



American Petroleum Institute
Guide to Reporting Process Safety Events
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AMERICAN PETROLEUM INSTITUTE

GUIDE TO REPORTING PROCESS SAFETY EVENTS

1 GENERAL

1.1 Purpose

The purpose of this document is to provide guidance to refining and petrochemical companies on the collection and reporting of process safety events suitable for nationwide public reporting as defined in the American Petroleum Institute (API) Recommended Practice (RP) 754, *Process Safety Performance Indicators for the Refining and Petrochemical Industries, Third Edition*.

Disclaimer: This document does not preempt any federal, state or local laws regulating process safety. Therefore, nothing contained in this document is intended to alter or determine a Company's compliance responsibilities set forth in the OSHA's Occupational Safety and Health Act of 1970 and/or the OSHA standards themselves, or any other legal or regulatory requirement concerning process safety. The use of the term or concept "process safety" contained in OSHA regulatory requirements, or as the term may be used in other legal or regulatory contexts. In the event of conflict between this document and any OSHA or other legal requirements, the OSHA or other legal requirements should be fully implemented.

1.2 Objective

The objective of this survey is to collect information on Tier 1 and Tier 2 Process Safety Events (PSEs) as defined in API RP 754 in order to drive performance improvement.

1.3 Applicability

NOTE At joint venture sites and tolling operations, the Company should encourage the joint venture or tolling operation to consider applying this RP.

This RP was developed for the refining and petrochemical industries but may also be applicable to other industries with operating systems and processes where loss of containment has the potential to cause harm (see Note). 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.

NOTE To enable consistent application of this RP to other refining and petrochemical industry subsegments, informative annexes have been created to define the Applicability and Process definition for those subsegments. The user would substitute the content of those annexes for the referenced sections of this RP: Annex A—Petroleum Pipeline and Terminal Operation, Annex B—Retail Service Stations, Annex C—Oil and Gas Drilling and Production Operations.

This RP applies to the responsible party. At co-located facilities (e.g. industrial park), this RP applies individually to the responsible parties and not to the facility as a whole.

Events associated with the following activities fall outside the scope of this RP and shall not be included in data collection or reporting efforts:

- a) releases from transportation pipeline operations occurring outside the control of the responsible party;
- b) marine transport operations, except when the vessel is connected or in the process of connecting or disconnecting to the process;

NOTE The boundary between marine transport operations and in the process of connecting to or disconnecting from the process is the first/last step in loading/unloading procedure (e.g. first line ashore, last line removed, etc.).

- c) truck or rail transport operations, except when the truck or rail car is connected or in the process of connecting or disconnecting to the process, or when the truck or rail car is being used for on-site storage;

NOTE 1 Active staging is not part of connecting or disconnecting to the process; active staging is not considered on-site storage; active staging is part of transportation.

NOTE 2 The boundary between truck or rail transport operations and in the process of connecting to or disconnecting from the process is the first/last step in loading/unloading procedure (e.g. wheel chocks, set air

brakes, disconnect master switch, etc.).

- d) vacuum truck operations, except on-site truck loading or discharging operations, or use of the vacuum truck transfer pump;
- e) routine emissions from permitted or regulated sources;

NOTE Upset emissions are evaluated as possible Tier 1 or Tier 2 PSEs per 5.2 and 6.2.

- f) office, shop, and warehouse building events (e.g. office fires, spills, personnel injury or illness, etc.);
- g) personal safety events (e.g. slips, trips, falls) that are not directly associated with on-site response or exposure to a LOPC event;
- h) LOPC events from ancillary equipment not connected to the process;
- i) quality assurance (QA), quality control (QC), and research and development (R&D) laboratories (pilot plants are included);
- j) new construction that is positively isolated (e.g. blinded or air gapped) from a process prior to commissioning and prior to the introduction of any process fluids and that has never been part of a process;
- k) retail service stations; and
- l) on-site fueling operations of mobile and stationary equipment (e.g. pick-up trucks, diesel generators, and heavy equipment).

2 DEFINITIONS

For the purposes of this survey, the following definitions apply:

2.1

acids/bases, moderate

Substances with *Globally Harmonized System of Classification and Labeling of Chemicals* (GHS) Skin Corrosion Category 1B ^[1] or substances with pH ≥ 1 and < 2, or pH > 11.5 and ≤ 12.5. Either definition may be used for classification. The GHS definition is considered more precise for skin corrosion classification; however, the availability of this measurement may preclude its use.

NOTE GHS Skin Corrosion Category 1B ^[1] is defined as substances that cause destruction of skin tissue, namely visible necrosis through the epidermis and into the dermis in at least one animal following exposure > 3 minutes and ≤ 1 hour and observations ≤ 14 days.

2.2

acids/bases, strong

Substances with GHS Skin Corrosion Category 1A ^[1] or substances with pH < 1 or pH > 12.5. Either definition may be used for classification. The GHS definition is considered more precise for skin corrosion classification; however, availability of this measurement may preclude its use.

NOTE GHS Skin Corrosion Category 1A ^[1] is defined as substances that cause destruction of skin tissue, namely visible necrosis through the epidermis and into the dermis in at least one animal after exposure ≤ 3 minutes during an observation period ≤ 1 hour.

2.3

acids/bases, weak

Substances with GHS Skin Corrosion Category 1C ^[1] or substances with a pH \geq 2 or pH \leq 11.5. Either definition may be used for classification. The GHS definition is considered more precise for skin corrosion classification; however, availability of this measurement may preclude its use.

NOTE GHS Skin Corrosion Category 1C ^[1] is defined as substances that cause destruction of skin tissue, namely, visible necrosis through the epidermis and into the dermis in at least one animal after exposures > 1 hour and \leq 4 hours and observations \leq 14 days.

2.4

active staging

Truck or rail cars waiting to be unloaded where the only delay to unloading is associated with physical limitations with the unloading process (e.g. number of unloading stations) or the reasonable availability of manpower (e.g. unloading on daylight hours only, unloading Monday through Friday only) and not with any limitations in available volume within the process. Active staging is part of transportation.

Any truck or rail cars waiting to be unloaded due to limitations in available volume within the process are considered on-site storage.

2.5

active warehouse

An on-site building, structure, or designated area that stores raw materials, intermediates, or finished products used or produced by a process.

From a process perspective, an active warehouse is equivalent to a bulk storage tank. Rather than being stored in a single large container, the raw materials, intermediates, or finished products are stored in smaller containers (e.g. totes, barrels, pails, etc.).

2.6

acute environmental cost

Cost of short-term cleanup and material disposal associated with an LOPC with off-site environmental impact.

2.7

Company

When designated with a capital C or "the Company," refers to the operating Company in the refining and petrochemical industries, its divisions, or its consolidated affiliates. As used in this RP, the terms "Company" and "Responsible Party" are synonymous.

2.8

containment, primary

A tank, vessel, pipe, truck, rail car, or other equipment designed to keep material within it, typically for the purposes of storage, separation, processing, or transfer of material.

Primary containment also includes closed systems that have a pressure boundary such that there is no exposure of process material to the atmosphere. Where there is a pressure boundary, liquids and vapors are recovered or controlled, and at no time is material directly in contact with the atmosphere. Examples include closed drainage or collection systems, rapid deinventory systems, double-walled tanks, etc.

2.9

containment, secondary

An impermeable physical barrier specifically designed to mitigate the impact of materials that have breached primary containment. Secondary containment systems include but are not limited to tank dikes, curbing around process equipment, open drainage collection systems, trenches, pits, open sumps, the outer wall of open-top double-walled tanks, etc.

2.10

contractor and subcontractor

Any individual not on the Company payroll, whose exposure hours, injuries, and illnesses occur on site.

2.11

days away from work injury

Work-related injuries that result in employee person being unfit for work on any day after the day of the injury as determined by a physician or other licensed health professional. "Any day" includes rest days, weekend days, vacation days, public holidays, or days after ceasing employment.

2.12

deflagration

Propagation of a combustion zone at a velocity that is less than the speed of sound in the unreacted medium.

2.13

deflagration vent

An opening in a vessel or duct that prevents failure of the vessel or duct due to overpressure. The opening is covered by a pressure-relieving cover (e.g. rupture disk, explosion disk or hatch).

2.14

detonation

Propagation of a combustion zone at a velocity that is greater than the speed of sound in the unreacted medium.

2.15

destructive device

A flare, scrubber, incinerator, quench drum or other similar device used to mitigate the potential consequences of an engineered pressure relief [e.g. pressure-relief device (PRD), safety instrumented system (SIS), or manually initiated emergency depressure] device release.

2.16

direct cost

Fire or explosion direct cost includes the material and labor cost of (1) in-kind repairs, replacement, or restoration of process and non-process equipment and tangible public or private property to pre-event condition whether completed or not, (2) aftermath cleanup, (3) material disposal, and (4) short-term cleanup and material disposal associated with fire/explosion emergency response efforts that result in off-site environmental impact (e.g. fire-fighting foam/water runoff).

Direct cost does not include the cost of (1) emergency response personnel, equipment, materials, and supplies utilized to manage the event or incidental damage caused by the emergency response, (2) engineering or inspection assessments to determine the extent of damage or necessary repairs, (3) opportunity upgrades to materials or technology, (4) superficial or cosmetic only damage that does not affect function or performance to company-owned process and non-process equipment, (5) indirect costs, such as business opportunity, business interruption, fines, and feedstock/product losses, (6) loss of profits due to equipment outages, costs of obtaining or operating temporary facilities, or (7) costs of obtaining replacement products to meet customer demand.

Direct cost does not include the cost of repairing or replacing the failed component leading to LOPC if the component is not further damaged by the fire or explosion. Direct cost does include the cost of repairing or replacing the failed component leading to LOPC if the component failed due to internal or external fire or explosion.

2.17

employee

Any individual on the Company payroll whose exposure hours, injuries, and illnesses are routinely tracked by the Company. Individuals not on the Company payroll, but providing services under direct company supervision are also included (e.g. government sponsored interns, secondees, etc.).

2.18

explosion

A release of energy that causes a pressure discontinuity or blast wave (e.g. detonations, deflagrations, and rapid releases of high pressure, e.g. a sudden phase change of material).

2.19

facility

The buildings, containers, or equipment that contain a process.

2.20

fire

Any combustion resulting from a LOPC, regardless of the presence of flame. This includes smoldering, charring, smoking, singeing, scorching, carbonizing, or the evidence that any of these have occurred.

2.21

flammable gas

Any material that is a gas at 35 °C (95 °F) or less and 101.3 kPa (14.7 psi) of pressure and is ignitable when in a mixture of 13 % or less by volume with air or has a flammable range of at least 12 % as measured at 101.3 kPa (14.7 psi).

2.22

flash point (in petroleum products)

The lowest temperature corrected to a barometric pressure of 101.3 kPa (760 mm Hg), at which application of an ignition source causes the vapors of a specimen of the sample to ignite under specified conditions of test. Test methods include ASTM D92-12b ^[2], ASTM D93-15 ^[3], D3941-14 ^[4], D56-05 ^[5], or other equivalent test methods appropriate to the material characteristics and flash point range specified in the test procedure.

2.23

hospital admission

Formal acceptance by a hospital or other inpatient health care facility of a patient who is to be provided with room, board, and medical service in an area of the hospital or facility where patients generally reside at least overnight. Treatment in the hospital emergency room or an overnight stay in the emergency room would not by itself qualify as a "hospital admission."

2.24

indoor release

A release within a structure composed of four walls, floor, and roof.

NOTE The potential consequences of indoor releases are magnified due to hazards associated with congestion, confinement, personnel proximity, and limitations on egress. Open doors or windows and powered or natural ventilation systems do not change the definition of indoor.

2.25

loss of primary containment

LOPC

An unplanned or uncontrolled release of any material from primary containment, including non-toxic and non-flammable materials (e.g. steam, hot water, nitrogen, compressed CO₂, or compressed air).

NOTE The duration of the material release is assessed from the beginning of the release to the end of the release, not from the beginning of the release to the containment or mitigation of the release.

2.26

major construction

Large scale investments with specific, one-time project organizations created for design, engineering, and construction of new or significant expansion to existing process facilities.

2.27

material

Substance with the potential to cause harm due to its chemical (e.g. flammable, toxic, corrosive, reactive, asphyxiate) or physical (e.g. thermal, pressure) properties.

2.28

moderate acids/bases

See acids/bases, moderate.

2.29

normal boiling point

The temperature at which boiling occurs under a pressure of 101.3 kPa (760 mm Hg). Test methods include ASTM E1719-12 [6], ASTM D86-12 [7], or other equivalent test method. For the purpose of this RP, the terms normal boiling point and initial boiling point are considered synonymous.

2.30

office building

Buildings intended to house office workers (e.g. administrative or engineering building, affiliate office complex, etc.).

2.31

officially declared

A declaration by a recognized community official (e.g. fire, police, civil defense, emergency management) or delegate (e.g. Company official) authorized to order the community action (e.g. shelter-in-place, evacuation).

2.32

oil barrel

1 oil barrel = 42 gallons = 0.159 M³.

2.33

pilot plant

An assembly of process equipment that is intended to produce the equivalent of a salable product (whether an actual sale occurs or not). The purpose of a pilot plant is to optimize the chosen chemistry, quantify process parameters to facilitate design and construction of a commercial scale facility, and determine product purity and quality standards.

2.34

precautionary (evacuation, public protective measure, shelter-in-place)

A measure taken from an abundance of caution.

- For example, a company may require all workers to shelter-in-place in response to an LOPC independent of or prior to any assessment (e.g., wind direction, distance from the LOPC, etc.) of the potential hazard to the worker.
- For example, a recognized community official (e.g., fire, police, civil defense, emergency management) may order a community shelter-in-place, evacuation, or public protective measure (e.g., road closure) in the absence of information from a company experiencing a PSE, or 'just in case' the wind direction changes, or due to the sensitive nature of the potentially affected population (e.g., school children, the elderly).

2.35

pressure relief device

PRD

A device designed to open and relieve excess pressure [e.g. safety valve (SV), thermal relief, rupture disk, rupture pin, deflagration vent, pressure/vacuum vents (PV), etc.].

NOTE A PRD discharge is a LOPC due to the nature of the unplanned release. The PRD discharge is evaluated against the consequence criteria to determine if it is a Tier 1 or Tier 2 PSE.

2.36

primary containment

See containment, primary.

2.37

process

Production, distribution, storage, utilities, or pilot plant facilities used in the manufacture of petrochemical and petroleum refining products. This includes process equipment (e.g. reactors, vessels, piping, furnaces, boilers, pumps, compressors, exchangers, cooling towers, refrigeration systems, associated ancillary equipment, etc.), storage tanks, active warehouses, support areas (e.g. boiler houses and wastewater treatment plants), on-site remediation facilities, and distribution piping under control of the Company.

2.38

process safety

A disciplined framework for managing the integrity of hazardous operating systems and processes by applying good design principles, engineering, and operating and maintenance practices.

It deals with the prevention and control of events that have the potential to release hazardous materials or energy. Such events can cause toxic effects, fire, or explosion and could ultimately result in serious injuries, property damage, lost production and environmental impact.

2.39

process safety event

PSE

An unplanned or uncontrolled release of any material—including non-toxic and non-flammable materials (e.g. steam, hot water, nitrogen, compressed CO₂, or compressed air)—from a process, or an undesired event or condition that under slightly different circumstances could have resulted in a release of material.

2.40

public receptors

Off-site residences, institutions (e.g. schools, hospitals), industrial, commercial, and office buildings, parks, or recreational areas where members of the public could potentially be exposed to toxic concentrations, radiant heat, or overpressure, as a result of a LOPC.

2.41

rainout

Two-phase relief (vapor and entrained liquid) from a vent or relief device with the vapor phase dispersing to the atmosphere and the remaining liquid falling to grade or ground or the evidence that the remaining liquid has fallen to grade or ground.

2.42

recordable injury

A work-related injury that results in any of the following: death, days away from work, restricted work or transfer to another job, medical treatment beyond first aid, loss of consciousness or a significant injury diagnosed by a physician or other licensed health professional. This is an abridged version of the definition used to report days away from work injuries for OSHA ^[8].

2.43

Research and Development (R&D) laboratory

A facility that provides controlled conditions in which scientific or technological research, experiments, and measurement may be performed.

2.44

responsible party

The party charged with operating the facility in a safe, compliant, and reliable manner is the responsible party. In some countries or jurisdictions, the responsible party may be called the 'duty holder' or the party with regulatory reporting responsibility. As used in this RP, the terms "Responsible Party" and "Company" are synonymous.

NOTE The responsible party is determined prior to any PSE. The responsible party could be the facility owner or the facility operator depending upon the relationship between the two. Is the owner or the operator responsible for the performance of the facility? Who is responsible for developing and implementing prevention programs? Who is responsible for performing the investigation and identifying and implementing corrective action following a PSE?

2.45

safety instrumented system

SIS

An instrumented protection layer whose purpose is to take the process to a safe state when predetermined conditions are violated.

2.46

secondary containment

See containment, secondary.

2.47

shelter-in-place

The use of a structure or portion of a structure and its indoor atmosphere to temporarily separate individuals from a potentially hazardous outdoor atmosphere.

2.48

strong acids/bases

see acids/bases, strong.

2.49

third-party

Any individual other than an employee, contractor, or subcontractor of the Company [e.g., visitors, non-contracted delivery drivers (e.g. UPS, U.S. Mail, Federal Express), residents, etc.].

2.50

tolling operation

A company with specialized equipment that processes raw materials or semi-finished goods for another company.

2.51

total work hours

Total employee, contractor, and subcontractor hours at a facility worked minus the hours associated with any major construction projects (see 3.1.27 of API 754 for definition) at that facility. This is the same number typically used to calculate a facility occupational injury and illness rate.

NOTE Total work hours is used as a normalizing factor to calculate a process safety event rate. The normalized rate data can then be used to compare the performance of various size and complexity facilities, the performance of different industry sectors, and performance over time. Subtracting major construction hours from the total work hours for a facility prevents an anomaly in the rate data due to these limited duration projects with work hours that could significantly exceed the traditional work hours at a facility.

2.52

United Nations Dangerous Goods (UNDG)

A classification system used to evaluate the potential hazards of various chemicals when released, which is used by most international countries as part of the product labeling or shipping information^[9]. In the United States, these hazard categories are defined in U.S. DOT 49 CFR 173.2a^[10] and listed in U.S. DOT 49 CFR 172, Subpart B^[11].

2.53

UNDG Class 2, Division 2.2 (non-flammable, non-toxic gases)

Non-flammable, non-toxic gases (corresponding to the groups designated asphyxiant or oxidizing), excluding air.

Asphyxiant – Gases which are non-oxidizing, non-flammable, and non-toxic, which dilute or replace oxygen normally in the atmosphere.

Oxidizing – Gases, which may, generally by providing oxygen, cause or contribute to the combustion of other material more than air does. These gases are pure gases or gas mixtures with an oxidizing power greater than 23.5% as determined by a method specified in ISO 10156:2010(E).^[12]

2.54

unsafe location

An atmospheric PRD or upset emission discharge or a downstream destructive device (e.g. flare, scrubber) discharge that results in a potential hazard to personnel, whether present or not, due to the formation of flammable mixtures at ground level or on elevated work structures, presence of toxic or corrosive materials at ground level or on elevated work structures, or thermal radiation effects at ground level or on elevated work structures from ignition of relief streams at the point of emission as specified in API 521, Section 5.8.4.4.^[13]

Excluded from the definition of an unsafe location are those ground level and elevated work structure locations that have a known potential for exposure of personnel to flammable mixtures, toxic substances, corrosive materials, or thermal radiation effects if access to those locations is controlled by virtue of authorized access or hard barriers with appropriate warning signs.

NOTE The term “unsafe location” is used in the description of one of the four potential Tier 1 or Tier 2 consequences associated with an engineered pressure relief or an upset emission from a permitted or regulated source. The assumption is the discharge from the engineered pressure relief whether directly to atmosphere or via a downstream destructive device or the emission from a permitted or regulated source are engineered for safe dispersion of the release.

2.55

upset emission

Any condition that exceeds the documented permit parameters or conditions associated with routine emission from a permitted or regulated source. This could include process parameters such as temperature, pressure, volume, rate, concentration, and duration or release conditions such as timing, location, day/night, wind speed/direction, and simultaneous operations.

NOTE Upset emission applies to specific identified assets (e.g. furnace stacks) and not general or fugitive emission sources (e.g. seals, packing) that are covered under blanket or site-wide permitting.

2.56

weak acids/bases

See acids/bases, weak.

3 REPORTABLE PROCESS SAFETY EVENT

A reportable PSE is an unplanned or uncontrolled release of any material including non-toxic and non-flammable materials (e.g., steam, hot water, nitrogen, compressed CO₂, or compressed air) from a process that meets the definitions for Tier 1 or Tier 2 Indicators below.

3.1 Tier 1 Indicator Definition and Consequences

A Tier 1 PSE is a LOPC with the greatest consequence as defined by this RP. A Tier 1 PSE is an unplanned or uncontrolled release of any material, including non-toxic and non-flammable materials (e.g. steam, hot water, nitrogen, compressed CO₂ or compressed air), from a process that results in one or more of the consequences listed below.

NOTE 1 Some non-toxic and non-flammable materials (e.g. steam, hot water, or compressed air) have no threshold quantities and are only included in this definition because of their potential to result in one of the other consequences.

NOTE 2 A PRD, SIS, or manually initiated emergency depressure discharge is a LOPC due to the unplanned nature of the release. The determination of Tier 1 PSE is based upon the criteria described below.

NOTE 3 An internal fire or explosion that causes a LOPC from a process triggers an evaluation of the Tier 1 consequences. The LOPC does not have to occur first.

- an employee, contractor or subcontractor “days away from work” injury and/or fatality;
- a hospital admission and/or fatality of a third-party;
- an officially declared community evacuation or community shelter-in-place including precautionary community evacuation or community shelter-in-place;
- fire or explosion damage greater than or equal to \$100,000 of direct cost;
- 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 in any 1-hour period, to atmosphere whether directly or via a downstream destructive device that results in one or more of the following four consequences. The threshold quantity determination is made at the discharge of the engineered PRD, while the consequence is determined when the material reaches atmosphere whether directly or via a downstream destructive device.
 - rainout;
 - discharge to a potentially unsafe location;
 - an on-site shelter-in-place or on-site evacuation, excluding precautionary on-site shelter-in-place or on-site evacuation;
 - public protective measures (e.g. road closure) including precautionary public protective measures.
- an upset emission from a permitted or regulated source, of a quantity greater than or equal to the threshold quantities in Table 1 in any 1-hour period, that results in one or more of the following four consequences.
 - rainout;
 - discharge to a potentially unsafe location;
 - an on-site shelter-in-place or on-site evacuation, excluding precautionary on-site shelter-in-place or on-site evacuation;
 - public protective measures (e.g., road closure) including precautionary public protective measures.
- an unignited release of material greater than or equal to the threshold quantities described in Table 1 in any 1-hour period, excluding engineered pressure-relief discharges and upset emissions from permitted or regulated sources.

NOTE 1 In determining the threshold release category (TRC), a Company may choose to use either the properties of the released material based upon laboratory analysis at the time of release or the properties documented in a safety data sheet (SDS). Companies should be consistent in their approach for all LOPCs.

NOTE 2 The material hazard classification in this document is not related to piping service classes in API 570 nor any other material class descriptions in other API documents.

NOTE 3 Engineered pressure-relief discharges and upset emissions from permitted or regulated sources are special-case LOPCs with their own criteria for classification as a Tier 1 PSE.

Tables E.1 through E.16 in Annex E of API RP 754, PSE Examples and Questions, provide a wide variety of examples to assist companies in determining the proper classification of Tier 1.

Figure H.1 in Annex H of API RP 754, PSE Tier 1/Tier 2 Determination Decision Logic Tree, provides a flowchart to assist companies in determining if a LOPC is a Tier 1 or Tier 2 PSE.

Table 1 (Tier 1 and Tier 2 threshold release quantities) is organized by TRCs. Each TRC lists the specific materials included in that category using one of two material hazard classification descriptions. Option 1 primarily uses toxic inhalation hazard (TIH), DOT, and UNDG language, while Option 2 primarily utilizes GHS language. For each material involved in a LOPC, a company will determine the TRC and the corresponding threshold release quantity using one of these two descriptors. The two material hazard classification options are substantially, but not exactly, equivalent for some materials. As a result, a company may choose either option, but once chosen, they should apply that option consistently to all LOPC classifications.

When using material hazard classification Option 1 to determine the TRC, a company should first use the toxic, flammable, or corrosive characteristic of the material. If the TRC cannot be determined from these characteristics, then and only then is the packing group descriptor used.

Released materials may represent more than one hazard type (e.g. toxic, flammable, corrosive) dependent upon its composition and physical state. Annex G, Application of TRCs to Multicomponent Releases, describes the rule set for determining the TRC for a variety of multicomponent streams. When a single component has multiple hazards (e.g. toxic and flammable), the TRC category that gives the most severe tier rating should be used. Additionally, Annex F describes the process for assigning packing groups and TIH zones based upon flammability and toxicity information.

In determining the TRC, a Company may choose to use either the properties of the released material based upon laboratory analysis at the time of release, or the properties documented in a SDS. Companies should be consistent in their approach for all LOPCs.

3.2 Tier 2 Indicator Definition and Consequences

A Tier 2 PSE is a LOPC with lesser consequence. A Tier 2 PSE is an unplanned or uncontrolled release of any material, including non-toxic and non-flammable materials (e.g. steam, hot water, nitrogen, compressed CO₂, or compressed air), from a process that results in one or more of the consequences listed below and is not reported as a Tier 1 PSE.

NOTE 1 Some non-toxic and non-flammable materials (e.g. steam, hot water, or compressed air) have no threshold quantities and are only included in this definition because of their potential to result in one of the other consequences.

NOTE 2 A PRD, SIS, or manually initiated emergency depressure discharge is a LOPC due to the unplanned nature of the release. The determination of Tier 2 PSE is based upon consequences and threshold quantities described below.

NOTE 3 An internal fire or explosion that causes a LOPC from a process triggers an evaluation of the Tier 2 consequences. The LOPC does not have to occur first.

- an employee, contractor or subcontractor recordable injury;
- a fire or explosion damage greater than or equal to \$2,500 of direct cost;

NOTE Some companies rather than performing a detailed estimate use a simple rule-of-thumb to determine if the direct cost exceeded \$2500: if the damage requires repair, then the direct cost is often at least \$2500.

- an engineered pressure-relief (PRD, SIS, or manually initiated emergency depressure) device discharge, of a quantity greater than or equal to the threshold quantities in Table 1 in any 1-hour period, to atmosphere whether directly or via a downstream destructive device that results in one or more of the following four consequences. The threshold quantity determination is made at the discharge of the engineered PRD, while the consequence is determined when the material reaches atmosphere whether directly or via a downstream

destructive device.

- rainout;
 - discharge to a potentially unsafe location;
 - an on-site shelter-in-place or on-site evacuation, excluding precautionary on-site shelter-in-place or on-site evacuation;
 - public protective measures (e.g. road closure) including precautionary public protective measures.
- an upset emission from a permitted or regulated source, of a quantity greater than or equal to the threshold quantities in Table 1 in any one-hour period, that results in one or more of the following four consequences:
- rainout;
 - discharge to a potentially unsafe location;
 - an on-site shelter-in-place or on-site evacuation, excluding precautionary on-site shelter-in-place or on-site evacuation;
 - public protective measures (e.g., road closure) including precautionary public protective measures.
- an unignited release of material greater than or equal to the threshold quantities described in Table 1 in any 1-hour period, excluding engineered pressure-relief discharges and upset emissions from permitted or regulated sources

NOTE 1 In determining the TRC, a Company may choose to use either the properties of the released material based upon laboratory analysis at the time of release or the properties documented in a SDS. Companies should be consistent in their approach for all LOPCs.

NOTE 2 The material hazard classification in this document is not related to piping service classes in API 570 nor any other material class descriptions in other API documents.

NOTE 3 Engineered pressure-relief discharges and upset emissions from permitted or regulated sources are special-case LOPCs with their own criteria for classification as a Tier 2 PSE.

Tables E.1 through E.16 in Annex E of API RP 754, PSE Examples and Questions, provide a wide variety of examples to assist companies in determining the proper classification of Tier 2.

Figure H.1 in Annex H of API RP 754, PSE Tier 1/Tier 2 Determination Decision Logic Tree, provides a flowchart to assist companies in determining if a LOPC is a Tier 1 or Tier 2 PSE.

3.3 Calculation of a PSE Rate

The Tier 1 PSE Rate shall be calculated as follows:

Tier 1 PSE Rate_{200,000} = (Total Tier 1 PSE Count / Total Work Hours) x 200,000, or

Tier 1 PSE Rate_{1,000,000} = (Total Tier 1 PSE Count / Total Work Hours) x 1,000,000

The Tier 2 PSE Rate shall be calculated as follows:

Tier 2 PSE Rate_{200,000} = (Total Tier 2 PSE Count / Total Work Hours) x 200,000

Tier 2 PSE Rate_{1,000,000} = (Total Tier 2 PSE Count / Total Work Hours) x 1,000,000

The choice of calculating PSE Rate utilizing either a 200,000 or 1,000,000 man hour multiplier should be consistent with the basis for calculating the Company's occupational injury rate or public reporting conventions.

NOTE 1 Total Work Hours was chosen as the normalizing factor for PSE Rate as a balance between ready availability of the data, relevance to harm, and applicability to various refining and petrochemical operations. Other suggested normalizers such as throughput, Dow Fire and Explosion Index, etc. did not strike this balance. Total Work Hours includes employees and contractors (see 3.1.52 of API RP 754 for definition).

NOTE 2 If a company chooses to calculate an aggregated PSE Rate for their organization (e.g. segment, region, corporate), they would do so by aggregating the Total Work Hours and the PSE Count of the facilities included in the aggregation.

The choice of calculating PSE Rate utilizing either a 200,000 or 1,000,000 work hour multiplier should be consistent with the basis for calculating the Company's occupational injury rate.

4 REPORTING TO API

During the first quarter of each calendar year, participating companies will be asked to submit data for the previous calendar year. The annual report will provide the information contained in Appendix B of this document.

An annual Process Safety Report will be issued annually by API. It will present aggregate industry data that will reflect the total number of events for U.S. refining facilities. The report will also contain a brief explanation of the data and its overall meaning.

5 REFERENCES

For complete information on Tier 1 and Tier 2 Process Safety Indicator Definitions and examples of PSEs:

- ANSI/API Recommended Practice 754, *Process Safety Indicators for the Refining and Petrochemical Industries, Third Edition* 2021.

For more information on chemical listings:

- AIChE CCPS, *Process Metrics: Guide for Selecting Leading and Lagging Indicators*, Appendix B (additional information regarding UN dangerous goods classification and listing of chemicals), New York, 2018, https://www.aiche.org/sites/default/files/docs/pages/ccps_process_safety_metrics_-_v3.2.pdf
- UNECE, ECE/TRANS/202, Vol. I and II ("ADR 2009"), *European Agreement Concerning the International Carriage of Dangerous Goods by Road (ADR)* <http://www.unece.org/trans/danger/publi/adr/adr2009/09ContentsE.html>
- United Nation's *Globally Harmonized System of Classification and Labeling of Chemicals (GHS)*, Eighth Edition, New York and Geneva, 2019, https://www.unece.org/fileadmin/DAM/trans/danger/publi/ghs/ghs_rev08/ST-SG-AC10-30-Rev8e.pdf
- U.S. DOT 9, 49 CFR, Part 172, Subpart B—Table of Hazardous Materials and Special Provisions, <https://www.ecfr.gov/cgi-bin/text-idx?node=pt49.1.172#sp49.2.172.b>
- U.S. DOT, 49 CFR 173.2a, Classification of a Material Having More Than One Hazard, http://edocket.access.gpo.gov/cfr_2006/octqtr/49cfr173.2a.htm

APPENDIX A

Table 1—Material Release Threshold Quantities

Threshold Release Category	Material Hazard Classification Option 1	Material Hazard Classification Option 2	Tier 1		Tier 2	
			Threshold Quantity (Outdoor)	Threshold Quantity (Indoor)	Threshold Quantity (Outdoor)	Threshold Quantity (Indoor)
TRC 1	TIH Zone A materials	H330 Fatal if inhaled, acute toxicity, inhalation (ch. 3.1) (cat. 1)	≥ 5 kg (11 lb)	≥ 0.5 kg (1.1 lb)	≥ 0.5 kg (1.1 lb)	≥ 0.25 kg (0.55 lb)
TRC 2	TIH Zone B materials	H330 Fatal if inhaled, acute toxicity, inhalation (ch. 3.1) (cat. 2)	≥ 25 kg (55 lb)	≥ 2.5 kg (5.5 lb)	≥ 2.5 kg (5.5 lb)	≥ 1.25 kg (2.75 lb)
TRC 3	TIH Zone C materials	H331 Toxic if inhaled, acute toxicity, inhalation (ch. 3.1) (cat. 3)	≥ 100 kg (220 lb)	≥ 10 kg (22 lb)	≥ 10 kg (22 lb)	≥ 5 kg (11 lb)
TRC 4	TIH Zone D materials	H332 Harmful if inhaled, acute toxicity, inhalation (ch. 3.1) (cat. 4)	≥ 200 kg (440 lb)	≥ 20 kg (44 lb)	≥ 20 kg (44 lb)	≥ 10 kg (22 lb)
TRC 5	Flammable gases	H220 Extremely flammable gas, flammable gases (ch. 2.2) (cat. 1A) H221 Flammable gas, flammable gases (ch. 2.2) (cat. 1B,2)	≥ 500 kg (1100 lb)	≥ 50 kg (110 lb)	≥ 50 kg (110 lb)	≥ 25 kg (55 lb)
	Liquids with normal boiling point ≤ 35 °C (95 °F) and flash point < 23 °C (73 °F)	H224 Extremely flammable liquid and vapor, flammable liquids (ch. 2.6) (cat. 1)				
	Other Packing Group I materials (excluding acids/bases and excluding UNDG Class 1; Class 2.2; Class 4.2; Class 4.3; Class 7; and Class 9 materials)	H228 Flammable solid, flammable solids (ch. 2.7) (cat. 1,2) H230 May react explosively even in the absence of air, flammable gases (ch. 2.2) (chemically unstable gas cat. A) H231 May react explosively even in the absence of air at elevated pressure and/or temperature, flammable gases (ch. 2.2) (chemically unstable gas cat. B) H232 May ignite spontaneously if exposed to air, flammable gases (ch. 2.2) (cat. 1A pyrophoric gas) H250 Catches fire spontaneously if exposed to air, pyrophoric liquids and pyrophoric solids (ch. 2.9 & 2.10) (cat. 1) H310 Fatal in contact with skin, acute toxicity, dermal (ch. 3.1) (cat. 1)				

Threshold Release Category	Material Hazard Classification Option 1	Material Hazard Classification Option 2	Tier 1		Tier 2	
			Threshold Quantity (Outdoor)	Threshold Quantity (Indoor)	Threshold Quantity (Outdoor)	Threshold Quantity (Indoor)
TRC 6	Liquids with normal boiling point > 35 °C (95 °F) and flash point < 23 °C (73°F)	H225 Highly flammable liquid and vapor, flammable liquids (ch. 2.6) (cat. 2)	≥ 1000 kg (2200 lb) or ≥ 7 oil bbl	≥ 100 kg (220 lb) or ≥ 0.7 oil bbl	≥ 100 kg (220 lb) or ≥ 0.7 oil bbl	≥ 50 kg (110 lb) or ≥ 0.35 oil bbl
	Crude oil ≥ 15 API Gravity (unless actual flash point available)	Crude oil ≥ 15 API Gravity (unless actual flash point available)				
	Other Packing Group II materials (excluding acids/bases and excluding UNDG Class 1; Class 2.2; Class 4.2; Class 4.3; Class 7; and Class 9 materials)	H240 Heating may cause an explosion, self-reactive substances and mixtures and organic peroxides (ch. 2.8 & 2.15) (type A) H241 Heating may cause a fire or explosion, self-reactive substances and mixtures and organic peroxides (ch. 2.8 & 2.15) (type B) H242 Heating may cause a fire, self-reactive substances and mixtures and organic peroxides (ch. 2.8 & 2.15) (types C–F) H271 May cause fire or explosion; strong oxidizer, oxidizing liquids and oxidizing solids (ch. 2.13 & 2.14) (cat. 1) H310 Fatal in contact with skin, acute toxicity, dermal (ch. 3.1) (cat. 2)				
TRC 7	Liquids with flash point ≥ 23 °C (73 °F) and ≤ 60 °C (140 °F)	H226 Flammable liquid and vapor, flammable liquids (ch. 2.6) (cat. 3)	≥ 2000 kg (4400 lb) or ≥ 14 oil bbl	≥ 200 kg (440 lb) or ≥ 1.4 oil bbl	≥ 200 kg (440 lb) or ≥ 1.4 oil bbl	≥ 100 kg (220 lb) or ≥ 0.7 oil bbl
	Liquids with flash point > 60 °C (140 °F) released at a temperature at or above flash point	H227 Combustible liquid, flammable liquids (ch. 2.6) (cat. 4) [**Released at a temperature at or above flash point **] Liquids with flash point > 93 °C (200 °F) released at a temperature at or above flash point				
	Crude oil < 15 API Gravity (unless actual flash point available)	Crude oil < 15 API Gravity (unless actual flash point available)				
	UNDG Class 2, Division 2.2 (non-flammable, non-toxic gases) excluding air	H270 May cause or intensify fire; oxidizer oxidizing gases (ch. 2.4) (cat. 1) UNDG Class 2, Division 2.2 (non-flammable, non-toxic gases) excluding air				
	Other Packing Group III materials (excluding acids/bases and excluding UNDG Class 1; Class 2.2; Class 4.2; Class 4.3; Class 7; and Class 9 materials)	H272 May intensify fire; oxidizer, oxidizing liquids and oxidizing solids (ch. 2.13 & 2.14) (cat. 2,3) H311 Toxic in contact with skin, acute toxicity, dermal (ch. 3.1) (cat. 3)				

Threshold Release Category	Material Hazard Classification Option 1	Material Hazard Classification Option 2	Tier 1		Tier 2	
			Threshold Quantity (Outdoor)	Threshold Quantity (Indoor)	Threshold Quantity (Outdoor)	Threshold Quantity (Indoor)
TRC 8	Liquids with flash point > 60 °C (140 °F) and ≤ 93 °C (200 °F) released at a temperature below flash point	H227 Combustible liquid, flammable liquids (ch. 2.6) (cat. 4) [**Released at a temperature below flash point **]	N/A	N/A	≥ 1000 kg (2200 lb)	≥ 500 kg (1100 lb)
	Strong acids/bases (see definition 3.1.2)	H314 Causes severe skin burns, skin corrosion/irritation (ch. 3.2) (cat. 1A)			or	or
	No equivalent	H370 Causes damage to organs, specific target organ toxicity, single exposure (ch. 3.8) (cat. 1)			≥ 7 oil bbl	≥ 3.5 oil bbl

NOTE 1 It is recognized that threshold quantities given in kg or lb and bbl are not exactly equivalent. Companies should select one of the pair and use it consistently for all recordkeeping activities.

NOTE 2 Refer to 5.2.3 for guidance on selecting the correct TRC and the use of material hazard classification Option 1 and Option 2.

APPENDIX B

PSE DATA CAPTURE INFORMATION

Facility Information

The following information shall be captured for each facility:

- a) type of facility (NAICS or equivalent international code);
- b) corporate name;
- c) company name (if different);
- d) facility location/name (country, state/province, city, facility name);
- e) facility identifier(s) (unique number(s) assigned by data collection groups);
- f) total work hours:
 - 1) total hours worked by employees, and
 - 2) total hours worked by contractors and subcontractors.

Tier 1 PSE Information

The following information shall be captured for each Tier 1 PSE:

- a) facility identifier;
- b) Tier 1 PSE consequences/triggers, each Tier 1 PSE will have one or more of the following consequences (check all that apply):

NOTE Since a Tier 1 Process Safety Event can result in one or more consequences, the total count of consequences will be equal to or greater than the total count of Tier 1 PSEs.

- 1) an employee, contractor, or subcontractor "days away from work" injury and/or fatality:
 - i) number of employee days away from work injuries,
 - ii) number of employee fatalities,
 - iii) number of contractor or subcontractors days away from work injuries,
 - iv) number of contractor or subcontractor fatalities;
- 2) a third party (non-employees/contractor, community members) hospital admission and/or fatality:
 - i) number of third-party hospital admissions,
 - ii) number of third-party fatalities;
- 3) an officially declared community evacuation or community shelter-in-place including precautionary community evacuation or community shelter-in-place;
- 4) a fire or explosion causing \$100,000 or more in direct cost:
 - i) fire,
 - ii) explosion;
- 5) 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 in any one-hour period, to atmosphere whether directly or via a downstream destructive device (check one):
 - i) PRD, SIS, or manually initiated emergency depressure device directly to atmosphere,
 - ii) PRD, SIS, or manually initiated emergency depressure device to atmosphere via a downstream destructive device;

that results in one or more of the following four consequences (check all that apply):

- i) rainout,
- ii) discharge to a potentially unsafe location,
- iii) an on-site shelter-in-place or on-site evacuation, excluding precautionary on-site shelter-in-place or on-site evacuation,
- iv) public protective measures (e.g., road closure) including precautionary public protective measures;

- 6) an upset emission from a permitted or regulated source, of a quantity greater than or equal to the threshold quantities in Table 1 in any one-hour period, that results in one or more of the following four consequences (check all that apply):
 - i) rainout;
 - ii) discharge to a potentially unsafe location;
 - iii) an on-site shelter-in-place or on-site evacuation, excluding precautionary on-site shelter-in-place or on-site evacuation;
 - iv) public protective measures (e.g., road closure) including precautionary public protective measures.
- 7) a release of flammable, combustible, toxic, corrosive, or UNDG Class 2, Division 2.2 material from primary containment (check one):
 - i) Tier 1 (Table 1) TRC 1,
 - ii) Tier 1 (Table 1) TRC 2,
 - iii) Tier 1 (Table 1) TRC 3,
 - iv) Tier 1 (Table 1) TRC 4,
 - v) Tier 1 (Table 1) TRC 5,
 - vi) Tier 1 (Table 1) TRC 6,
 - vii) Tier 1 (Table 1) TRC 7.

Release location (check one):

 - (a) outdoor release,
 - (b) indoor release.
- 8) Tier 1 PSE severity weight

Tier 2 PSE Information

The following information shall be captured for each Tier 2 PSE:

- a) facility identifier;
- b) Tier 2 PSE consequences/triggers; each Tier 2 PSE will have one or more of the following consequences (check all that apply) :

NOTE Since a Tier 2 Process Safety Event can result in one or more consequences, the total count of consequences will be equal to or greater than the total count of Tier 2 PSEs.

- 1) an employee, contractor, or subcontractor recordable injury:
 - i) number of employee recordable injuries,
 - ii) number of contractor or subcontractor recordable injuries;
- 2) a fire or explosion causing \$2,500 or more in direct cost:
 - i) fire,
 - ii) explosion;
- 3) an engineered pressure relief (PRD, SIS, or manually initiated emergency depressure) discharge, of a quantity greater than or equal to the threshold quantities in Table 2 in any one-hour period to atmosphere whether directly or via a downstream destructive device (check one):
 - i) PRD, SIS, or manually initiated emergency depressure device directly to atmosphere,
 - ii) PRD, SIS, or manually initiated emergency depressure device to atmosphere via a downstream destructive device;

that results in one or more of the following four consequences (check all that apply):

- i) rainout,
- ii) discharge to a potentially unsafe location,
- iii) an on-site shelter-in-place or on-site evacuation excluding precautionary on-site shelter-in-place or precautionary on-site evacuation,
- iv) public protective measures (e.g. road closure) including precautionary public protective measures;

- 4) an upset emission from a permitted or regulated source, of a quantity greater than or equal to the threshold quantities in Table 2 in any one-hour period, that results in one or more of the following four consequences (check all that apply):
 - i) rainout;
 - ii) discharge to a potentially unsafe location;
 - iii) an on-site shelter-in-place or on-site evacuation, excluding precautionary on-site shelter-in-place or on-site evacuation;
 - iv) public protective measures (e.g., road closure) including precautionary public protective measures.
- 5) a release of flammable, combustible, toxic, corrosive, or UNDG Class 2, Division 2.2 material from primary containment (check one):
 - i) Tier 2 (Table 2) TRC 1,
 - ii) Tier 2 (Table 2) TRC 2,
 - iii) Tier 2 (Table 2) TRC 3,
 - iv) Tier 2 (Table 2) TRC 4,
 - v) Tier 2 (Table 2) TRC 5,
 - vi) Tier 2 (Table 2) TRC 6,
 - vii) Tier 2 (Table 2) TRC 7
 - viii) Tier 2 (Table 2) TRC 8.
 Release location (check one):
 - i) outdoor release,
 - ii) indoor release.

PSE Related Information

The following information is useful in data analysis and shall be captured for each Tier 1 and Tier 2 PSE:

- a) Date and Time of Event
- b) Event Description
 - i. Briefly describe “what happened” and “why”. For example: “Leak on a fractionator reflux line due to external corrosion caused from a leak in a process water line dripping on the reflux line.” Another example: “LOPC from overfilling a small caustic tank due to malfunctioning level indication.”
- c) Comments (optional)
- d) Type of Process:
 - a. Refining:
 - i. Active Warehouse
 - ii. alkylation, hydrofluoric (HF)
 - iii. Alkylation, Sulfuric
 - iv. Bitumen / Resid / Asphalt
 - v. Calcining
 - vi. Coking
 - vii. Crude / Vacuum Distillation
 - viii. Fluid Catalytic Cracking (FCC)
 - ix. Flares / Flare Systems / Flare Gas Recovery
 - x. Gas and Liquid Desulfurization / Treating (H₂S absorbers, amine systems, Merox)
 - xi. Hydrogen
 - xii. Hydrotreating
 - xiii. Hydrocracking
 - xiv. Isomerization
 - xv. Loading / Unloading / Truck / Rail / Transport Vessel
 - xvi. Marine / Jetty / Wharf

- xvii. Pilot Plant
 - xviii. Reforming
 - xix. Sulfur Recovery
 - xx. Tank Farm / Storage Facility / Off-sites / Storage and Transfer Piping
 - xxi. Utilities / Steam Plant / Cogeneration
 - xxii. Vapor Recovery/Light Ends
 - xxiii. Sewer / Lift Station / Wastewater Handling, Treatment, or Disposal
 - xxiv. Other (describe)
- b. Petrochemical:
- i. Acetic Acid and Derivatives
 - ii. Active Warehouse
 - iii. Amines Derivatives
 - iv. Aromatics Derivatives (cumene, dis-proportionation, aromatic isomerization, linear alkylbenzene)
 - v. Benzene
 - vi. Butadiene
 - vii. Butane
 - viii. Cyclohexane
 - ix. Dehydrogenation (propylene, butylenes)
 - x. Diisocyanates (TDA, MDA, IPDA, etc.)
 - xi. ETBE
 - xii. Ethane
 - xiii. Ethanol
 - xiv. Ethyl Benzene and Derivatives
 - xv. Ethylene and Derivatives
 - xvi. Ethylene Dichloride and Derivatives
 - xvii. Ethylene Oxide
 - xxviii. Flares / Flare Systems / Flare Gas Recovery
 - xix. Formaldehyde and Derivatives
 - xx. Glycols (ethylene, propylene)
 - xxi. Hexane
 - xxii. Hexanol
 - xxiii. Isobutane
 - xxiv. Isobutene
 - xxv. Isocyanates
 - xxvi. Isopropanol
 - xxvii. LNG
 - xxviii. Loading / Unloading / Truck / Rail / Transport Vessel
 - xxix. Methane
 - xxx. Methanol
 - xxxi. Methyl Mercaptan
 - xxxii. MTBE
 - xxxiii. NGL Fractionation
 - xxxiv. Paraxylene
 - xxxv. Pentane
 - xxxvi. Phenol
 - xxxvii. Pilot Plant

- xxxviii. Polyethylene
- xxxix. Polypropylene
 - xl. Polystyrene
 - xli. Propane
 - xlii. Propylene
 - xliii. Propylene Oxide and Derivatives
 - xliv. Sewer / Lift Station / Wastewater Handling, Treatment or Disposal
 - xlv. Specialty Chemicals
 - xlvi. Styrene-Butadiene
 - xlvii. Synthesis Gas (CO, H₂)
- xlviii. Tank Farm / Storage Facility / Offsites / Storage and Transfer Piping
 - xlix. Toluene
 - I. Utilities / Steam Plant / Cogeneration
 - li. Xylene
 - lii. Other (describe)

e) Mode of Operation:

- a. Start-up
- b. Planned Shutdown
- c. Emergency Shutdown
- d. Normal (check one):
 - i. Changing Lineups
 - ii. Equipment Commissioning / Putting in Service Following Maintenance
 - iii. Equipment Preparation / Taking Out of Service for Maintenance
 - iv. Filling / Draining
 - v. Loading / Unloading
 - vi. Mixing / Handling Chemicals
 - vii. Operator Performed Maintenance
 - viii. Sampling
 - ix. Steady State Operation
 - x. Switching Equipment (e.g. pumps, filters)
 - xi. Other (describe)
- e. Upset
- f. Turnaround
- g. Routine Maintenance
- h. Temporary
- i. Other (describe)

f) Point of Release (*Detail 1* and *Detail 2* options included from AFPM's Event Sharing database):

- a. Atmospheric Tank (fixed roof or internal / external floating roof)
 - i. *Process Liquids Storage, Large tank (>1320 gal/5000 L)*
 - 1. *Release from vent, overflow, or around seal on floating roof*
 - 2. *Sunk Floating Roof*
 - 3. *Leak*
 - 4. *Vacuum / Collapse*
 - 5. *Other*
 - ii. *Process Liquids Storage, Small tank or tote (≤1320 gal/5000 L)*
 - 1. *Release from vent, overflow, or around seal on floating roof*
 - 2. *Leak*

- 3. Vacuum / Collapse
 - 4. Other
 - iii. Chemical Injection / Utility Storage Large tank (>1320 gal/ 5000 L)
 - 1. Release from vent, overflow, or around seal on floating roof
 - 2. Sunk Floating Roof
 - 3. Leak
 - 4. Vacuum / Collapse
 - 5. Other
 - iv. Chemical Injection / Utility Storage Small tank or tote (\leq 1320 gal/ 5000 L)
 - 1. Release from vent, overflow, or around seal on floating roof
 - 2. Leak
 - 3. Vacuum / Collapse
 - 4. Other
 - v. Other Storage
- b. Blower / Fan
- i. Seal Leak
 - ii. Packing Leak
 - iii. Flange / Gasket Leak
 - iv. Gasket Failed
 - v. Flange Face Damage
 - vi. Wrong Gasket
 - vii. Bolts Relaxed (i.e. thermal cycle)
 - viii. Loose Bolts
 - ix. Other
 - x. Casing Leak
 - xi. Threading Fitting Leak
 - xii. Fitting Thread Leak
 - xiii. Fitting Body Leak
 - xiv. Other
 - xv. Auxiliary System Leak (i.e. tube oil)
 - xvi. Other
- c. Compressor
- i. Centrifugal Compressor
 - ii. Seal Leak
 - iii. Packing Leak
 - iv. Flange / Gasket Leak
 - v. Casing Leak
 - vi. Threading Fitting Leak
 - vii. Auxiliary System Leak (i.e. tube oil)
 - viii. Other
 - ix. Reciprocating Compressor
 - x. Seal Leak
 - xi. Packing Leak
 - xii. Flange / Gasket Leak
 - xiii. Casing Leak
 - xiv. Threading Fitting Leak
 - xv. Auxiliary System Leak (i.e. tube oil)
 - xvi. Other
 - xvii. Other Compressor
 - xviii. Seal Leak
 - xix. Packing Leak
 - xx. Flange / Gasket Leak
 - xxi. Casing Leak
 - xxii. Threading Fitting Leak
 - xxiii. Auxiliary System Leak (i.e. tube oil)

xxiv. *Other*

d. Cooling Tower

e. Filter / Coalesce / Strainer

- i. Housing Leak*
- ii. Head / Closure Gasket Leak*
- iii. Gasket Failed*
- iv. Flange Face Damage*
- v. Wrong Gasket*
- vi. Bolts Relaxed (i.e. thermal cycle)*
- vii. Loose bolts*
- viii. Other*
- ix. Flange / Gasket Leak*
- x. Gasket Failed*
- xi. Flange Face Damage*
- xii. Wrong Gasket*
- xiii. Bolts Relaxed (i.e. thermal cycle)*
- xiv. Loose Bolts*
- xv. Other*
- xvi. Threading Fitting Leak*
- xvii. Fitting Thread Leak*
- xviii. Fitting Body Leak*
- xix. Other*
- xx. Other*

f. Fired Boiler

- i. Steam / Water Tube Leak*
- ii. Fuel Leak*
- iii. Fire Box Explosion*
- iv. Flange / Gasket Leak*
- v. Gasket Failed*
- vi. Flange Face Damage*
- vii. Wrong Gasket*
- viii. Bolts Relaxed (i.e. thermal cycle)*
- ix. Loose Bolts*
- x. Other*
- xi. Threading Fitting Leak*
- xii. Fitting Thread Leak*
- xiii. Fitting Body Leak*
- xiv. Other*
- xv. Other*

g. Flare / Relief System

- i. Flare System Leak (headers / drums / stack)*
- ii. Relief Valve Leak*
- iii. Flare Liquid Carry Over / Rainout*
- iv. Atmospheric Relief Valve Discharge*
- v. Other*

h. Furnace / Fired Heater

- i. Process Tube Leak*
- ii. Steam / Water Tube Leak*
- iii. Fuel Leak*
- iv. Fire Box Explosion*
- v. Flange / Gasket Leak*
- vi. Gasket Failed*
- vii. Flange Face Damage*

- viii. *Wrong Gasket*
- ix. *Bolts Relaxed (i.e. thermal cycle)*
- x. *Loose Bolts*
- xi. *Other*
- xii. *Threading Fitting Leak*
- xiii. *Fitting Thread Leak*
- xiv. *Fitting Body Leak*
- xv. *Other*
- xvi. *Other*

i. Heat Exchanger

- i. *Shell and Tube Type*
- ii. *Shell Leak*
- iii. *Tube Leak*
- iv. *Channel Head / Tube Sheet / Gasket Leak*
- v. *Flange / Gasket Leak*
- vi. *Repair Clamp Leak*
- vii. *Other*
- viii. *Air Cooler Type*
- ix. *Header Box Leak*
- x. *Tube Leak*
- xi. *Flange / Gasket Leak*
- xii. *Exchanger Repair Clamp Leak*
- xiii. *Other*
- xiv. *Plate and Frame*
- xv. *Plate / Gasket Leak*
- xvi. *Flange / Gasket Leak*
- xvii. *Exchanger Repair Clamp Leak*
- xviii. *Other*
- xix. *Other Exchanger*
- xx. *Shell Leak*
- xxi. *Tube Leak*
- xxii. *Channel Head / Tube Sheet / Gasket Leak*
- xxiii. *Flange / Gasket Leak*
- xxiv. *Repair Clamp Leak*
- xxv. *Other*

j. Instrumentation

- i. *Control valve*
- ii. *Valve Packing Leak*
- iii. *Valve Leak Thru*
- iv. *Valve Left Open*
- v. *Valve Body Leak*
- vi. *Other*
- vii. *Analyzer*
- viii. *Flow Instrument*
- ix. *Pressure Instrument*
- x. *Level Instrument*
- xi. *Temperature Instrument*
- xii. *Other*

k. Piping System, Large Bore > 50 mm (2 inch) (piping, gaskets, sight glasses, expansion joints, tubing, valves)

- i. *Above Ground Piping Leak, Diameter >2" (non dead leg)*
- ii. *Pipe Run Leak (leak in wall of pipe)*
- iii. *Piping Repair Clamp Leak*
- iv. *Flange / Gasket Leak*
- v. *Valve*
- vi. *Fitting Leak*

- vii. Other
- viii. *Below Ground Piping Leak, Diameter >2" (non dead leg)*
- ix. *Pipe Run Leak (leak in wall of pipe)*
- x. *Piping Repair Clamp Leak*
- xi. *Flange / Gasket Leak*
- xii. *Valve*
- xiii. *Fitting Leak*
- xiv. *Other*
- xv. *Dead Leg Leak, Diameter >2" (either above or below ground)*
- xvi. *Pipe Run Leak (leak in wall of pipe)*
- xvii. *Piping Repair Clamp Leak*
- xviii. *Flange / Gasket Leak*
- xix. *Valve*
- xx. *Fitting Leak*
- xxi. *Other*
- xxii. *Tubing Leak*
- xxiii. *SS Tubing*
- xxiv. *Copper Tubing*
- xxv. *Plastic / PVC Tubing*
- xxvi. *Other Tubing*
- xxvii. *Hose Leak*
- xxviii. *Braided Metal*
- xxix. *Chemical Hose (typically plastic or polymer)*
- xxx. *Utility Hose (typically rubber)*
- xxxi. *Other Hose*
- xxxii. *PVC or other non-metallic pump*
- xxxiii. *Pipe Run Leak (leak in wall of pipe)*
- xxxiv. *Piping Repair Clamp Leak*
- xxxv. *Flange / Gasket Leak*
- xxxvi. *Valve*
- xxxvii. *Fitting Leak*
- xxxviii. *Other*

I. Piping System, Small Bore ≤ 50 mm (2 inch) (piping, gaskets, sight glasses, expansion joints, tubing, valves)

- i. *Above Ground Piping Leak, Diameter ≤ 2 " (non dead leg)*
- ii. *Pipe Run Leak (leak in wall of pipe)*
- iii. *Piping Repair Clamp Leak*
- iv. *Flange / Gasket Leak*
- v. *Valve*
- vi. *Fitting Leak*
- vii. *Other*
- viii. *Below Ground Piping Leak, Diameter ≤ 2 " (non dead leg)*
- ix. *Pipe Run Leak (leak in wall of pipe)*
- x. *Piping Repair Clamp Leak*
- xi. *Flange / Gasket Leak*
- xii. *Valve*
- xiii. *Fitting Leak*
- xiv. *Other*
- xv. *Dead Leg Leak, Diameter ≤ 2 " (either above or below ground)*
- xvi. *Pipe Run Leak (leak in wall of pipe)*
- xvii. *Piping Repair Clamp Leak*
- xviii. *Flange / Gasket Leak*
- xix. *Valve*
- xx. *Fitting Leak*
- xxi. *Other*
- xxii. *Tubing Leak*
- xxiii. *SS Tubing*
- xxiv. *Copper Tubing*
- xxv. *Plastic / PVC Tubing*

- xxvi. *Other Tubing*
- xxvii. *Hose Leak*
- xxviii. *Braided Metal*
- xxix. *Chemical Hose (typically plastic or polymer)*
- xxx. *Utility Hose (typically rubber)*
- xxxi. *Other Hose*
- xxxii. *PVC or other non-metallic pump*
- xxxiii. *Pipe Run Leak (leak in wall of pipe)*
- xxxiv. *Piping Repair Clamp leak*
- xxxv. *Flange / Gasket Leak*
- xxxvi. *Valve*
- xxxvii. *Fitting Leak*
- xxxviii. *Other*

m. *Pressure Vessel (drum, tower, pressurized storage)*

- i. *Tower*
- ii. *Wall / Head Leak*
- iii. *Flange / Gasket Leak*
- iv. *Threading Fitting Leak*
- v. *Other*
- vi. *Drum*
- vii. *Wall / Head Leak*
- viii. *Flange / Gasket Leak*
- ix. *Threading Fitting Leak*
- x. *Other*
- xi. *Pressurized Storage*
- xii. *Wall / Head Leak*
- xiii. *Flange / Gasket Leak*
- xiv. *Threading Fitting Leak*
- xv. *Other*
- xvi. *Other Pressure Vessel*
- xvii. *Wall / Head Leak*
- xviii. *Flange / Gasket Leak*
- xix. *Threading Fitting Leak*
- xx. *Other*

n. *Pump*

- i. *Process Pump*
- ii. *Seal Leak*
- iii. *Packing Leak*
- iv. *Flange / Gasket Leak*
- v. *Casing Leak*
- vi. *Threading Fitting Leak*
- vii. *Auxiliary System leak (i.e. tube oil)*
- viii. *Other*
- ix. *Chemical Injection / Utility Pump*
- x. *Seal Leak*
- xi. *Packing Leak*
- xii. *Flange / Gasket Leak*
- xiii. *Casing Leak*
- xiv. *Threading Fitting Leak*
- xv. *Auxiliary System leak (i.e. tube oil)*
- xvi. *Other*
- xvii. *Other Pump*
- xviii. *Seal Leak*
- xix. *Packing Leak*
- xx. *Flange / Gasket Leak*
- xxi. *Casing Leak*
- xxii. *Threading Fitting Leak*

- xxiii. *Auxiliary System leak (i.e. tube oil)*
- xxiv. *Other*

o. Reactor

- i. *Wall / Head Leak*
- ii. *Flange / Gasket Leak*
- iii. *Gasket Failed*
- iv. *Flange Face Damage*
- v. *Wrong Gasket*
- vi. *Bolt Relaxed (i.e. thermal cycle)*
- vii. *Loose Bolts*
- viii. *Other*
- ix. *Threaded Fitting Leak*
- x. *Fitting Thread Leak*
- xi. *Fitting Body Leak*
- xii. *Other*
- xiii. *Other*

p. Other (describe)

g) Type of Material released (check one):

- a. Flammable
- b. Combustible
- c. Toxic
- d. Corrosive
- e. UNDG Class 2, Division 2.2
- f. Utilities (e.g. air, water, steam, nitrogen, etc.)
- g. Other (describe)

h) Causal Factors (select at least one, maximum of three):

- a. Change Management / MOC / PSSR
 - i. Action Items Implementation LTA
 - ii. Commissioning Not Authorized
 - iii. Informing / Training Personnel LTA
 - iv. MOC Hazard Analysis LTA
 - v. No MOC
 - vi. QA/QC Design and Construction LTA
 - vii. Temporary MOC Past Removal Date
 - viii. Updating Procedures / PSI LTA
 - ix. Other (describe)
- b. Communication
 - i. Ambiguous
 - ii. Language Barrier
 - iii. Misunderstood
 - iv. No Communication
 - v. Not Timely
 - vi. Pework Safety Review LTA
 - vii. Shift Turnover LTA
 - viii. Signs, Warnings, or Labels LTA
 - ix. Other (describe)
- c. Design / Construction

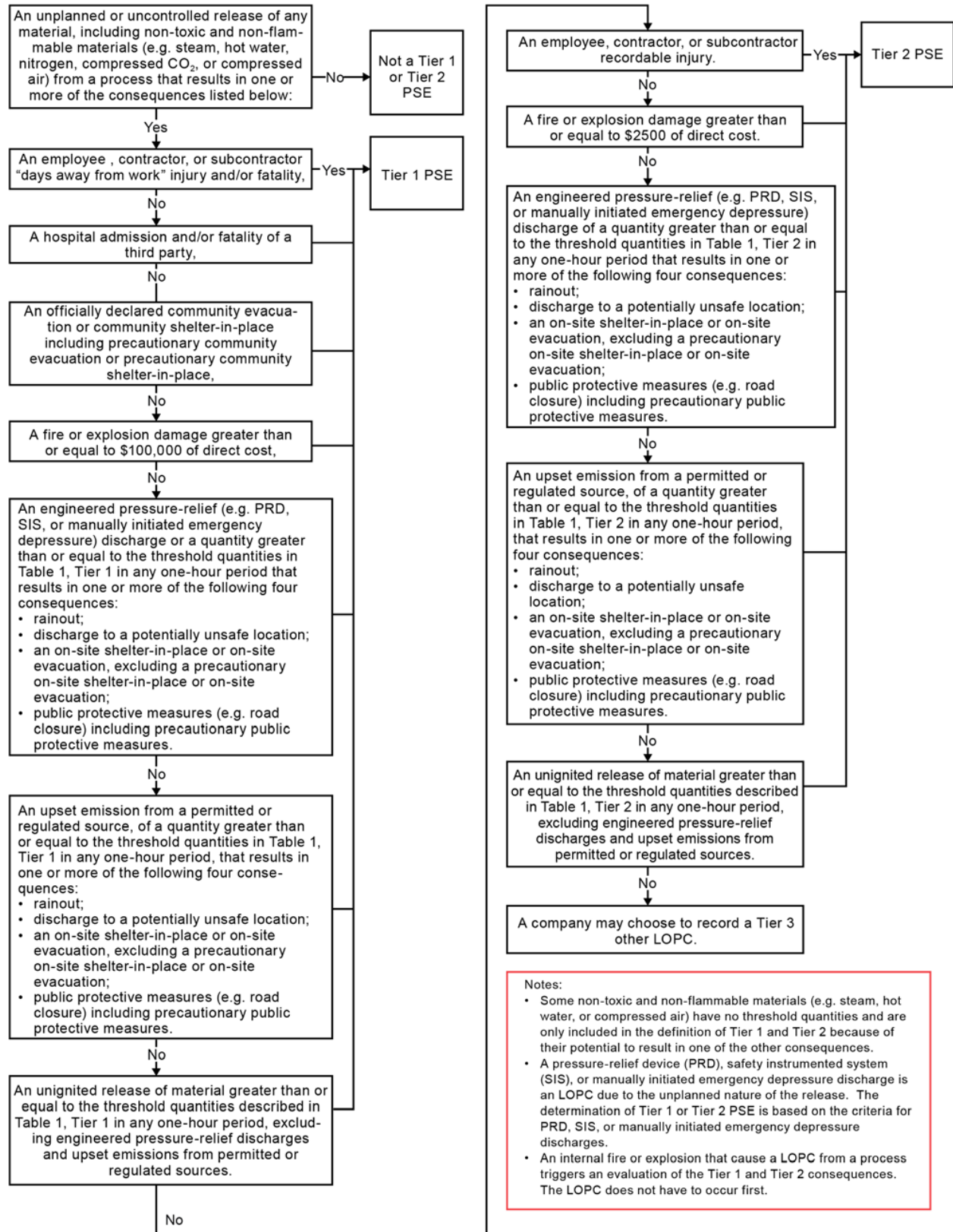
- i. Codes and Standards, Specifications, or Practices LTA
 - ii. Construction Not Consistent with Design
 - iii. Engineering LTA
 - iv. Fabrication or Installation LTA
 - v. Wrong Material(s) of Construction
 - vi. Other (describe)
- d. Equipment Reliability
 - i. Maintenance Methodology LTA
 - ii. Premature Failure
 - iii. Preventive Maintenance / Testing Frequency LTA
 - iv. Repair Methodology LTA
 - v. Testing Methodology LTA
 - vi. Other (describe)
- e. Fixed Equipment Inspection
 - i. Corrective Action Not Timely
 - ii. Frequency LTA
 - iii. Knowledge / Experience of Inspector LTA
 - iv. Location LTA
 - v. No Inspection
 - vi. QA/QC LTA
 - vii. Records LTA
 - viii. Technique LTA
 - ix. Other (describe)
- f. Human Performance
 - i. Ergonomics LTA
 - ii. Human Machine Interface LTA
 - iii. Physiologically Related – Fatigue, Illness, Impairment
 - iv. Time Constraint / Pressure
 - v. Work Environment
 - vi. Workload – Physical / Mental
 - vii. Other (describe)
- g. Knowledge and Skills, and Experience
 - i. Experience LTA
 - ii. Knowledge LTA
 - iii. Skills LTA
 - iv. Other (describe)
- h. Operating Limits
 - i. No Operating Limits
 - ii. Not Alarmed
 - iii. Not Monitored
 - iv. Operating Limits Exceeded
 - v. Operating Limits Not Correct
 - vi. Other (describe)

- i. Procedures
 - i. Operating
 - 1. No Procedure Available
 - 2. Procedure Available but Not Used / Followed
 - 3. Procedure Followed Incorrectly (e.g. steps out of order)
 - 4. Procedure Not Accurate / Clear
 - 5. Situation Not Covered
 - 6. Used Wrong Procedure
 - 7. Other (describe)
 - ii. Maintenance
 - 1. No Procedure Available
 - 2. Procedure Available but Not Used / Followed
 - 3. Procedure Followed Incorrectly (e.g. steps out of order)
 - 4. Procedure Not Accurate / Clear
 - 5. Situation Not Covered
 - 6. Used Wrong Procedure
 - 7. Other (describe)
 - iii. Contractor
 - 1. No Procedure Available
 - 2. Procedure Available but Not Used / Followed
 - 3. Procedure Followed Incorrectly (e.g. steps out of order)
 - 4. Procedure Not Accurate / Clear
 - 5. Situation Not Covered
 - 6. Used Wrong Procedure
 - 7. Other (describe)
 - iv. Other (describe)
- j. Risk Assessment and Incident Investigation
 - i. Action Item Closure LTA or Not Timely
 - ii. Incident Investigation LTA
 - iii. No Risk Assessment
 - iv. Risk Assessment Not Adequate
 - v. Risk Assessment Not Accurate
 - vi. Other (describe)
- k. Safe Work Practices or Procedures
 - i. Confined Space Practice or Procedure Problem LTA
 - ii. Energy Control / Isolation Practice or Procedure LTA
 - iii. Hot Work Practice or Procedure LTA
 - iv. Line Breaking / Equipment Opening Practice or Procedure LTA
 - v. Other (describe)
- l. Work Monitoring
 - i. Insufficient Oversight
 - ii. QA/QC LTA
 - iii. Rules Not Enforced
 - iv. Rules Not Followed
 - v. Scheduling LTA
 - vi. Simultaneous Operations

- vii. Working on Wrong Location
- viii. Other (describe)
- m. Other (describe)

APPENDIX C

PSE Tier 1 / Tier 2 DETERMINATION DECISION LOGIC TREE



APPENDIX D

Tier 1 PSE Severity Weighting

Severity weighting provides additional useful information about Tier 1 PSEs that may help drive performance improvement. Table 3 describes the methodology for calculating a severity weight for Tier 1 PSEs. The severity weighting is not intended to produce an ordinal ranking of Tier 1 PSEs but rather a relative differentiation between one Tier 1 PSE and another. There is no intended or implied equating of consequences from one category to the next. Also, there is no intended or implied value judgment that a Tier 1 PSE with a higher severity score is “worse” than another Tier 1 PSE with a lower severity score.

Using Table 3, a severity weight for each Tier 1 PSE shall be calculated by summing the points associated with each consequence category.

Table 3—Tier 1 Process Safety Event Severity Weighting

Severity Points	Consequence Categories				
	Safety/Human Health ^c	Direct Cost from Fire or Explosion	Material Release Within Any 1-hr Period ^{a d e}	Community Impact	Off-site Environmental Impact ^{b c}
1 point	Injury requiring treatment beyond first aid to an employee, contractor, or subcontractor. (Meets the definition of a U.S. OSHA recordable injury.)	Resulting in $\$100,000 \leq$ direct cost damage $< \$1,000,000$.	Release volume $1 \times \leq$ Tier 1 TQ $< 3 \times$ outside of secondary containment.	— Officially declared shelter-in-place or public protective measures (e.g. road closure) for < 3 hours, or — officially declared evacuation < 3 hours.	Resulting in $\$100,000 \leq$ acute environmental cost $< \$1,000,000$.
3 points	— Days away from work injury to an employee, contractor, or subcontractor, or — injury requiring treatment beyond first aid to a third party.	Resulting in $\$1,000,000 \leq$ direct cost damage $< \$10,000,000$.	Release volume $3 \times \leq$ Tier 1 TQ $< 9 \times$ outside of secondary containment.	— Officially declared shelter-in-place or public protective measures (e.g. road closure) for > 3 hours, or — officially declared evacuation > 3 hours < 24 hours.	— 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	— A fatality of an employee, contractor, or subcontractor, or — a hospital admission of a third party.	Resulting in $\$10,000,000 \leq$ direct cost damage $< \$100,000,000$.	Release volume $9 \times \leq$ Tier 1 TQ $< 27 \times$ outside of secondary containment.	Officially declared evacuation > 24 hours < 48 hours.	— 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	— Multiple fatalities of employees, contractors, or subcontractors, or — multiple hospital admission of third parties, or — a fatality of a third party.	Resulting in $\geq \$100,000,000$ of direct cost damages.	Release volume $\geq 27 \times$ Tier 1 TQ outside of secondary containment.	Officially declared evacuation > 48 hours.	— Resulting in $\geq \$100,000,000$ of acute environmental costs, or — large-scale injury or death of aquatic or land-based wildlife.

- a Where there is no secondary containment, the quantity of material released from primary containment is used. Where secondary containment is designed to only contain liquid, the quantity of the gas or vapor being released and any gas or vapor evolving from a liquid must be calculated to determine the amount released outside of secondary containment.
- b Judging small-, medium-, or large-scale injury or death of aquatic or land-based wildlife should be based on local regulations or Company guidelines.
- c The severity weighting calculation includes a category for “off-site environmental impact” and injury beyond first aid (i.e. OSHA “recordable injury”) level of safety/human health impact that are not included in the Tier 1 PSE threshold criteria. However, the purpose of including both of these values is to achieve greater differentiation of severity points for events that result in any form of injury or environmental impact.
- d For the purpose of severity weighting, general paving or concrete under process equipment, even when sloped to a collection system, is not credited as secondary containment.
- e Material release is not tabulated for fires or explosions. These events severity will be determined by the other consequence categories in this table.

APPENDIX E

Application to Petroleum Pipeline & Terminal Operations (informative)

API 754 was developed for the refining and petrochemical industries but may also be applicable to other industries with operating systems and processes where loss of containment has the potential to cause harm, such as petroleum pipeline and terminal operations. API 754 may be applied to petroleum pipeline and terminal operations by substituting the following sections for those used in the body of this RP.

Applicability

The RP applies to the responsible party. At co-located facilities (e.g. industrial park), this RP applies individually to the responsible parties and not to the facility as a whole.

Events associated with the following activities fall outside the scope of this RP and shall not be included in data collection or reporting efforts:

- a) marine transport operations, except when the vessel is connected or in the process of connecting or disconnecting to the process;

NOTE The boundary between marine transport operations and connecting to/disconnecting from the process is the first/last step in loading/unloading procedure (e.g. first line ashore, last line removed, etc.).

- b) truck or rail operations, except when the truck or rail car is connected or in the process of connecting or disconnecting to the process, or when the truck or rail car is being used for on-site storage;

NOTE 1 Active staging is not part of connecting or disconnecting to the process; active staging is not considered on-site storage; active staging is considered part of transportation.

NOTE 2 The boundary between truck or rail transport operations and connecting to/disconnecting from the process is the first/last step in loading/unloading procedure (e.g. wheel chocks, set air brakes, disconnect master switch, etc.).

- c) vacuum truck operations, except on-site truck loading or discharging operations, or use of the vacuum truck transfer pump;
- d) routine emissions from permitted or regulated sources;
NOTE Upset emissions are evaluated as possible Tier 1 or Tier 2 PSEs per 5.2 and 6.2.
- e) office, shop, and warehouse building events (e.g. office fires, spills, personnel injury or illness, etc.);
- f) personal safety events (e.g. slips, trips, falls) that are not directly associated with on-site response or exposure to a LOPC event;
- g) LOPC events from ancillary equipment not connected to the process;
- h) QA and QC laboratories; and
- i) on-site fueling operations of mobile and stationary equipment (e.g. pick-up trucks, diesel generators, and heavy equipment).

Terms and Definitions

process

Distribution, storage, utilities, or loading facilities used store and transport petrochemical and petroleum refining feedstocks, and products. This includes process equipment (e.g. vessels, piping, process sumps, vapor recovery systems, pumps, compressors, exchangers, pigging stations, metering stations, refrigeration systems, associated ancillary equipment, etc.), storage tanks, active warehouses, support areas (e.g. wastewater and ballast water treatment plants), on-site remediation facilities, and on-site and off-site distribution piping under control of the Company.

APPENDIX F

Application to Retail Service Stations (informative)

API 754 was developed for the refining and petrochemical industries but may also be applicable to other industries with operating systems and processes where loss of containment has the potential to cause harm such as retail service stations. API 754 may be applied to retail service stations by substituting the following sections for those used in the body of this RP. Retail service stations dispense gasoline, diesel, biofuels, propane, compressed natural gas, and hydrogen to the public.

This RP applies to the responsible party. At co-located facilities (e.g. industrial park), this RP applies individually to the responsible parties and not to the facility as a whole.

Applicability

Events associated with the following activities fall outside the scope of this RP and shall not be included in data collection or reporting efforts:

- a) truck operations, except when the truck is connected or in the process of connecting or disconnecting to the process, or when the truck is being used for on-site storage;

NOTE 1 Active staging is not part of connecting or disconnecting to the process; active staging is not considered on-site storage; active staging is part of transportation.

NOTE 2 The boundary between truck or rail transport operations and connecting to/disconnecting from the process is the first/last step in loading/unloading procedure (e.g. wheel chocks, set air brakes, disconnect master switch, etc.).

- b) routine emissions from permitted or regulated sources;

NOTE Upset emissions are evaluated as possible Tier 1 or Tier 2 PSEs per Section 5.2 and 6.2 of RP 754.

- c) office, shop, and convenience store events (e.g. office fires, spills, personnel injury or illness, etc.);
- d) personal safety events (e.g., slips, trips, falls) that are not directly associated with on-site response or exposure to a LOPC event;
- e) LOPC events from ancillary equipment not connected to the process, and releases caused by the actions of retail customers.

NOTE Failure of the auto shutoff, in countries where 'latch' filling is permitted, that causes a spill is not considered an action of the retail customer.

Terms and Definitions

process

Storage and dispensing facilities used for retail sales of petroleum refining products and biofuels. This includes process equipment (e.g., LPG vessels, piping, hoses, pumps, compressors, exchangers, etc.), above or below ground storage tanks, active warehouses, dispensers, and LPG exchange cylinders under control of the Company.

APPENDIX G

Oil & Gas Drilling and Production Operations (informative)

API 754 was developed for the refining and petrochemical industries but may also be applicable to other industries with operating systems and processes where loss of containment has the potential to cause harm such as oil and gas drilling and production activities. API 754 may be applied to oil and gas drilling and production operations by following the guidance provided in IOGP Report No. 456.

References

The following documents are directly referenced in this document.

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- [3] ASTM D93-15, *Standard Test Methods for Flash Point by Pensky-Martens Closed Cup Tester*
- [4] ASTM D3941-14, *Standard Test Method for Flash Point by the Equilibrium Method With a Closed-Cup Apparatus*
- [5] ASTM D56-05, *Standard Test Method for Flash Point by Tag Closed Cup Tester*
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- [8] OSHA 3245-01R², *OSHA Recordkeeping Handbook: The Regulation and Related Interpretations for Recording and Reporting Occupational Injuries and Illnesses*, <http://www.osha.gov/recordkeeping/index.html>
- [9] UNECE³, ECE/TRANS/202, Vol. I and II ("ADR 2009"), *European Agreement Concerning the International Carriage of Dangerous Goods by Road (ADR)* <http://www.unece.org/trans/danger/publi/adr/adr2009/09ContentsE.html>
- [10] U.S. DOT⁴, 49 CFR 173.2a, *Classification of a Material Having More Than One Hazard*, http://edocket.access.gpo.gov/cfr_2006/octqtr/49cfr173.2a.htm
- [11] U.S. DOT⁹, 49 CFR, Part 172, *Subpart B—Table of Hazardous Materials and Special Provisions*, <https://www.ecfr.gov/cgi-bin/text-idx?node=pt49.1.172#sp49.2.172.b>
- [12] ISO 10156:2010(E)⁵, *Gas cylinders—Gases and gas mixtures—Determination of fire potential and oxidizing ability for the selection of cylinder valve outlets*, Third Edition
- [13] API Standard 521, *Pressure-relieving and Depressuring Systems*, Seventh Edition

¹ ASTM International, 100 Barr Harbor Drive, West Conshohocken, PA 19428, www.astm.org.

² U.S. Department of Labor, Occupational Safety and Health Administration, 200 Constitution Avenue NW, Washington, DC 20210, www.osha.gov.

³ United Nations Economic Commission for Europe, Information Service, Palais des Nations, CH-1211 Geneva 10, Switzerland, www.unece.org.

⁴ U.S. Department of Transportation, 1200 New Jersey Avenue SE, Washington, DC 20590, www.dot.gov.

⁵ International Organization for Standardization, Chemin de Blandonnet 8, CP 401, 1214 Vernier, Geneva, Switzerland, www.iso.org.