



ANSI / API RP-754

Process Safety Performance Indicators for the Refining & Petrochemical Industries

Part 2: Tier 1 and 2 Process Safety Events

Kelly Keim
Vice - Chair API RP-754 Drafting Committee

- Welcome and thank you for joining us for the second in a series of four webinars to discuss the content and implementation of the new ANSI/API Recommended Practice 754, Process Safety Performance Indicators for the Refining and Petrochemical Industries
- All four webinars are being recorded for future playback on the API website.
- My name is Kelly Keim and I am a Process Safety Engineering Associate for ExxonMobil and it was my pleasure to serve as vice-chairman of the RP-754 drafting committee
- Following the presentation, there will be an opportunity for questions and answers.
- Let's get started.
- In this session we will introduce the details of the top two tiers of Process Safety Indicators as defined in RP-754.

- TRANSITION TO NEXT SLIDE



ANSI / API RP-754

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Part 2: Tier 1 and 2 Process Safety Events

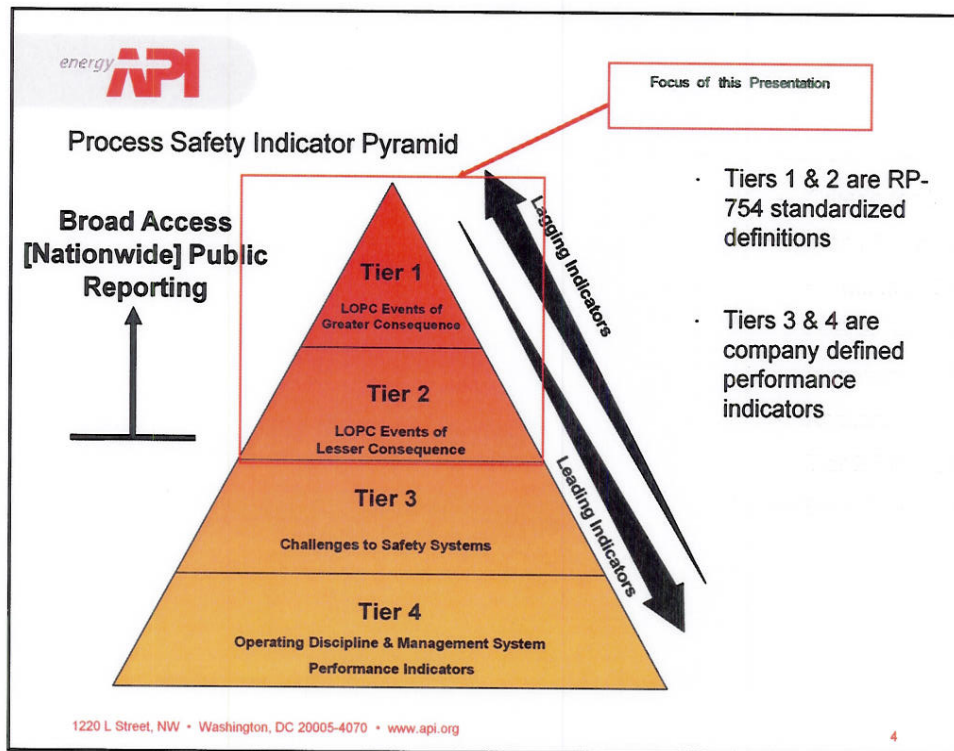
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- Overview of Process Safety Indicator Pyramid
- Criteria for Selection of Tier 1 & 2 Indicators
- Tier 1 Process Safety Event
 - Indicator Definition
 - Definitions of Key Terms
- Identifying a Material Threshold Release Category
- Applicability
- Tier 2 Process Safety Event Indicator Definition
- Data Capture for Tier 1 & 2 Events
- A few example situations

- This presentation starts with a quick overview of the Process Safety Indicator Pyramid to ensure that we're together on what is covered in this presentation.
- Next, we'll cover the guiding principles used in selecting and defining Tier 1 and 2 indicators.
- Then we'll be ready to move into the detailed definition of the Tier 1 indicator and cover those definitions key to applying the indicator as intended.
- We'll also cover briefly how a user of the standard might go about determining which Threshold Release Category applies to a material of concern.
- We'll cover the applicability of the standard for certain common situations to assist in determining which incidents would be counted as Tier 1 and 2.
- Then we'll introduce the Tier 2 indicator definition, which is very similar to Tier 1.
- We'll review the data that is expected to be captured and reported with each Tier 1 and Tier 2 incident.
- Finally, we'll review a few example situations to ensure we have clarity regarding the application of the standard.



- A lot of information represented on this slide, so let me break it down
 - The pyramid itself reflects the 1931 Heinrich model which embodies two key concepts:
 - First, events can be placed on a scale of increasing consequence
 - Second, precursor or predictive events occur at a lower consequence for each event with a higher consequence
 - In terms of the CSB recommendation
 - Tier 1 serves as a lagging indicator
 - Tier 2 serves as a leading indicator (predictive of Tier 1)
 - Tiers 3 & 4 serve as indicator for use at individual facilities
 - Leading and lagging labels are often debated, but the classification is not important.
 - The important point is to capture information that can be acted upon to correct a situation.
 - Indicators at the top of the pyramid tend to be more lagging, while indicators at the bottom tend to be more leading or predictive
 - Tier 4 and to some extent Tier 3 are the action end of the pyramid. It is at this level that performance is improved which in turn affect the outcome measured by Tiers 1 & 2.

Criteria for Selection of Tier 1 & 2 Process Safety Indicators

Indicators should be

- Objective, few and simple
- Well defined, capable of being applied consistently across the industry
- Useful to drive process safety performance improvement and learning.
- Useful to all stakeholders and allow internal and external benchmarking
- Statistically valid
 - Provide appropriate sensitivity to be useful for monitoring continuous improvement
 - Capture a sufficient number of events to allow predictive monitoring and identification of performance trends.

- The first of the guiding principles used in developing the Tiers 1 & 2 indicators were that any two trained teams should be able to consistently and accurately determine the categorization of an incident. This is a basic requirement for any indicator to be used to benchmark across sites, companies and industries. In order to make that true for Process Safety, the indicators needed to be Objective, Well-defined, few and simple.
- In order for indicator users to drive process safety performance improvement and learning, the number of events within a Tier must be statistically valid for trending at either the industry, company or site level.
- Let's see how this is achieved in the API RP 754 standard.
- TRANSITION TO NEXT SLIDE



Applicability and Events Excluded from Process Safety Reporting

Applicability is not limited to those facilities covered by the OSHA Process Safety Management Standard , 29 CFR 1910.119 or similar national and international regulations.

Events associated with the following activities fall outside the scope of this RP:

- a) Releases from pipeline transfer operations occurring outside the process or storage facility fence line;
- b) Marine transport operations, except when the vessel is connected to the process for the purposes of feedstock or product transfer;
- c) Truck or rail operations, except when the vessel is connected to the process for the purposes of feedstock or product transfer, or if the truck or rail car is being used for on site storage;
- d) Vacuum truck operations, except on-site truck loading or discharging operations, or use of the vacuum truck transfer pump;
- e) Routine emissions that are allowable under permit or regulation;
- f) Office, shop and warehouse building events (e.g. office fires, spills, personnel injury or illness, etc.)

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Use of the standard is not limited to just those facilities covered by the OSHA Process Safety Management standard or similar national and international regulations, but is more broadly applied to process, storage and transfer facilities where loss of containment may pose a hazard.

In developing this document, the drafting committee focused solely on indicators of process safety performance vs. indicators of health, personal safety and environmental performance. Each is important and each should have its own performance indicators as a part of a comprehensive and robust facility Health, Safety and Environmental program. Process Safety Hazards can result in major accidents involving the release of potentially dangerous materials resulting in catastrophic effects such as multiple injuries and fatalities, as well as substantial economic, property and environmental damage, and can affect workers inside the facility and members of the public who reside or work nearby.

As a result certain events and activities have been excluded from Process Safety Indicator reporting to ensure that the resulting indicators have the focus intended in the CSB recommendation.

Exclusions cover events outside areas with process, storage and transfer facilities, events that primarily reflect transportation, and others that are Personnel Safety not directly resulting from LOPC.

LOPC from marine, truck and rail that occur when connected to process are included in PSE reporting, otherwise they are captured in Transportation incident reporting.



Applicability and Events Excluded from Process Safety Reporting

Events associated with the following activities fall outside the scope of this RP:

- g) Personal safety events (e.g. slips, trips, falls) that are not directly associated with on-site response to a loss of primary containment (LOPC) event;
- h) LOPC events from ancillary equipment not connected to the process (e.g. small sample containers);
- i) Quality assurance (QA), quality control (QC) and research and development (R&D) laboratories (pilot plants are within RP scope);
- j) Retail service stations; and
- k) On-site fueling operations of mobile and stationary equipment (e.g. pick-up trucks, diesel generators, and heavy equipment).

Highlight that unless an injury occurs as a direct result of on-site response to a LOPC, it will not be included as a PSE.

Fueling operations of mobile and stationary equipment is not included in PS events.

Also, retail service stations are not considered process, storage or transfer facilities included in Process Safety reporting.

Definitions and Terms

Note that a full section of Definitions and Terms has been included as Section 3.1 in the RP. The definitions in this section govern the use of listed terms as applied to this Recommended Practice.

Specific definitions have been provided for words and terms as they apply to this Recommended Practice. These definitions may be different than those of regulatory requirements and in common usage.

Tier 1 Process Safety Event

- Tier 1 & 2 Process Safety Events always start with Loss of Primary Containment
 - Loss of Primary Containment: An unplanned or uncontrolled release of material from Primary Containment, including non-toxic and non-flammable materials (e.g. steam, hot condensate, nitrogen or compressed air)
 - Primary Containment: A tank, vessel, pipe, truck, rail car or equipment intended to serve as the primary container or used for processing or transfer of material
 - Secondary Containment: Exists to contain or control a release from primary containment. Secondary containment systems include tank dikes, curbing around process equipment, drainage collection systems, the outer wall of double walled tanks, etc.

- The Tier 1 & 2 indicators will always start with Loss of Primary Containment, so let's ensure we've defined that adequately.
- **Read definitions from slide.**



Tier 1 Process Safety Event

An unplanned or uncontrolled release of material, including non-toxic and non-flammable materials, from a process which results in one or more of the consequences:

- An employee, contractor or sub-contractor Days Away From Work injury and/or fatality;
- A hospital admission and/or fatality of a third-party;
- An officially declared community evacuation or shelter-in-place;
- A fire or explosion that causes \$25,000 or more of Direct Cost;
- A pressure relief device discharge to the atmosphere whether directly or via a downstream destructive device that results in one or more of the following consequences:
 - Liquid carryover; or
 - Discharge to a potentially unsafe location*;
 - An on-site shelter-in-place; or
 - Public protective measures (e.g., road closure);and a relief device discharge quantity greater than the threshold in Table 1; or
- A release of material from primary containment of greater than the threshold quantities described in Table 1 in any one-hour period.

* A location which results in a potential hazard, such as the formation of flammable mixtures at grade level or on elevated structures, or exposure of personnel to toxic vapors or corrosive chemicals.

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- Read Tier 1 definition from slide
 - Emphasize inclusion of non-toxic and non-flammable materials
 - Recognize that pressure relief device discharge is a LOPC, but that because engineering controls have are in place to ensure that these discharges occur safely, circumstances where a safe discharge does not result are captured in Tier 1 for discharges that are large enough in quantity. Highlight asterisk which describes discharge to a potentially unsafe location.
 - Recognize that Table 1 is coming up in a couple of slides.
 - Emphasize that threshold quantities are described in terms of release in any one-hour period, not on a per-hour basis.

Definitions of Key Terms

Fire - An unplanned ignition of flammable or combustible material (solid, liquid, or vapor) either with an open flame or without flame (smoldering). This includes smoldering, charring, smoking, singeing, scorching, carbonizing, uncontained electrical arcing / sparking, or evidence that any of these have occurred.

Explosion - A release of energy that causes a pressure discontinuity or blast wave. Examples include: detonations, deflagrations, and rapid releases of high pressure caused by rupture of equipment or piping.

Direct Cost is only included in relation to Fire and Explosion

Officially Declared Community Evacuation or Shelter-in-place – must be declared by an authorized community official.

Some definitions of key terms used in the Tier 1 indicator are:

[Read Slide](#)

Tier 1 Material Release Threshold Quantities

Threshold Release Category	Material Hazard Classification	Threshold Quantity (outdoors)	Threshold Quantity (indoors)
1	TIH Hazard Zone A Materials	5 kg (11 lbs)	2.5 kg (5.5 lbs)
2	TIH Hazard Zone B Materials	25 kg (55 lbs)	12.5 kg (27.5 lbs)
3	TIH Hazard Zone C Materials	100 kg (220 lbs)	50 kg (110 lbs)
4	TIH Hazard Zone D Materials	200 kg (440 lbs)	100 kg (220 lbs)

Indoors refers to the inside of a structure composed of four complete (floor to ceiling) walls, floor and roof.

- Introduce the first part of the Threshold Release Table.
- Many different materials representing different types of hazards.
- Standard needed to group these different materials in as few categories as practical while still reflecting relative hazards of each.
- Toxic Gases and Vapors recognized as hazard with greatest threat from smallest quantity of material, but some materials are highly toxic while others are only mildly so. These materials are placed into 4 groups according to the principles set out in the United Nations Globally Harmonized System of Classification and Labeling of Chemicals (GHS) which is applied in the UN Dangerous Goods List and by the US Department of Transportation which has published the criteria for placement into Toxic Inhalation Hazard Zones A through D.
- Note that Threshold Quantities are stated for both Outdoor and Indoor releases to reflect the relatively higher threat caused by releases inside buildings and enclosures. The simple halving of the threshold quantities reflect this higher risk without introducing evaluation of the complexities of ventilation systems.

TIH – Toxic Inhalation Hazard & Zones

TIH – Zone A: Br, HCN, Nickel Carbonyl, Phosgene, Methyl Isocyanate (MIC)

TIH – Zone B: Boron Trifluoride (BF₃), Chlorine, H₂S, Red Fuming Nitric Acid

TIH – Zone C: Hydrogen Chloride (HCl), Hydrogen Fluoride (HF), Sulfur Dioxide (SO₂)

TIH – Zone D: Ammonia (NH₃), Carbon Monoxide (CO), Ethylene Oxide

Toxic Inhalation Hazards range from the worst in Zone A with the smallest release thresholds like bromine, hydrogen cyanide, phosgene and methyl isocyanate (the material released at Bhopal) to materials which have lethal effects only at higher concentrations like the Zone D materials of ammonia, carbon monoxide and ethylene oxide.

RP-754 Table 1, Continued

Threshold Release Category	Material Hazard Classification	Threshold Quantity (outdoors)	Threshold Quantity (indoors)
5	Flammable Gases or Liquids with IBP \leq 35 °C & FP < 23 °C, or Other Packing Group I Materials excluding strong acids/bases	500 kg (1100 lbs)	250 kg (550 lbs)
6	Liquids with IBP > 35 °C and Flash Point < 23 °C, or Other Packing Group II Materials	1000 kg (2200 lbs) or 7 bbls	500 kg (1100 lbs) or 3.5 bbls
7	Liquids with FP \geq 23 °C and \leq 60 °C, or Liquids with Flash Point > 60 °C released at or above FP, or Strong acids/bases, or Other Packing Group III Materials	2000 kg (4400 lbs) or 14 bbls	1000 kg (2200 lbs) or 7 bbls

- The other three Threshold Release Categories reflect the relative risk of flammable materials:
 - Flammable Gases in Category 5
 - Flammable Liquids are separated based upon flash point, with those of lower flash points being in Category 6
 - Category 7 reflects liquids with higher flash point temperatures and those materials that may have higher flash points but are also released at a temperature at or above the flash point.
- Releases of strong acids and bases present a hazard only in direct contact to personnel, the environment or to plant assets and have been placed into Category 7.
- It is also recognized that some materials present hazards other than direct toxicity, flammability or corrosiveness. Where those properties do not reflect the hazardous nature of a material, the Packing Group, as identified in the UN Dangerous Goods List or the US DOT Hazardous Materials Table are applied. Thus
 - Packing Group I materials are placed into Threshold Release Category 4
 - Packing Group II materials are placed into Threshold Release Category 5
 - and Packing Group III materials are placed into TRC 6.
- Once again, the Threshold Quantities are halved for releases occurring indoors.
- Note that quantities in kilograms, pounds and barrels are not directly



Materials Typical of Threshold Release Categories

UN DGL & GHS designations for Flammable Liquids & Gases

Flammable Gases and Liquids with IBP < 35°C

Hydrogen, Methane, Ethane, LPG, Ethylene, isopentane

Flammable Liquids with IBP > 35°C and FP < 23°C

N-pentane, cyclopentane, hexane, cyclohexane, gasoline / petrol, toluene, o-xylene (but not meta or para-xylene), MTBE, ethanol, some crude oils

Flammable Liquids with FP > 23°C and ≤ 60°C

Diesel fuel, most kerosenes, p-xylene, n-butanol, isobutanol, some crude oils

Flammable Liquids with FP > 60°C

Most asphalts, tars, molten sulfur (160°C), ethylene glycol (110°C), propylene glycol (99°C) - (Must be released above Flash Point for Tier 1)

Let's look at where some common materials fall within the Threshold Release Categories.

Flammable Gases and Liquids with IBP < 35 C are Threshold Release Category 5.

Flammable Liquids with IBP > 35 C and FP < 23 C are TRC 6

Flammable Liquids with FP > 23 but < 60 C and liquids with FP > 60 C but released at a temperature above FP are TRC 7.

Liquids with a FP > 60 C released at a temperature < FP are not included in Tier 1.

Acids / Bases – Strong

Substances with $\text{pH} < 1$ or > 12.5 , or more precisely, substances that cause full thickness destruction of intact skin tissue within an observation period up to 60 minutes starting after the exposure time of three minutes or less, consistent with Globally Harmonized System of Classification and Labeling of Chemicals (GHS) Skin Corrosion Category 1A

Acids / Bases Moderate

Substances with $\text{pH} \geq 1$ and < 2 , or $\text{pH} > 11.5$ and \leq , or more precisely, substances that cause full thickness destruction of intact skin tissue within an observation period up to 14 days starting after the exposure time of 60 minutes or less, but greater than three minutes, consistent with GHS Skin Corrosion Category 1B

Strong and Moderate Acids and Bases are defined in the Globally Harmonized System of Classification and Labeling of Chemicals. Most of the time, however, pH will be an adequate indicator for placement of these materials into a TRC.

Other hazardous materials are assigned to a Packing Group (I, II, or III) depending upon level of hazard.

PG I: Aluminum Alkyls, Some Liquid Amines, Sodium Cyanide, Sodium Peroxide

PG II: Aluminum Chloride, Calcium Carbide, Carbon Tetrachloride, Nicotine, Some Organic Peroxides, Phenol

PG III: Calcium Oxide (CaO), Activated Carbon, Chloroform, Some Organic Peroxides, Sodium Fluoride, Sodium Nitrate, Sulfur

Packing Groups are used where the material's hazards are not represented by its level of Toxic Inhalation Hazard, Flash Point or pH.

Other materials present a hazard that is not a result of toxic inhalation or flammability. This may include pyrophoric materials which burst into flame on contact with air, to materials that react violently with water, others that may detonate, and still others that may be toxic by contact. These have been placed into one of 3 Packing Groups within the UN DGL and are used when the other listed criteria (TIH, Flammability, and Corrosivity) do not apply. Packing Group 1 has the lowest Threshold Release Quantity and Packing Group 3 has the highest.

Determining Threshold Release Category from US DOT Hazardous Materials Table (§ 172.101)

§ 172.101 HAZARDOUS MATERIALS TABLE—Continued

Sym- bols	Hazardous materials descrip- tions and proper shipping names	Hazard class or Di- vision	Identifica- tion Num- bers	PG	Label Codes	Special provisions (§ 172.102)	Packaging (§173	
							Excep- tions (6A)	Non- bulk (6B)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(6A)	(6B)
				III	3	B1, IB3, T4, TP1, TP29	150	203
	Ethyl acetate	3	UN1175	II	3	IB2, T4, TP1	150	202
	Ethyl acrylate, stabilized	3	UN1917	II	3	IB2, T4, TP1, TP13	150	202
	Ethyl alcohol, see Ethanol							
	Ethyl acrylate, see Acetal- dehyde							
	Ethyl amyl ketone	3	UN2271	III	3	B1, IB3, T2, TP1	150	203
	N-Ethyl-N-benzylaniline	6.1	UN2274	III	6.1	IB3, T4, TP1	153	203
	Ethyl borate	3	UN1176	II	3	IB2, T4, TP1	150	202
	Ethyl bromide	6.1	UN1891	II	6.1	IB2, T7, TP2, TP13	None	202
	Ethyl bromoacetate	6.1	UN1603	II	6.1, 3	IB2, T7, TP2	None	202
	Ethyl butyl ether	3	UN1179	II	3	B1, IB2, T4, TP1	150	202
	Ethyl butyrate	3	UN1180	III	3	B1, IB3, T2, TP1	150	203
	Ethyl chloride	2.1	UN1037		2.1	B77, T50	None	322
	Ethyl chloroacetate	6.1	UN1181	II	6.1, 3	IB2, T7, TP2	None	202
	Ethyl chloroformate	6.1	UN1182	I	6.1, 3, 8	2, A3, A6, A7, B9, B14, B32, B74, N34, T20, TP2, TP13, TP38, TP45	None	227
	Ethyl 2-chloropropionate	3	UN2905	III	3	B1, IB3, T2, TP1	150	203
	Ethyl chlorobromoformate	8	UN2926	II	8, 6.1, 3	2, B9, B14, B32, B74, T20, TP2, TP38, TP45	None	227
	Ethyl crotonate	3	UN1862	II	3	IB2, T4, TP2	150	202
	Ethyl ether, see Diethyl ether							
	Ethyl fluoride or Refrigerant gas R161	2.1	UN2453		1		306	304
	Ethyl formate	3	UN1190	II	3	IB2, T4, TP1	150	202
	Ethyl hydroperoxide	Forbidden						
	Ethyl isobutyrate	3	UN2385	II	3	IB2, T4, TP1	150	202
	Ethyl isocyanate	3	UN2481	I	3, 6.1	1, A7, B9, B14, B30, B72, T22, TP2, TP13, TP38, TP44	None	226

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In this slide I will discuss the use of the US DOT Hazardous Materials Table, 172.101 to identify the applicable Threshold Release Category.

• Let's look at the columns we'll be using:

- 2 – the hazardous material name or description
- 3 – the hazard class or division
- 4 – the UN identification number may be useful if looking in the UN DGL
- 5 – the Packing Group
- 6 – Label Codes
- 7 – Special Provisions will be useful in determining the TIH Zone

• We'll start with Ethyl Isocyanate. The Label Codes are 3, which tells us that it is a flammable liquid and 6.1, which tells us that the material is a toxic substance, like its relative Methyl Isocyanate, which is normally a gas. The Ethyl Isocyanate is a liquid with a boiling point of only 60 C. Because Ethyl Isocyanate boils at such a low temperature we must consider that vapor will also be generated from any spill, therefore we must look at column 7 for indication of a TIH Zone. We find that the very first code in column 7 is a 1, which indicates that as a gas or vapor ethyl isocyanate is a TIH Zone A with a threshold release quantity of 5 kg. When the first code in column 7 is an integer between 1 and 4 the material is a TIH. 1 is Zone A, 2 is Zone B, 3 is Zone C and 4 is Zone D.

• For ethyl formate there is no integer as the first code in column 7, nor do the label codes indicate that the material is a toxic substance. We do see that ethyl formate has a label code of 3 for flammable liquid. It has a boiling point of 54.3C and a flash point of -20C. That puts us into TR Category 6, which is also consistent with its designation as a Packing Group II material. In most cases these will align, however for materials that are solely designated as flammable liquid hazards, the IBP and flash point are the primary determinants of TRC along with release temperature.

• Now look at Ethyl Chloride. It has no integer code at the beginning of column 7, therefore it is not a TIH. It also does not have a Packing Group designated. Note that this material has a Hazard Class in column 3 of 2.1. This tells us that it is a flammable gas. We can directly place the material into TRC 5, or we can look up its boiling point 12.3C and flash point -50C to see that it also aligns with TRC 5.

• When we find a material with a Hazard class of 2.2 in column 3 we will see that it is a non-toxic, non-flammable gas. This material has no TRC and a release of this material can only cause a Tier 1 or 2 event if it causes one of the listed consequences.

Footnotes Applicable to Table 1

- Threshold quantities given in kg, lb and bbl are not exactly equivalent. Companies should select one unit and use it consistently for all recordkeeping activities.
- Many materials exhibit more than one hazard. Correct placement in Hazard Zone or Packing Group shall follow the rules of DOT 49 CFR 173.2a or UN Recommendations on the Transportation of Dangerous Goods, Section 2.
- For solutions not listed on the UNDG, the anhydrous component shall determine the TIH zone or Packing Group classification. The threshold quantity of the solution shall be back calculated based on the threshold quantity of the dry component weight.
- For mixtures where the UNDG classification is unknown, the fraction of threshold quantity release for each component may be calculated. If the sum of the fractions is equal to or greater than 100%, the mixture exceeds the threshold quantity. Where there are clear and independent toxic and flammable consequences associated with a mixture, the toxic and flammable hazards are calculated independently. See Annex A, Examples 28, 29 and 30.

Some important details of applying Tables 1 and 2 are contained in the footnotes.



Tier 2 Process Safety Event

An unplanned or uncontrolled release of any material, including non-toxic and non-flammables materials from a process which results in one or more of the consequences listed below and is not reported in Tier 1:

- An employee, contractor or subcontractor recordable injury; or
- A fire or explosion resulting in greater than or equal to \$2,500 of direct cost to the Company; or
- A pressure relief device (PRD) discharge to atmosphere whether directly or via a downstream destructive device that results in one or more of the following four consequences:
 - Liquid carryover, or
 - Discharge to a potentially unsafe location, or
 - On-site shelter-in-place, or
 - Public protective measures (e.g., road closure);and a PRD discharge quantity greater than the threshold quantities in Table 2; or
- A release of material greater than the threshold quantities described in Table 2 in any one-hour period.

Tier 2 consequences are intended to be roughly an order of magnitude lower than those in Tier 1.

Read text of Tier 2. Highlight differences from Tier 1

- recordable injury to personnel
- damage from fire or explosion an order of magnitude (\$2,500) lower than Tier 1
- Same criteria for consequence from PRD discharge, but quantities > Table 2, but < Table 1.
- Table 2 thresholds for other releases.

Tier 2 Material Release Threshold Quantities

Threshold Release Category	Material Hazard Classification	Threshold Quantity (outdoors)	Threshold Quantity (indoors)
1	TIH Hazard Zone A Materials	0.5 kg (1.1 lbs)	0.25 kg (.55 lbs)
2	TIH Hazard Zone B Materials	2.5 kg (5.5 lbs)	1.2 kg (2.8 lbs)
3	TIH Hazard Zone C Materials	10 kg (22 lbs)	5 kg (11 lbs)
4	TIH Hazard Zone D Materials	20 kg (44 lbs)	10 kg (22 lbs)

Threshold release quantities an order of magnitude less than Table 1, but structured the same.

RP-754 Table 2, Continued

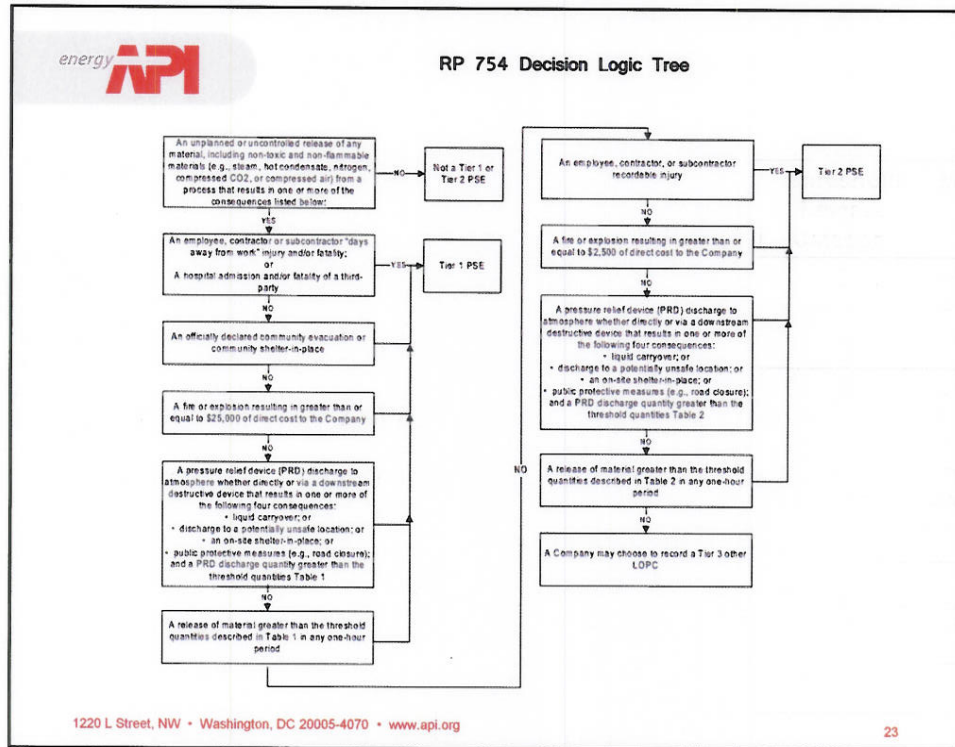
Threshold Release Category	Material Hazard Classification	Threshold Quantity (outdoors)	Threshold Quantity (indoors)
5	Flammable Gases or Liquids with IBP ≤ 35 °C and FP < 23 °C ; or Other Packing Group I Materials	50 kg (100 lbs)	25 kg (50 lbs)
6	Liquids with FP ≥ 23 °C and < 60 °C or Liquids with FP > 60 °C released at or above FP; or Other Packing Group II and III Materials excluding moderate acids/bases; or Strong acids and bases	100 kg (220 lbs) or 1 bbl	50 kg (110 lbs) or 0.5 bbl
7	Liquids with FP > 60 °C released below FP; or Moderate acids/bases	1000 kg (2200 lbs) or 10 bbl	500 kg (1100 lbs) or 5 bbl

Threshold Release Category 5 quantities an order of magnitude less than for Tier 1.

Highlight changes to Categories 6 and 7.

- Flammable liquid categories grouped together in Threshold Release Category 6 as are Packing Groups II and III.
- Strong Acids and Bases are also included in Category 6.
- Category 7 now includes liquids with FP > 60 released at a temperature below FP as well as Moderate acids and bases.

•Note that quantities in kilograms, pounds and barrels are not directly equivalent. A site should select and use a consistent set of units and apply them rather than switching between units.



The standard includes a Logic Tree to assist in categorizing events according to the 754 indicator criteria.

It helps emphasize that for an event to be Tier 1 or 2, LOPC must have occurred.

It also helps emphasize that if one of the indicators of harm occur (injury to people, the public impact, or to assets) as a result of a release other than from a PRD, the quantity of release is not considered.

For releases from PRDs, classification as Tier 1 or 2 only occurs if one of the 4 listed indicators of a hazardous release occurs. If one of those indicators occurs, the quantity released through the PRD is used to classify the incident.

When threshold release quantities are exceeded an event may also be classified in Tiers 1 or 2 even though it resulted in no other harm.



Process Safety Event (PSE) Rates

The Tier 1 PSE Rate is calculated as follows:

$$\text{Tier 1 PSE Rate} = (\text{Total Tier 1 PSE Count} / \text{Total Work Hours}) \times 200,000$$

The Tier 2 PSE Rate is calculated as follows:

$$\text{Tier 2 PSE Rate} = (\text{Total Tier 2 PSE Count} / \text{Total Work Hours}) \times 200,000$$

Total Work Hours includes employee, contractor and subcontractor hours worked minus the hours associated with major construction projects. This is the same number typically used to calculate occupational injury and illness rates.

Calculation of Process Safety Event rates are straightforward following the same formula typically used to calculate Personnel injury rates. Note that Total Work Hours includes employee, contractor and subcontractor hours worked less those hours associated with major construction projects.

Site Information

- Type of Facility (NAICS or equivalent international code)
- Corporate Name and Company Name (if different)
- Site Location/Name (country, state/province, city, site name)
- Site Identifier (unique number assigned by data collection group)
- Total work hours

Tier 1 or 2 PSE Information

- Site Identifier
- Identification of Tier 1 or 2 PSE Consequences / Triggers
 - o Harm to people
 - o An officially declared community evacuation or community shelter-in-place
 - o A fire or explosion
 - o A pressure relief device discharge to atmosphere whether directly or via a downstream destructive device
 - o An acute release of flammable, toxic or corrosive chemicals

The purposes of required data capture and reporting include:

- Each event is an opportunity for learning and improvement
- Cumulative data provides for analysis and benchmarking of performance
- Reporting of PSE data to industry associations can trigger to focus of industry resources to address common issues.

Basic information is to be captured and reported for each Tier 1 & 2 event.

PSE Related Information

- Type of Process
- Date & Time of Event
- Mode of Operation
- Point of Release
- Type of Material Released

Additional information to be captured and reported for Tier 1 and 2 events includes:

Read from slides.

This information will help at an industry level in determining where joint efforts should be targeted to reduce incident frequency.

More detail regarding methods and tools for data capture will be presented in the final webinar of this series.

Example Situations

1. A pinhole leak occurs on a sulfuric acid line causing a small, but steady drip. An instrument technician brushes against the line and receives a chemical burn that requires Medical Treatment.

1. The release was unplanned and uncontrolled. It is a Tier 2 PSE because the LOPC resulted in Medical Treatment.

2. 10 bbl spill of gasoline spilled at a steady rate over a period of 1 hour and 30 minutes. Calculations show that the spill rate was 6.7 bbl per hour.

2. The spill rate was less than the threshold of 7 bbl within 1 hour for Tier 1, but more than the 1 bbl threshold for Tier 2. This event is a Tier 2 PSE.

These are just a few of the examples contained in Annex A of
RP 754

Explain the answers to the examples.

These two examples are self explanatory.

Example Situations

3. A Maintenance contractor opens a process valve and is sprayed with a very small amount (<10 grams) of sulfuric acid resulting in a second degree burn requiring medical treatment.

4. An underground pipeline within a manufacturing site leaks and releases 1,000 bbl of heavy fuel oil (Flash Point > 60° C) over a period of 3 days. The spill results in contaminated soil that is subsequently remediated.

5. A small quantity of odorous material enters a cooling water system via a tube leak. The material is dispersed into the atmosphere at the cooling tower. An elementary school teacher decides not to conduct recess outside due to a noticeable odor.

3. This is a Tier 2 event since there is no release threshold amount when an LOPC results in medical treatment.

4. This is a Tier 2 event since the release rate exceeded 10 bbls per hour even though the fuel oil never reached the surface.

5. This is not an officially declared evacuation or shelter-in-place and therefore not a Tier 1 or Tier 2 event. The Company may choose to capture this event as a LOPC in its Tier 3 metrics.

Explain the answers to the examples.

These examples are self explanatory.

Example Situations

#6. There is a unit upset and a properly designed and operating relief valve opens, resulting in a gas release to the atmosphere.

#6. This is NOT a Tier 1 or 2 PSE since vapors and gases released to atmosphere from atmospheric relief are excluded as long as the release did not result in (1) a liquid carryover, (2) on-site activation of a shelter-in-place, or (3) public protective measures being taken, or (4) other indication that the discharge location resulted in a potential hazard.

#7. A chlorine vessel has a relief valve that was identified in a recent HAZOP to be undersized. In the process of making a transfer, the vessel overpressures. A release of 60 lb of chlorine gas occurs through this relief device to a location designed per the requirements of API 521 over a period of 25 minutes.

#7. This is NOT a Tier 1 or 2 PSE regardless of the HAZOP finding, so long as it did not result in (1) a liquid carryover, (2) on-site activation of a shelter-in-place, or (3) public protective measures being taken, or (4) other indication that the discharge location was to a potentially hazardous location.

Explain the answers to the examples.

These two are self explanatory.

#8. A pressure relief device (PRD) discharges to a scrubber that vents to atmosphere. The scrubber is overwhelmed by a flow rate greater than its design resulting in a discharge that is detected by fence-line monitoring and a public shelter-in-place order is issued. The PRD release quantity is estimated to be greater than the Tier 1 thresholds.

#8. This is a Tier 1 PSE

Explain the answer to the example.

Because the pressure relief discharge resulted in a hazardous concentration of the material that was detected at grade and resulted in a public protective measure, the event became Tier 1 when the PRD discharge exceeded the Tier 1 threshold quantity.



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- As I said at the beginning, all four webinars are being recorded for future playback on the API website.
- If you have any questions or comments beyond today's webinar, Karen Haase is the API Staff member working on RP-754. Her contact information is shown on the screen.
- Also, RP 754 is available for free electronic download at the URL shown.

Questions



- Okay, let's open it up for questions.