Event Entry Descriptions: The good, the bad and the ugly.
2. Severity Weighting
3. PSE Example Discussion
4. Remaining 2017 Webinar Dates

Event Entry Descriptions: The good, the bad and the ugly

- There is a wide range of level of detail of information submitted. The more detail the better. Does not hurt to have 'too much'.
- Additional detail helps in our QA/QC process.
- What happened?
 - ✓ Describe the LOPC.
- Why?
 - ✓ Describe the cause.
- Impact?
 - ✓ Describe the resulting impact.

Event Entry Descriptions: The good, the bad and the ugly

Event descriptions that are not very helpful:

- Pipe leak
- Tank 143 overfill
- Fire on Pump P-56
- H₂S release

Event Entry Descriptions: The good, the bad and the ugly

Better, but still with questions:

- 1" bleeder broken on exchanger head resulting in an LPG release.
 - What caused the break?
 - How much was released?
 - What was the impact?
- Tank overfill due to failure of level instrumentation.
 - Multiple instrument failure?
 - What was released and how much?
- What was the impact?

Event Entry Descriptions: The good, the bad and the ugly

Even Better

- 900 lbs of LPG released due to pipe vibration during startup that caused a crack on a 1” bleeder line that had been used for additional instrumentation during startup. No injuries.
- Caustic tank was overfilled during truck off-loading due to faulty level instrument with no additional instrumentation to verify level. 150 gallons released into diked area. No injuries.

API RP 754 Section 5.4: Tier 1 PSE Severity Weighting (Highly Encouraged)

Tier 1 severity weighting can provide additional useful information that may help drive performance improvement.

Severity consequence categories:

- Safety/Human Health
 - Direct Cost from Fire/Explosion
 - Material Release Within Any 1-Hr Period
 - Community Impact
 - Off-Site Environmental Impact
- There is no implied equating of consequences from one category to the next. Nor is there intended or implied value judgment that a Tier 1 PSE with a higher score is “worse” than another with a lower severity score.
 - May be useful in communicating a relative differentiation between one Tier 1 PSE and another, internally within the Company.
 - May be useful in directing risk reduction where it may have a larger impact.
 - May allow better communication with the public in the future. (If as an industry it is decided to use it.)

Annex D

Table D.1 -- Tier 1 Process Safety Event Severity Weighting

Severity Points	Consequence Categories				
	Safety/Human Health ^a	Direct Cost from Fire or Explosion	Material Release Within Any 1-Hr Period ^b	Community Impact	Off-Site Environmental Impact ^{a, c}
1 point	<ul style="list-style-type: none"> Injury requiring treatment beyond first aid to an employee, contractor, or subcontractor. (Meets the definition of a US OSHA recordable injury.) 	<ul style="list-style-type: none"> Resulting in $\\$100,000 \leq$ Direct Cost Damage $< \\$1,000,000$. 	<ul style="list-style-type: none"> Release volume $1x \leq$ Tier 1 TQ $< 3x$ outside of secondary containment. 	<ul style="list-style-type: none"> Officially declared shelter-in-place or public protective measures (e.g., road closure) for < 3 hours, or Officially declared evacuation < 3 hours. 	<ul style="list-style-type: none"> Resulting in $\\$100,000 \leq$ Acute Environmental Cost $< \\$1,000,000$.
3 points	<ul style="list-style-type: none"> Days Away From Work injury to an employee, contractor, or subcontractor, or Injury requiring treatment beyond first aid to a third party. 	<ul style="list-style-type: none"> Resulting in $\\$1,000,000 \leq$ Direct Cost Damage $< \\$10,000,000$. 	<ul style="list-style-type: none"> Release volume $3x \leq$ Tier 1 TQ $< 9x$ outside of secondary containment. 	<ul style="list-style-type: none"> Officially declared shelter-in-place or public protective measures (e.g., road closure) for > 3 hours, or Officially declared evacuation > 3 hours < 24 hours. 	<ul style="list-style-type: none"> Resulting in $\\$1,000,000 \leq$ Acute Environmental Cost $< \\$10,000,000$, or Small-scale injury or death of aquatic or land-based wildlife.
9 points	<ul style="list-style-type: none"> A fatality of an employee, contractor, or subcontractor, or A hospital admission of a third party. 	<ul style="list-style-type: none"> Resulting in $\\$10,000,000 \leq$ Direct Cost Damage $< \\$100,000,000$. 	<ul style="list-style-type: none"> Release volume $9x \leq$ Tier 1 TQ $< 27x$ outside of secondary containment. 	<ul style="list-style-type: none"> Officially declared evacuation > 24 hours < 48 hours. 	<ul style="list-style-type: none"> Resulting in $\\$10,000,000 \leq$ Acute Environmental Cost $< \\$100,000,000$, or Medium-scale injury or death of aquatic or land-based wildlife.
27 points	<ul style="list-style-type: none"> Multiple fatalities of employees, contractors, or subcontractors, or Multiple hospital admission of third parties, or A fatality of a third party. 	<ul style="list-style-type: none"> Resulting in $\geq \\$100,000,000$ of direct cost damages. 	<ul style="list-style-type: none"> Release volume $\geq 27x$ Tier 1 TQ outside of secondary containment. 	<ul style="list-style-type: none"> Officially declared evacuation > 48 hours. 	<ul style="list-style-type: none"> Resulting in $\geq \\$100,000,000$ of Acute Environmental Costs, or Large-scale injury or death of aquatic or land-based wildlife

Increasing Severity

PSE Tier 1 Severity: Example 1

- During startup following a maintenance outage, a distillation column was overfilled resulting in a release of 1,200 bbls of flammable liquid (Flash Point < 23°C)* in six minutes from an atmospheric relief device. The liquid release formed a flammable cloud which exploded killing 8 people, injured 47 people, and caused \$200 M in damage. A shelter-in-place order was issued for the nearby community for 2 hours. * T1 Threshold Quantity is 7 bbl.

Table D.1 – Tier 1 Process Safety Event Severity Weighting

Severity Points	Consequence Categories				
	Safety/Human Health ^a	Direct Cost from Fire or Explosion	Material Release Within Any 1-Hr Period ^b	Community Impact	Off-Site Environmental Impact ^{a,c}
1 point	<ul style="list-style-type: none"> Injury requiring treatment beyond first aid to an employee, contractor, or subcontractor. (Meets the definition of a US OSHA recordable injury.) 	<ul style="list-style-type: none"> Resulting in \$100,000 ≤ Direct Cost Damage < \$1,000,000. 	<ul style="list-style-type: none"> Release volume 1x ≤ Tier 1 TQ < 3x outside of secondary containment. 	<ul style="list-style-type: none"> Officially declared shelter-in-place or public protective measures (e.g., road closure) for < 3 hours, or Officially declared evacuation < 3 hours. 	<ul style="list-style-type: none"> Resulting in \$100,000 ≤ Acute Environmental Cost < \$1,000,000.
3 points	<ul style="list-style-type: none"> Days Away From Work injury to an employee, contractor, or subcontractor, or Injury requiring treatment beyond first aid to a third party. 	<ul style="list-style-type: none"> Resulting in \$1,000,000 ≤ Direct Cost Damage < \$10,000,000. 	<ul style="list-style-type: none"> Release volume 3x ≤ Tier 1 TQ < 9x outside of secondary containment. 	<ul style="list-style-type: none"> Officially declared shelter-in-place or public protective measures (e.g., road closure) for > 3 hours, or Officially declared evacuation > 3 hours < 24 hours. 	<ul style="list-style-type: none"> Resulting in \$1,000,000 ≤ Acute Environmental Cost < \$10,000,000, or Small-scale injury or death of aquatic or land-based wildlife.
9 points	<ul style="list-style-type: none"> A fatality of an employee, contractor, or subcontractor, or A hospital admission of a third party. 	<ul style="list-style-type: none"> Resulting in \$10,000,000 ≤ Direct Cost Damage < \$100,000,000. 	<ul style="list-style-type: none"> Release volume 9x ≤ Tier 1 TQ < 27x outside of secondary containment. 	<ul style="list-style-type: none"> Officially declared evacuation > 24 hours < 48 hours. 	<ul style="list-style-type: none"> Resulting in \$10,000,000 ≤ Acute Environmental Cost < \$100,000,000, or Medium-scale injury or death of aquatic or land-based wildlife.
27 points	<ul style="list-style-type: none"> Multiple fatalities of employees, contractors, or subcontractors, or Multiple hospital admission of third parties, or A fatality of a third party. 	<ul style="list-style-type: none"> Resulting in ≥ \$100,000,000 of direct cost damages. 	<ul style="list-style-type: none"> Release volume ≥ 27x Tier 1 TQ outside of secondary containment. 	<ul style="list-style-type: none"> Officially declared evacuation > 48 hours. 	<ul style="list-style-type: none"> Resulting in ≥ \$100,000,000 of Acute Environmental Costs, or Large-scale injury or death of aquatic or land-based wildlife.

PSE Tier 1 Severity: Example 1

- During startup following a maintenance outage, a distillation column was overfilled resulting in a release of 1,200 bbls of flammable liquid (Flash Point < 23°C)* in six minutes from an atmospheric relief device. The liquid release formed a flammable cloud which exploded killing 8 people, injured 47 people, and caused \$200 M in damage. A shelter-in-place order was issued for the nearby community for 2 hours. * T1 Threshold Quantity is 7 bbl.

Example PSE Severity Weight		
Safety/Human Health	Multiple Fatalities	27 Points
Direct Cost	\$200 M	27 Points
Material Release	≥ 27x Tier 1 TQ	27 Points
Community Impact	Shelter-in-Place < 3 hours	1 Point
Off-Site Environmental Impact	No Environmental Impact	0 Points
Tier 1 PSE Severity Weight Total		82 Points

PSE Severity Weight = 27 + 27 + 27 + 1 + 0 = 82 Points.

PSE Example

There is a heat exchanger with ethylene on the tube side and water on the shell. There is a safety valve on the shell which is designed to protect the shell from over pressuring in the event of a tube rupture. The safety valve discharge is routed to the atmosphere via a high discharge point, such that dispersion modeling indicates that it is a “safe location”.

- A tube ruptures and the valve relieves. The ethylene is dispersed, and consequences 2-4 do not occur.
- However, water is carried along with the ethylene and the water “rains out”. The water is cool/ambient and there is no risk of thermal burns to personnel.

Question: If the material which “rains out” as a result of a relief system discharge is non-hazardous (water in this scenario), does that invalidate this exemption such that the event must be reported as a T1 (or T2) PSE?

RP-754 language

An engineered pressure relief (e.g. PRD, SIS, or manually initiated emergency depressure) discharge, of a quantity greater than or equal to the threshold quantities in Table 1 [or 2] in any one-hour period, to atmosphere whether directly or via a downstream destructive device that results in one or more of the following four consequences:

1. Rainout
2. Discharge to a potentially unsafe location
3. An on-site shelter in place or on-site evacuation, excluding on-site shelter in place or site evacuation
4. Public protective measures (e.g. road closure) including precautionary public protective measures

PSE Example

Response:

- The release of the ethylene from the tube side to the shell side is an LOPC, so now, review the criteria that can cause it to be a Tier 1 or Tier 2.
- The release of the ethylene from the safety valve on the shell does not result in any of the four consequences associated with release from an engineering pressure relief, and therefore it is not a Tier 1 or a Tier 2. (It is important to note that in order to be a Tier 1 or a Tier 2, there would have to be one of the four consequences, and, it would have to be greater than the TQ in one hour for either Tier 1 or a Tier 2.)
- The release and subsequent rainout of the cool water would not be classified as a PSE 1 or PSE 2 because there is no process safety issue related to this release. Said another way, there is no Threshold Quantity for cool water.
- There is the potential that not all of the ethylene that leaks through the heat exchanger tube is released from the pressure relief valve, which is there to protect against overpressure of the shell side of the exchanger. If the ethylene that is not being released through the pressure relief valve is being released at a cooling tower one would have to consider the rate of release at the cooling tower to determine if a Tier 1 or Tier 2 threshold had been exceeded.
- The 4 consequences for release from a pressure relief valve must be considered and consequences 2 through 4 clearly do not apply. Rainout is intended to apply to a material with the potential to cause harm (Definition 3.1.25) which would not apply to cool water. If the water that was raining down was hot enough to cause harm, then it would be considered rainout of a material with the potential to cause harm.

2017 Webinar Dates

- February 28 – 10:00 am Eastern (Complete)
- June 6 – 11:00 am Eastern
 - 2017 QA/QC Observations
 - Interpretations
- September 19 – 11:00 am Eastern
 - Deep Dive Observations
 - Interpretations
- December 5 – 11:00 am Eastern
 - M&A/Event Sharing Collaboration
 - Interpretations

Questions? / Discussion!