



Module 7: Incident Investigation

Last Revised – June 2024



PS Bootcamp Modules

- ✓ **Module 1: Introduction**
- ✓ **Module 2: Hazard Identification**
- ✓ **Module 3: Risk Matrix**
- ✓ **Module 4: Safeguards Concept**
- ✓ **Module 5: Explosion/Fire Protection**
- ✓ **Module 6: Management of Change**
- ✓ **Module 7: Incident Investigation**
- ☐ **Module 8: Facility Siting**

Agenda

- **Incident/Near Miss Definitions**
- **Procedure and Reference Documents**
- **Incident Investigation Process**
- **First Steps after an Incident**
- **Process Safety Key Performance Indicators**
- **Incident Communication**
- **Investigation Report Process**
- **Working Example**

Objectives

Awareness of :

- Incident Notification Requirements
- Types of Incidents
- Process Safety Incidents and KPIs
- Overview Incident Investigation Process
- Incident Reporting and Communication Requirements

Incident/Near Miss Definitions

Why investigate?

Incident Investigations help:

- Prevent reoccurrence of the incident
- Demonstrate commitment to health and safety
- Promote positive workplace morale
- Improve operations

All incidents, regardless of size or impact, need to be investigated

The process helps employers look beyond what happened to discover why it happened



What is an Incident?

An incident is defined as an accident or event which results in:

- injury or illness
- property damage
- an adverse effect on production or product quality
- an adverse effect on the environment

This definition includes all releases to the environment or events which require governmental reporting or an abnormal process situation.



What is a Near Miss?

A near miss is defined as an accident or event which, under different circumstances, could have resulted in:

- injury or illness
- property damage
- an adverse effect on production or product quality
- an adverse effect on the environment

Near misses need to be reported!



Near Miss Examples

A contractor drops a wrench from elevated scaffolding,



but no one is struck.

A red barricade is not in place for a suspended load



and an employee walks under the load.

An employee is walking down a wet hallway and slips



but does not fall.

A high pH excursion through WWT to outfall 001 that nearly exceeded our permit limitation (within 0.5)



but was corrected prior to reaching the limit.

A critical procedure was not followed



but nothing detrimental happened.

An IPL was by-passed without the proper documentation



with no consequences.

The Tip of the Iceberg...

Incidents

Incidents resulting in injuries/releases are the tip of the iceberg of hazards

Near Misses

When you investigate near misses you are taking proactive steps to prevent similar or more serious incidents from happening in the future



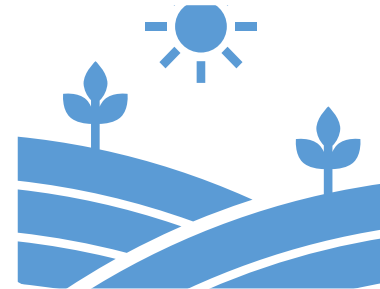
'EHS-Related' Incidents per IVL EHS-106



Transportation



Security



Environmental



Health and
Safety

Sub-Types of Incidents in Intelex

Security



Distribution



Fire



Injury/Illness



Process
Safety



Environmental



Property Damage



Reliability



Notice of Violation

Quality



Near Miss



Regulatory Agency
Inspection

Process Safety Incidents

**Highest
potential
for...**

- multiple injuries/deaths
- significant environmental harm
- property damage
- significant business interruption
- damage to reputation

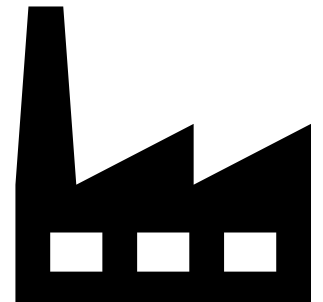
Process Safety Incident Examples

Unintended releases, mixing, reaction of chemicals

- Chemical release to the environment or a release of a utility stream (steam, water, N2, etc.) that results in injury
- Fires no matter the size
- Explosions
- Runaway reaction
- Unintended mixing of chemicals
- Injury due to a chemical release
- Officially declared evacuation or shelter in place due to a chemical release

Pressure Relief Device activated

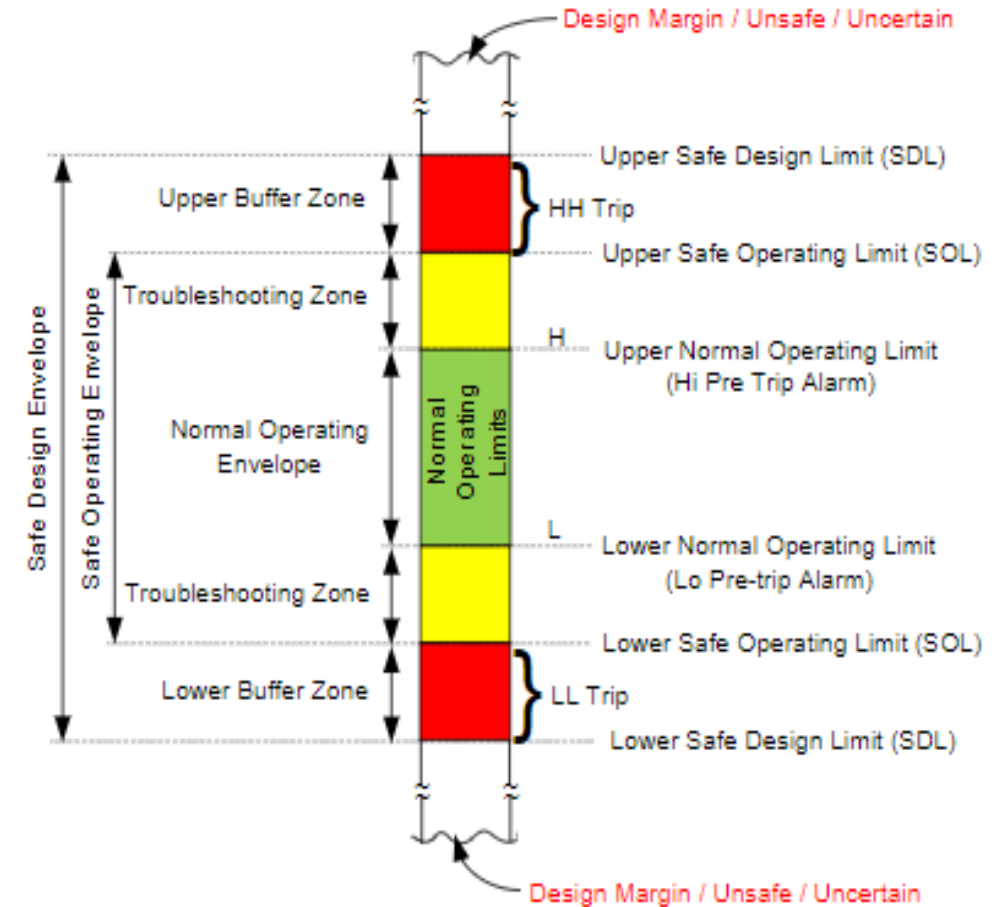
Demand on a Safety System



Process Safety Incident Examples

Safety System Activation and Design Exceedance

- Exceedance of a safe operating or design limit
- EHS critical shutdowns/trips or failure to trip when required
- EHS critical alarm and operator response
- A pressure relief device activated (leaking below set pressure is not included)
- Defeating / bypassing a safety device such as a relief valve, IPL, or fire protection system without the site's Authorization process being followed



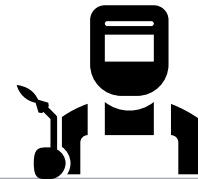
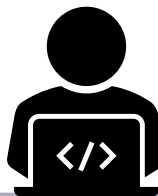
Procedure and Reference Documents

Procedures

IVL EHS-105 identifies the notification requirements for incidents and near misses

and

IVL EHS-106 outlines when and how the facility performs EHS related incident investigations



Apply to all employees, contractors and visitors.

References

Always refer to the Site Incident Investigation Standard Procedure for the complete incident investigation process.

Corporate Reference documents:

- IVL EHS-105 “Notification of Incidents”
- IVL EHS-106 “Incident Investigation”
- IVL EHS-1105A “Notification of Incident Matrix”
- IVL EHS-1106A “Steps of the Incident Investigation Method”
- IVL EHS-1106B “Apollo Root Cause Analysis Methodology”
- IVL EHS-1106F “Leader Competencies”
- IVL EHS-1106H “TapRoot Root Cause Analysis Methodology”
- IVL EHS-109 “IVL EHS Metrics and Reporting”
- IVL EHS-1109A “EHS Metrics Reporting, Methodology and Definitions”

Procedure Requirements

Investigate EHS-related incidents to accomplish the following:

- Determine the root causes underlying these incidents
- Identify and implement effective corrective actions to prevent their recurrence
- Report investigation results
- Communicate findings and share learnings to prevent recurrence
- Review and update existing risk studies to ensure that the hazards and risks associated with similar activities/processes have been accurately assessed



Roles and Responsibilities

Incident Investigation Leader must ensure:

Trained on and experienced in the methodology to be employed

Team is familiar with the principles of root cause analysis

Meet all applicable regulatory requirements

Employees and Contractors must:

Follow the site-specific procedure

Report all incidents

Participate in investigations and closure of action items

Timing

Recording of the incident begins as soon as possible after the incident

Full incident investigation of A to E severity or LIFE events must commence within 48 hours

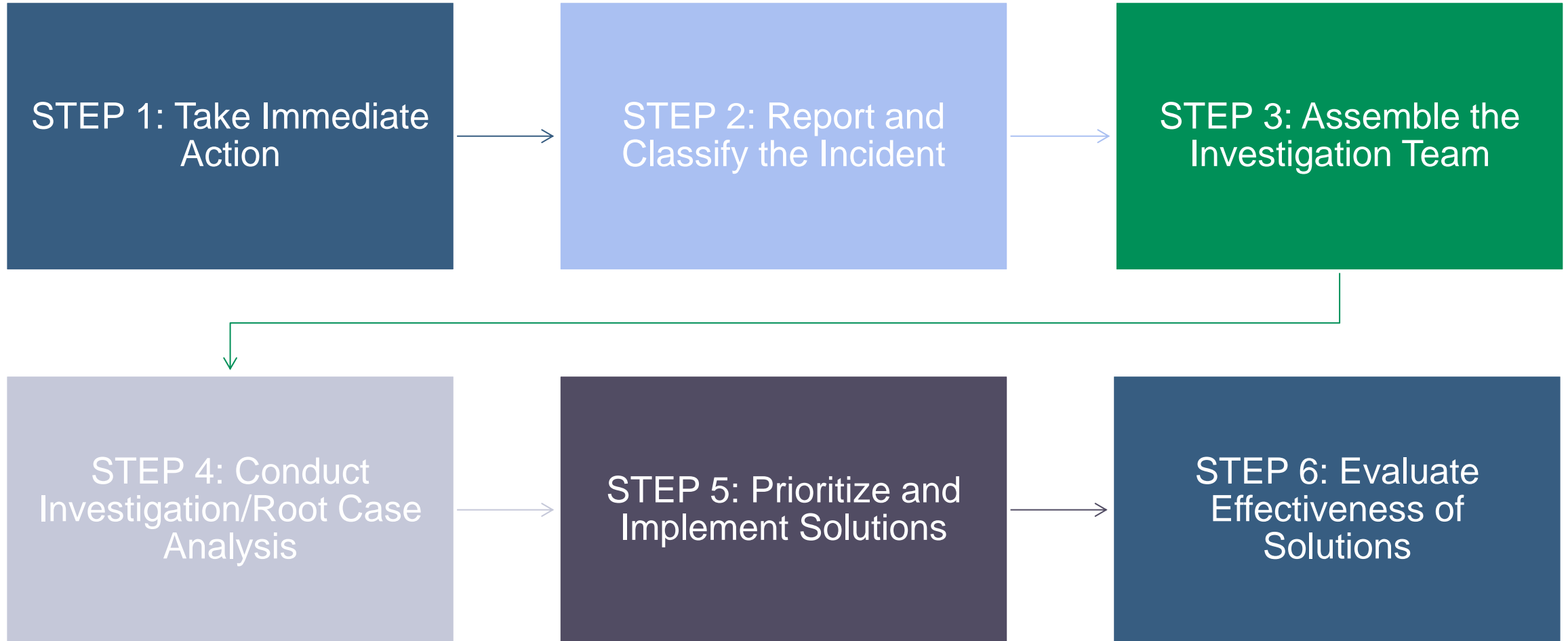
Severity F, G and H, non-LIFE events shall begin as soon as possible

Reports should be completed within 30 days, any extensions must be approved by the Site Head or designee



Incident Investigation Process

Incident Investigation Steps



STEP 1: Take Immediate Action

Provide assistance and emergency response

- Minimize exposures
- Eliminate/contain hazards

Secure the scene and preserve evidence

Collect initial information including witness statements

Manage initial communication related to the incident

Determine if equipment is safe to operate

If safe, take photographs and be sure to document the date, time and direction/orientation of the photo.



STEP 2: Report and Classify the Incident

Immediately provide verbal notification of all incidents per:

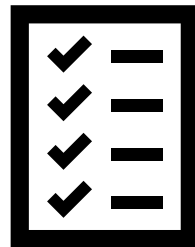
- Site Procedure, IVL EHS-105, Notification of Incidents

Record incident in electronic tracking system no later than 24 hours

Develop and issue one page PowerPoint within 48 hours for:

- PS Tier 1 and 2, LIFE, pLIFE, Recordable, and Environmental with Offsite Impacts

Refer to IVL EHS-1105A to determine the need for further investigation and by whom



Completion of the initial incident report form marks the initiation of the investigation

STEP 3: Assemble the Investigation Team

Site Head must assign a competent investigation team leader

Along with the Site Head the Leader will appoint investigation team members

Corporate legal must be notified for any possible legal liabilities
(e.g., meets the severity of an A to E according to EHS-1105A)

Contractors shall investigate or participate, as needed, in any investigations of EHS incidents that occur while performing work for IVL

Personnel involved in an incident are excluded as a member of the team for severity level A through F; for severity level G and H it is the site's decision



STEP 4: Conduct Investigation/RCA

Methodology	Incident Classification	Leader
Mandatory Root Cause Analysis (RCA), using predefined RCA tool	Health & Safety Incident Severity A to F Environmental Incident Severity A to E Process Safety Tier 1 Event Severity A to E Life-Impacting or Fatal Event (LIFE)	Regional EHS
Mandatory RCA, RCA tool free of Choice (e.g. Logic Tree, TapRoot®, 5 Why)	Severity G Severity H pLIFE Event Process Safety Tier 1 Event, unless it is an A to E severity or as otherwise directed by the business segment or Regional EHS.	Segment/Site Employees trained in selected methodology

STEP 4 Continued...

The investigation team must:

- Define the problem
- Identify and analyze the cause-effect relationships
- Identify and recommend effective solutions

The Team Leader is responsible, with support of the team, to prepare the report



NOTE: Incident Investigations should be completed within 30 days of the incident

STEP 5: Prioritize and Implement Solutions

All actions must be prioritized, and solutions implemented and tracked to closure through the electronic reporting system (e.g., Intelex)

All actions must be assigned to an owner with a completion date

Actions must be managed in accordance with the IVL EHS-107, IVL Management of Recommendations/Actions Standard

NOTE: Actions are **not** required to be completed before completion/closure of the incident investigation.

STEP 6: Evaluate Effectiveness of Solutions

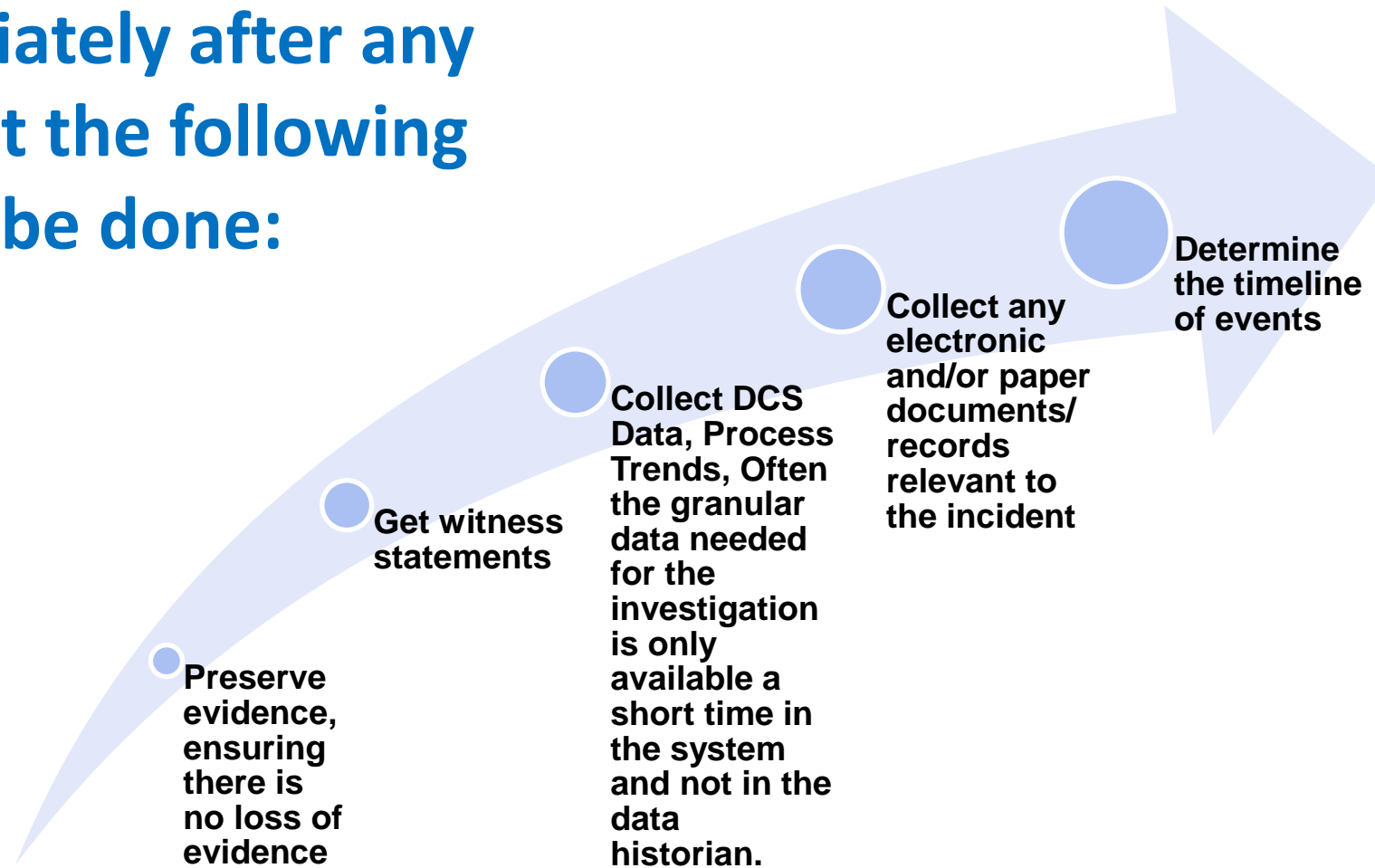
Completed actions/solutions must be evaluated for effectiveness according to IVL EHS-107 - Management of Recommendations/Actions



First Steps after an Incident

Evidence Collection

Immediately after any incident the following should be done:



Determine the Sub-Incident Type

Distribution
Fire
Property Damage
Reliability
Environmental
Injury/Illness
Process Safety
Quality
Security
Near Miss
Notice of Violation
Regulatory Agency Inspection

**Intelex
Categories**

Gather Key Information

EHS impacts (injuries, environmental impacts, short-time exposure concerns, agency notifications, etc.)

Process Safety classification (including actual severity and potential severity)

Process involved

Mode of operation

Point of release

Chemicals involved in a loss of containment and amount released

Duration of a loss of containment

Equipment damage

Emergency response/clean-up efforts and cost

Business impact

Product losses

Community impact


Impact to neighboring facilities

Releases and Leak Calculations


What are leak calculations for?

- Leak calculations are used by Process Safety/Environmental functions to determine if the release is a/an:
 - Process Safety Event (PSE)
 - Reportable Quantity (RQ)
 - Exceedance of the site Environmental Permits

What is required?

- It depends on the nature of the release.
 - Calculations can be technical and based on trends of the process with multiple variables
 - Bernoulli, choked flow, $\Delta P \propto \Delta n$, modeling
 - Calculations can be practical and based on observations
 - Drips per minute, spill would fill a one-gallon bucket, leaking component was tightened as soon as it was observed, level transmitters and vessel volumes
- 

What information is needed?

- Release characteristics, where available
 - Chemicals, quantity, temperature, start and stop time, duration, rate of release
 - Any assumptions or observations made to complete the calculation
 - PSM and Environmental may request additional details as needed
 - The CRANE Technical Paper 410 (Flow of Fluids) is an excellent resource.
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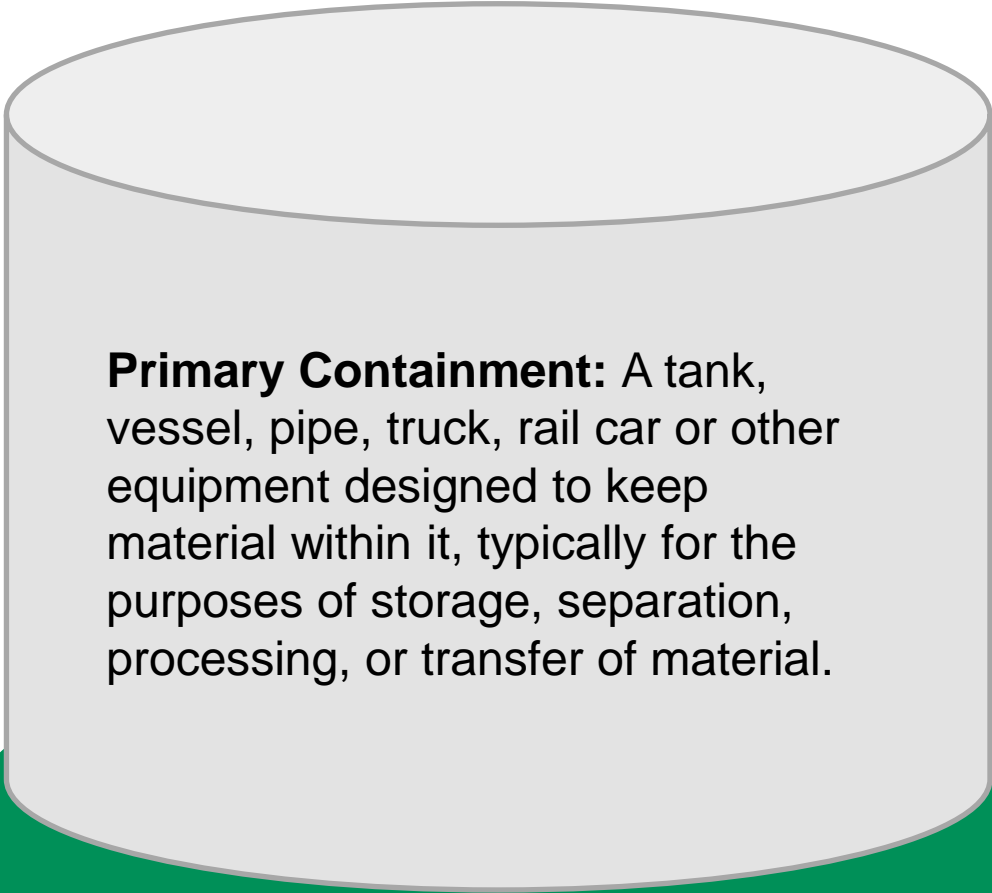
Process Safety Key Performance Indicators

KPIs for Process Safety Events

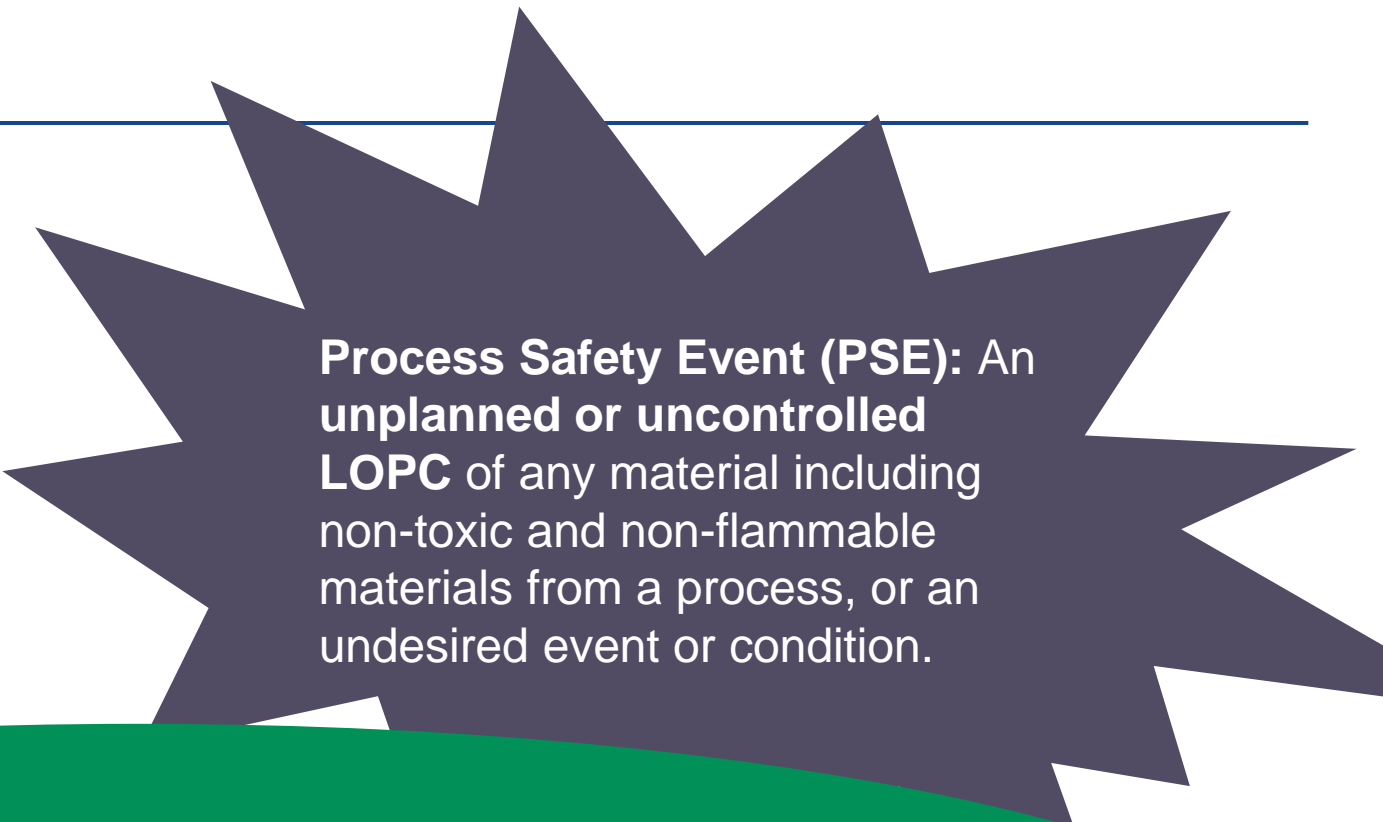
API RP 754 - Process Safety Performance Indicators for the Refining and Petrochemical Industries

- Originally published in 2010, recently updated third edition in August 2021
- Four tiers of leading and lagging process safety indicators for driving performance improvement
- Associated Material Release Threshold Quantities

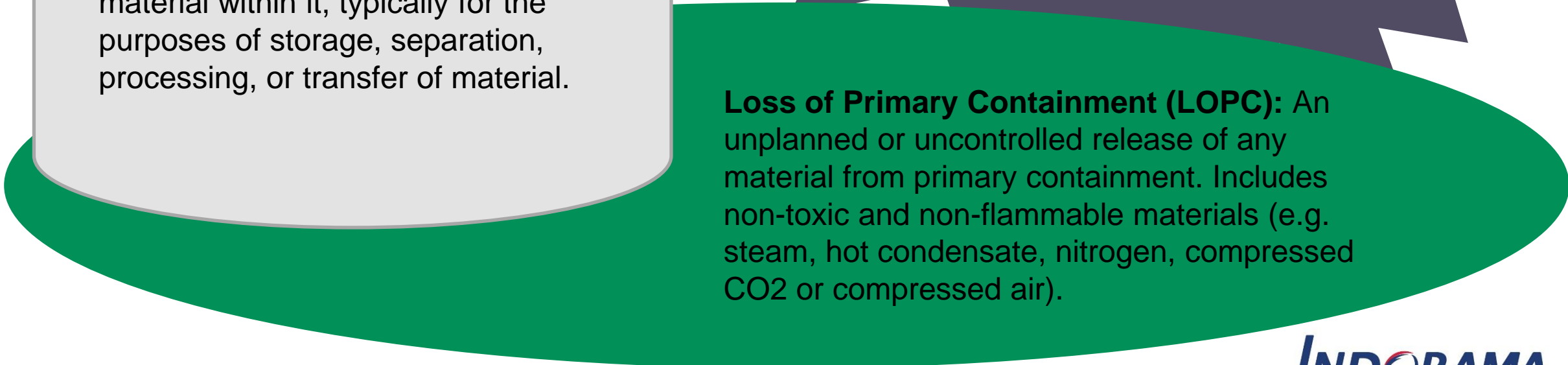
Key Definitions



Primary Containment: 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.

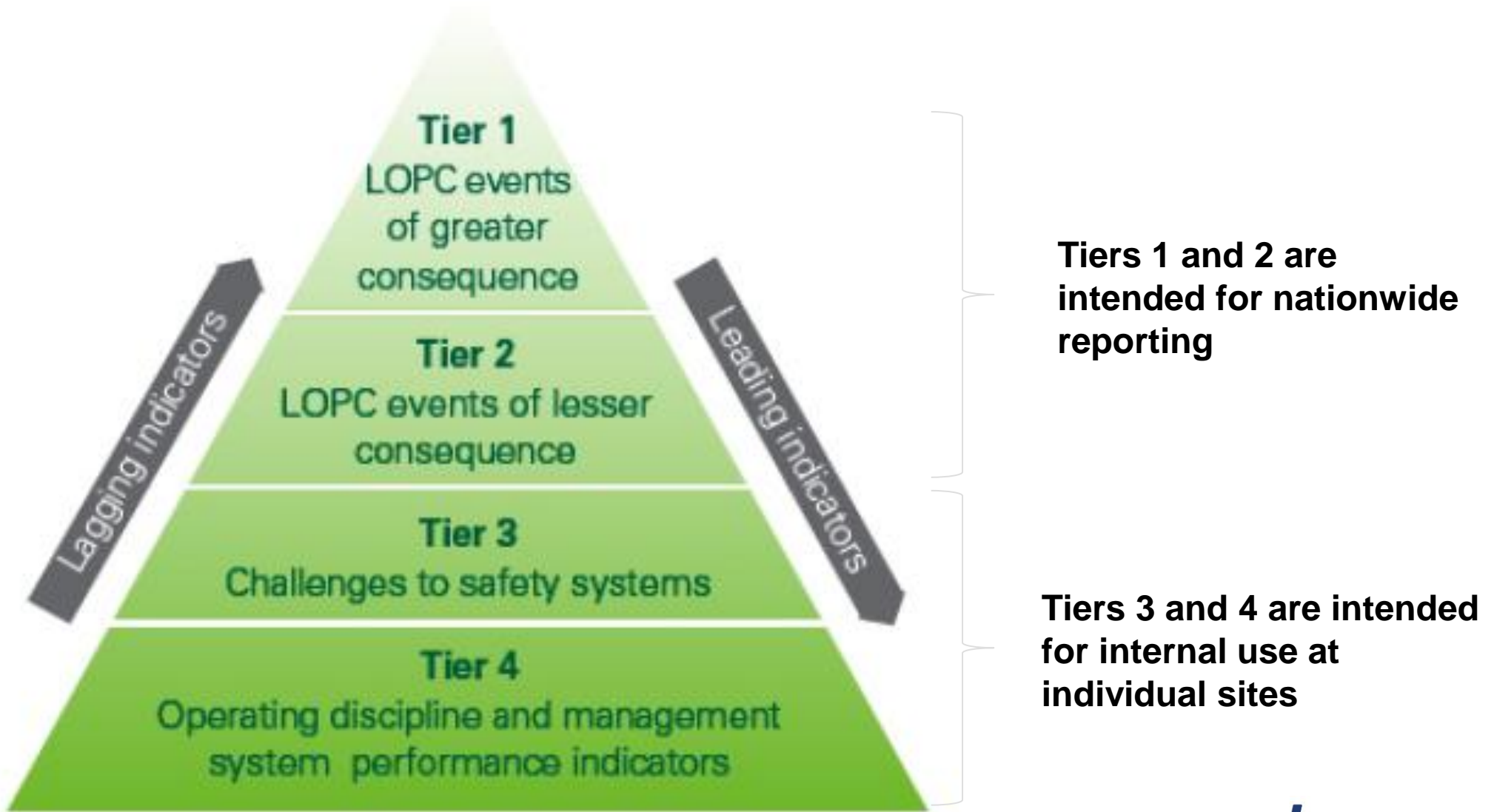


Process Safety Event (PSE): An unplanned or uncontrolled LOPC of any material including non-toxic and non-flammable materials from a process, or an undesired event or condition.

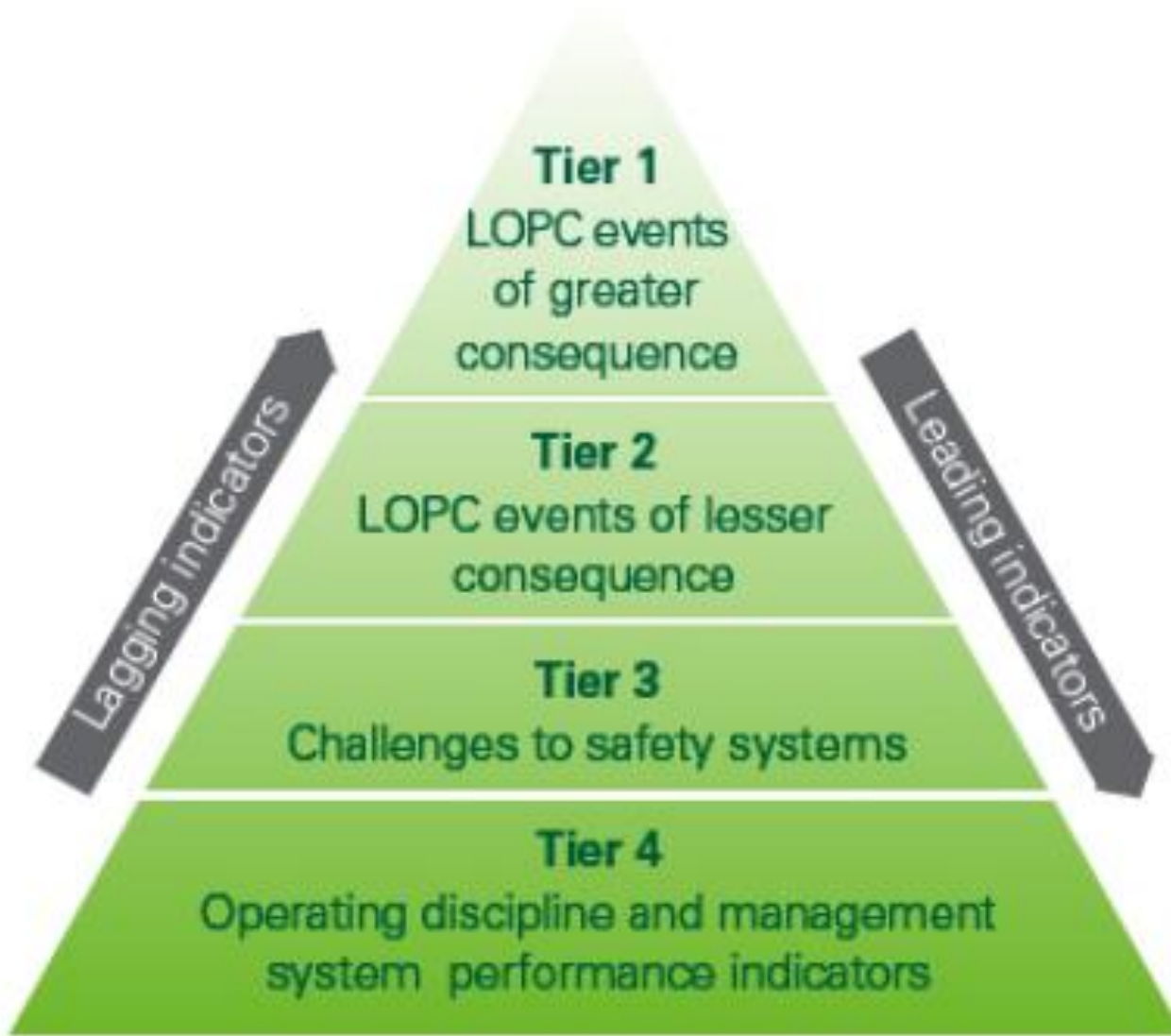


Loss of Primary Containment (LOPC): An unplanned or uncontrolled release of any material from primary containment. Includes non-toxic and non-flammable materials (e.g. steam, hot condensate, nitrogen, compressed CO2 or compressed air).

Process Safety Tiered Events



Indorama Monthly KPIs



Tier 1 and 2 required to be reported across all Indorama sites

Only required to report Demands on Protective Systems/ Safeguards or LOPC Tier 3

IVL is in the process of developing recommended Tier 4 Events for site level reporting

Tier 1 Process Safety Events

Tier 1: LOPC of Greater Consequence

Unplanned/Uncontrolled loss of primary containment resulting in:

- Lost Time or fatality on site
- Hospital admission or fatality of 3rd party
- Officially declared community evacuation or shelter-in-place
- Fire or explosion resulting in \geq \$100,000 (direct cost)
- PRD release exceeding the threshold quantity (Table 1) with at least 1 of the following: liquid rainout, unsafe discharge location, on site shelter-in-place, public impact
- Release of material in any 1 hour \geq threshold quantity in Table 1

Tier 2 Process Safety Events

Tier 2: LOPC of Lesser Consequence

Unplanned/Uncontrolled loss of primary containment resulting in:

- Recordable injury on site
- Fire or explosion resulting in $\geq \$2,500$ but $< \$100,000$ (direct cost)
- PRD release exceeding the threshold quantity (Table 2) with at least 1 of the following: liquid rainout, unsafe discharge location, on site shelter-in-place, public impact
- Release of material in any 1 hour \geq threshold quantity in Table 2

Tier 3 Process Safety Events

A Tier 3 indicator represents a challenge to the barrier system that progressed along the path to harm but stopped short of a Tier 1 or 2 loss of primary containment consequence.

Examples include:

- Actual Demands placed on EHS Critical Protective Systems/Safeguards
- Other LOPC Event



*Remember...these 2 are
Indorama Monthly KPIs*

Tier 3 Process Safety Events (cont.)

Demands placed on EHS Critical Protective Systems/Safeguards: Designed to prevent a loss of primary containment (LOPC) or to mitigate the consequences of a LOPC

Examples:

- EHS Critical Safety Shutdown
- EHS Critical pressure and/or vacuum relief protective devices, including scrubbing systems used for emergency purposes
- EHS Critical emergency power supplies (e.g. back up generators, Uninterrupted Power Supplies, etc.)
- EHS Critical protection systems, including Safety Integrity Level (SIL) rated systems, non-rated systems, etc., activated in order to mitigate a release of toxic or flammable materials even though no actual ignition or toxic exposure occurred
- Operator intervention which is required in order to mitigate an “out of control” process event

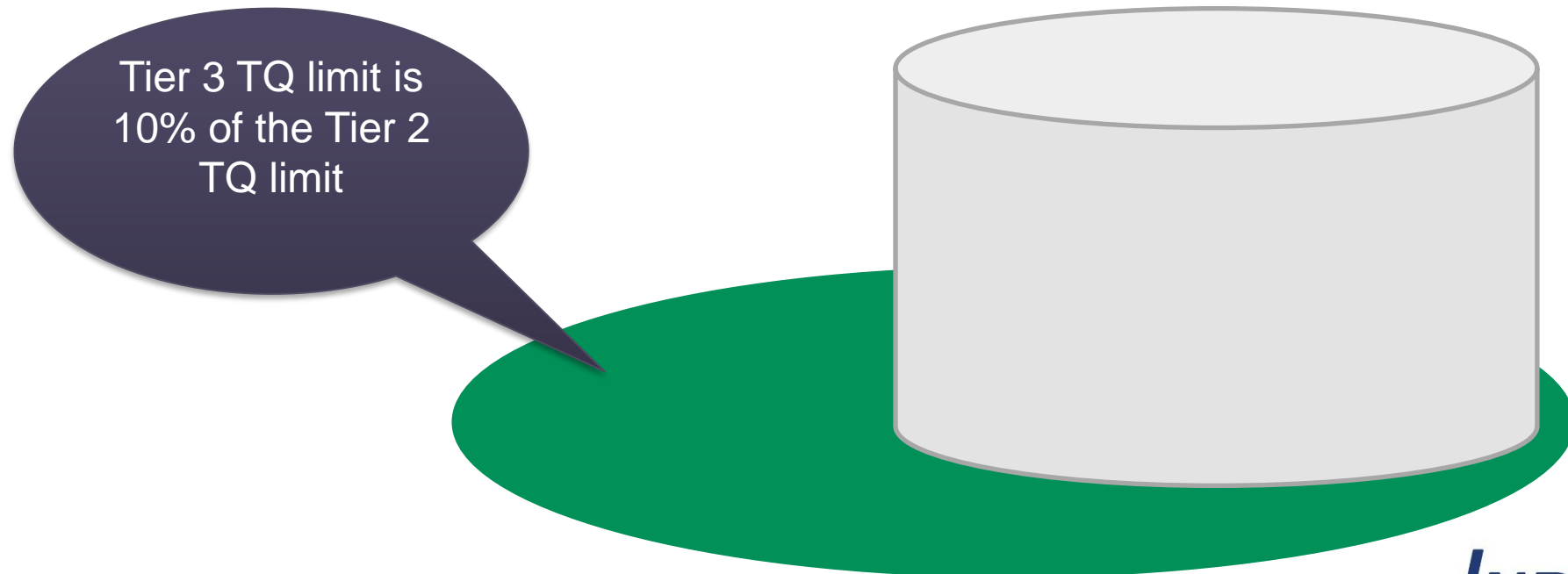
Exclusions include:

- Intentional activation during periodic testing or manual activation as part of a normal shutdown
- SIS activation configured for equipment protection with no LOPC
- Mechanical shutdown system activation for equipment protection with no LOPC

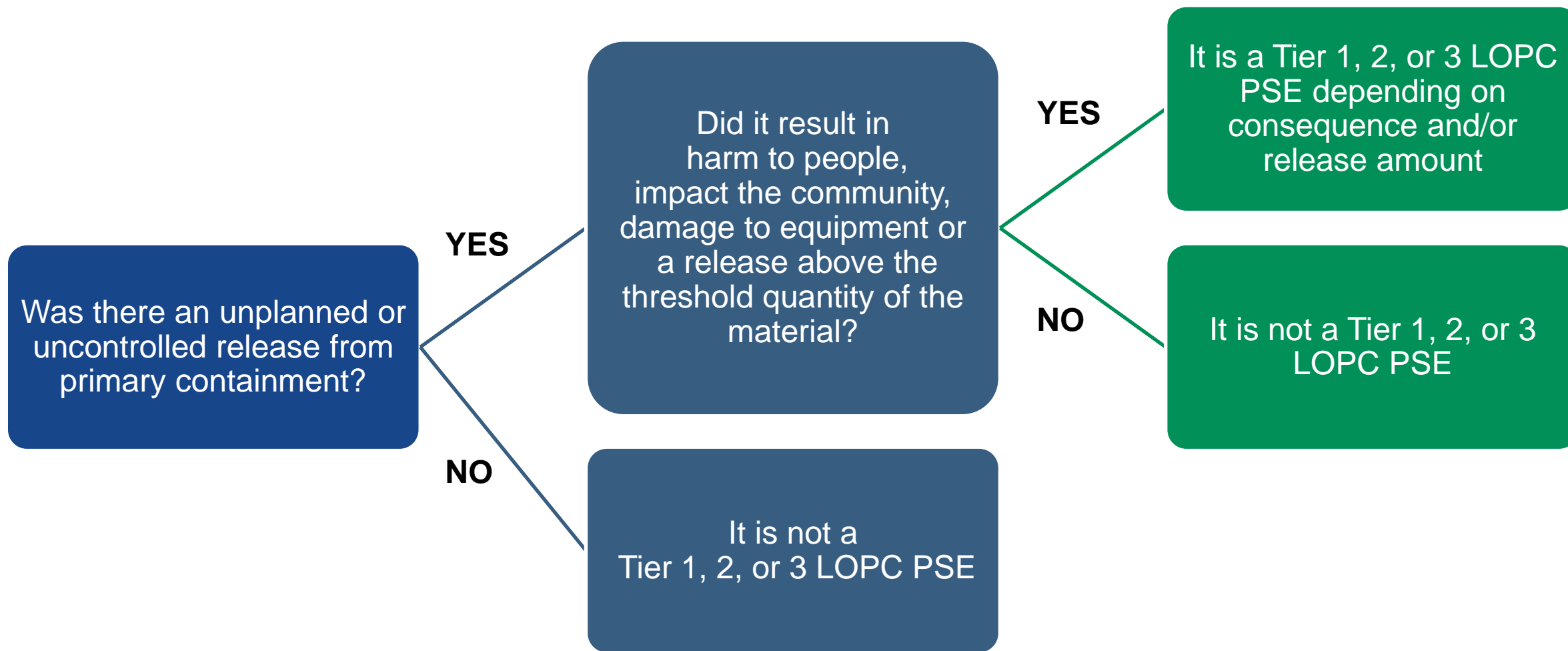
Tier 3 Process Safety Events (cont.)

Tier 3 LOPC

- All chemical releases (process and utilities) from primary containment that the release meets or exceeds the Tier 3 material release threshold quantity in any one-hour period of the release



LOPC in a Nutshell



KPIs from IVL EHS-109

Title: IVL EHS METRICS AND REPORTING
No: IVL EHS-109

Version: Original
Page 7 of 7

Metric	Data Input Frequency
Process Safety (PS)	
Number of Process Safety Events Tier 1	Monthly
Number of Process Safety Events Tier 2	Monthly
Number of Demands on Protective Systems/Safeguards or LOPC Tier 3	Monthly
Calculated Process Safety Metrics	
Process Safety Tier 1 Incident Rate	Monthly
Process Safety Tier 2 Incident Rate	Monthly

Monthly reporting means no later than the 10th calendar day of the subsequent month

Process Safety Incident Rate

PS Incident rate
Tier 1

=

Tier 1 count X
200,000

Man-hours

PS Incident rate
Tier 2

=

Tier 2 count X
200,000

Man-hours

Indorama Notifications

API 754 Event	Notification To	Within	Method
Tier 1 and Tier 2	Site Head, Regional Manufacturing Head, CTO, Segment EHS Leader, Regional EHS Director	24 Hours	Email
Tier 3	Follow site procedures for incident notification		

Where to find more Information?

Global EHS SharePoint

Global EHS
Home Document Library EHS Policies and Standards ▾ Golden Safe

+ New ▾ ↑ Upload ▾ Edit in grid view Share Copy link ↻

Documents > Reference Documents

File icon	Name ▾
	API 754_3rd Edition_Training.pptx
	Bulletins and Communication
	API 754_Training_2nd Edition.pptx
	API RP 754 2016_2nd Edition.pdf
	API RP 754 2021_3rd Edition.pdf
	Metal Structured Packing Fires.pdf
	Process Safety Tier Algorithm Rev23 Metric.xlsm
	Process Safety Tier Algorithm Rev23.xlsm

API RP 754

API 754 Process Safety Tier Level Event Classification

Incident Communication

Incident Communication

Required by IVL EHS-105

Lessons learned, recommendations, and other relevant information must be communicated to affected personnel (applicable findings must be shared with contractors!)

Corporate EHS will communicate any High Value Learnings (with actions) to all sites

Communication can happen in many ways:

- Retraining of affected personnel
- EHS Bulletins
- Formal bulletins or alerts
- Toolbox meetings
- Face-to-Face meetings with employees and/or contractors



Process Safety Incident Timing

Within 24 hours record and classify the incident in Intelex.

Within 30 calendar days, incident investigations should be completed.

**Within 48 hours provide one-page PowerPoint for:
Process Safety Tier 1
Process Safety Tier 2
LIFE, pLIFE,
Recordable Injuries, &
Environmental events with off-site impacts.**

Within 60 days, communicate investigation findings for incidents which resulted in or could reasonably have resulted in a catastrophic release of a highly hazardous chemical in the workplace.

Guidelines for Written Notifications

Details of the date, time and location of the event

Companies involved

Description of the initial causes

Any injuries or property damage and their severity

Trips or interlocks that activated

Actions taken immediately after the incident occurred

All chemicals involved, the affected environment (release to air, concrete, gravel, dirt, ditch, bayou, etc.)

Information relevant to the release such as the chemicals, quantity, process temperature, start and stop time, duration, rate of release where it is available

Chronological order of events, including any notifications

DO NOT include the name of any individuals involved!

Investigation Report Process

INTELEX

Question/Comments

