

Process & Plant Safety

**ZCHFP - Association of Chemical and Pharmaceutical
Industry of the Slovak Republic**

Liptovsky Jan, September 26, 2018

Stefan Drees, Cefic



Introduction



My Name/Education: Stefan Drees, Chemical Engineer

Where I work: Cefic / Covestro (Belgium/Germany)

Cefic: BREF Manager/Chair P&PS Network

Covestro: VP European Regulatory Affairs

Process & Plant Safety Experience: since 1989

Questions: sdr@cefic.be

A few Words about CEFIC



The European
Chemical Industry Council

Newsroom

Policy

Industry Support

Sustainability

Free guidances & tools for
the industry to support the
implementation of REACH

» Read more

Newsroom



Policy



Industry Support



Sustainability



A few words about Cefic



Cefic Members:

Cefic

- Founded 1972
- Based in Brussels
- Represents 29,000 companies...
- Who account for 17% of world chemical production
- And provide 1,2 M jobs

Corporate Members (ACOM)

Corporations with a production based in Europe and a worldwide turnover in chemicals of more than euro 1 billion.

Federation Members (AFEM)

European national federations and associated federations across Europe.

Business Members (ABM)

Sectoral businesses with a production base in Europe and a worldwide turnover in chemicals of less than euro 1 billion.

Associated Companies

Companies engaged in the production of chemicals in countries outside Europe in which the association has neither a member federation, nor an associated federation.

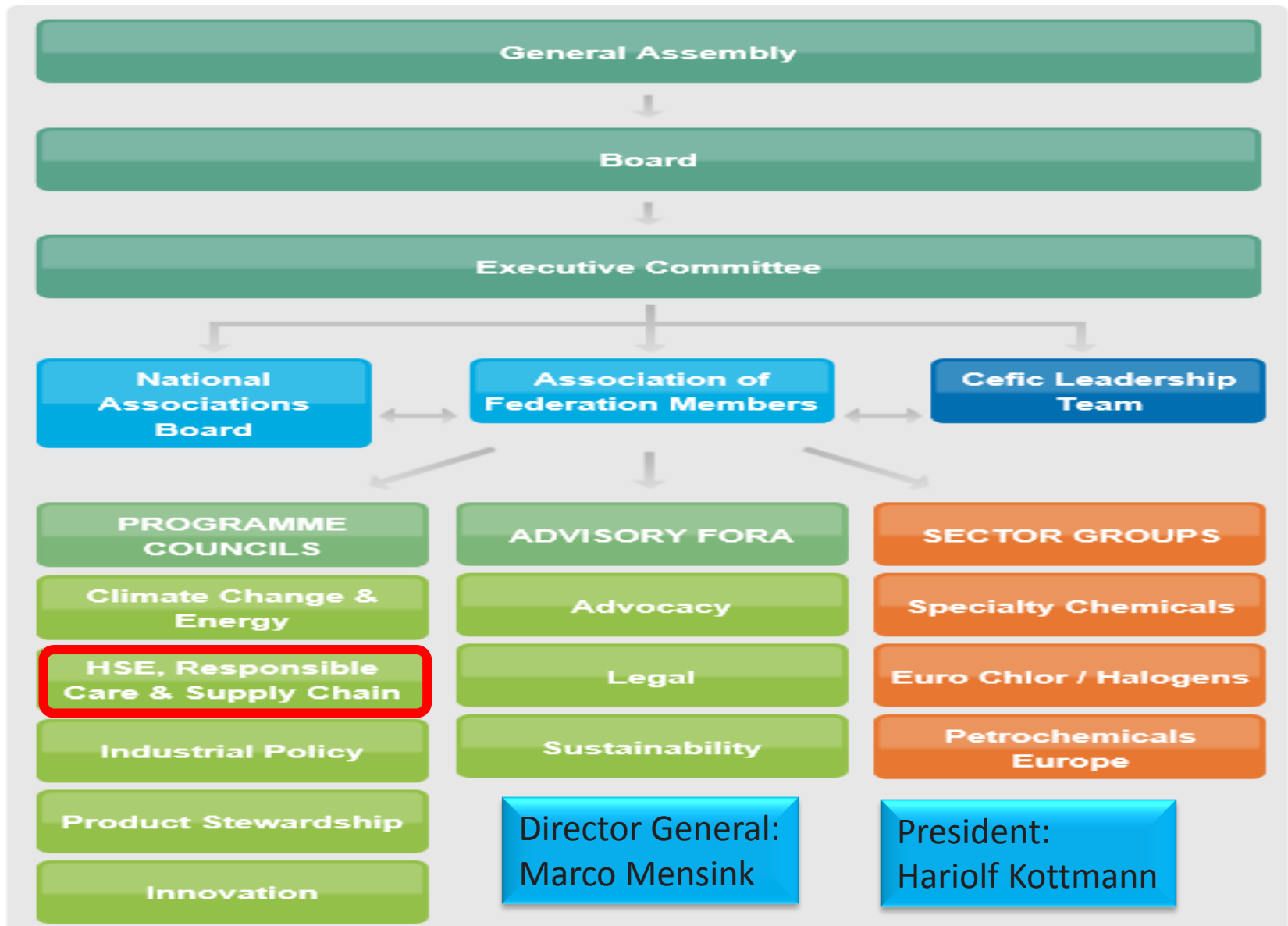
Affiliated Associations

European Associations representing a sector of the chemical industry.

Partners

European non-chemical companies working closely with the European chemical industry

A few words about Cefic



New Guideline for Process Safety by ICCA/RCLG



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TODAY: Several databases accessible to Industry

Reporting of (all kinds of) incidents



INRS

The French national research institute for safety (INRS) holds the EPICEA database, which provides 17 000 detailed "workplace accidents".



ERA – European Railway Agency

The European railway agency publishes reports on railway accidents in Europe (in English).



ILITY (Finlande)

The Finnish database ILITY gathers accidents worldwide ("database" in English, but without any search engine).



FACTS (Pays-bas)

FACTS is a database which contains information on more than 24000 (industrial) accidents (incidents) involving hazardous materials or dangerous goods worldwide. (restricted access)



ZEMA

The ZEMA database (Zentrale Melde- und Auswertestelle für Störfälle und Störungen in verfahrenstechnischen Anlagen) centralises information on accidents in Germany. The database is in German.

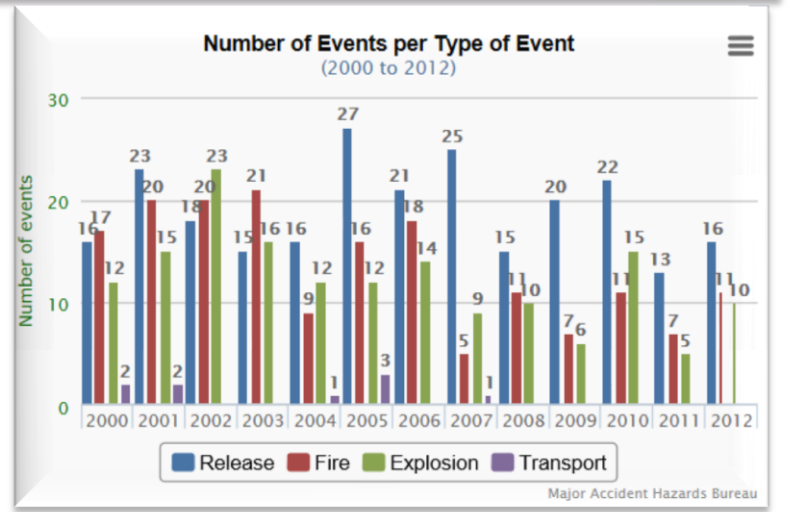
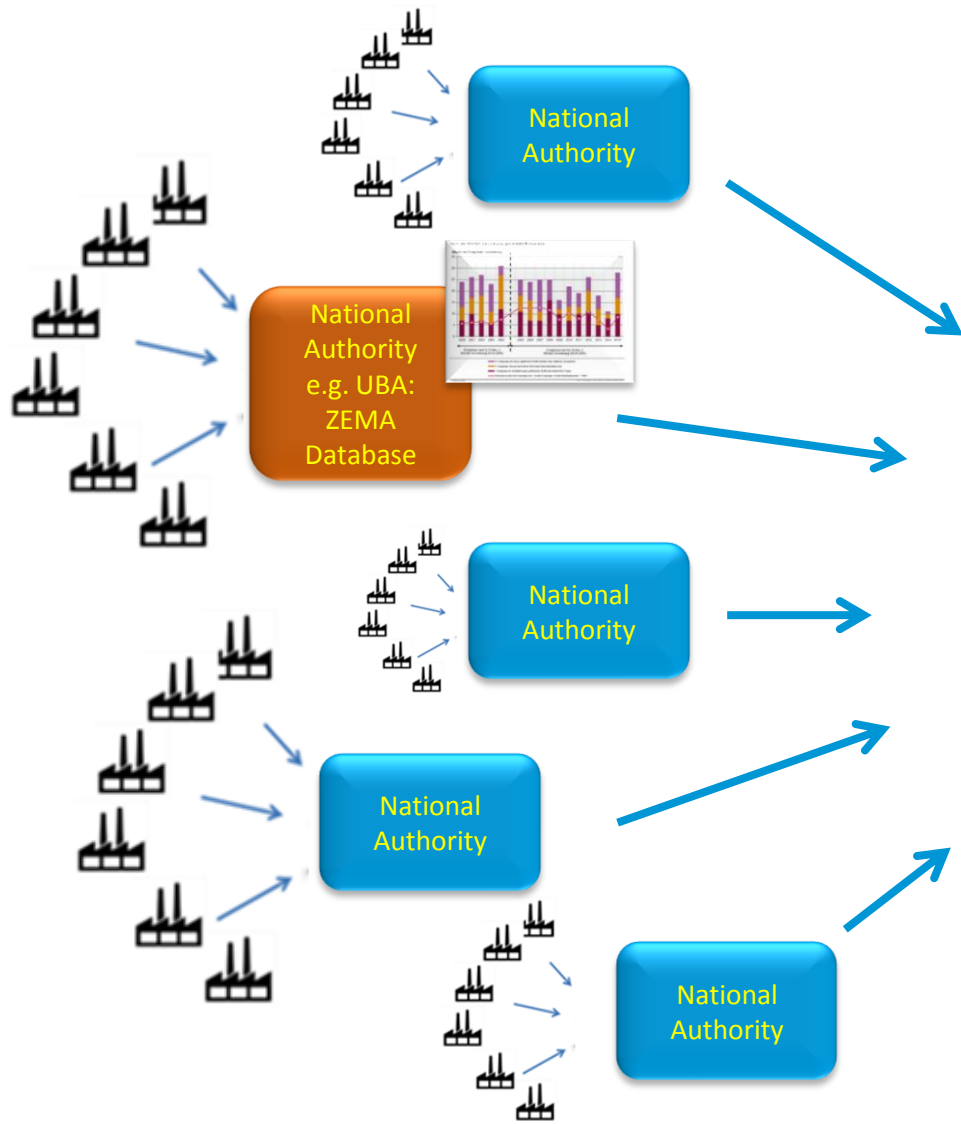


ARIA : Lessons learnt from industrial accidents
Collect, analyze, inform

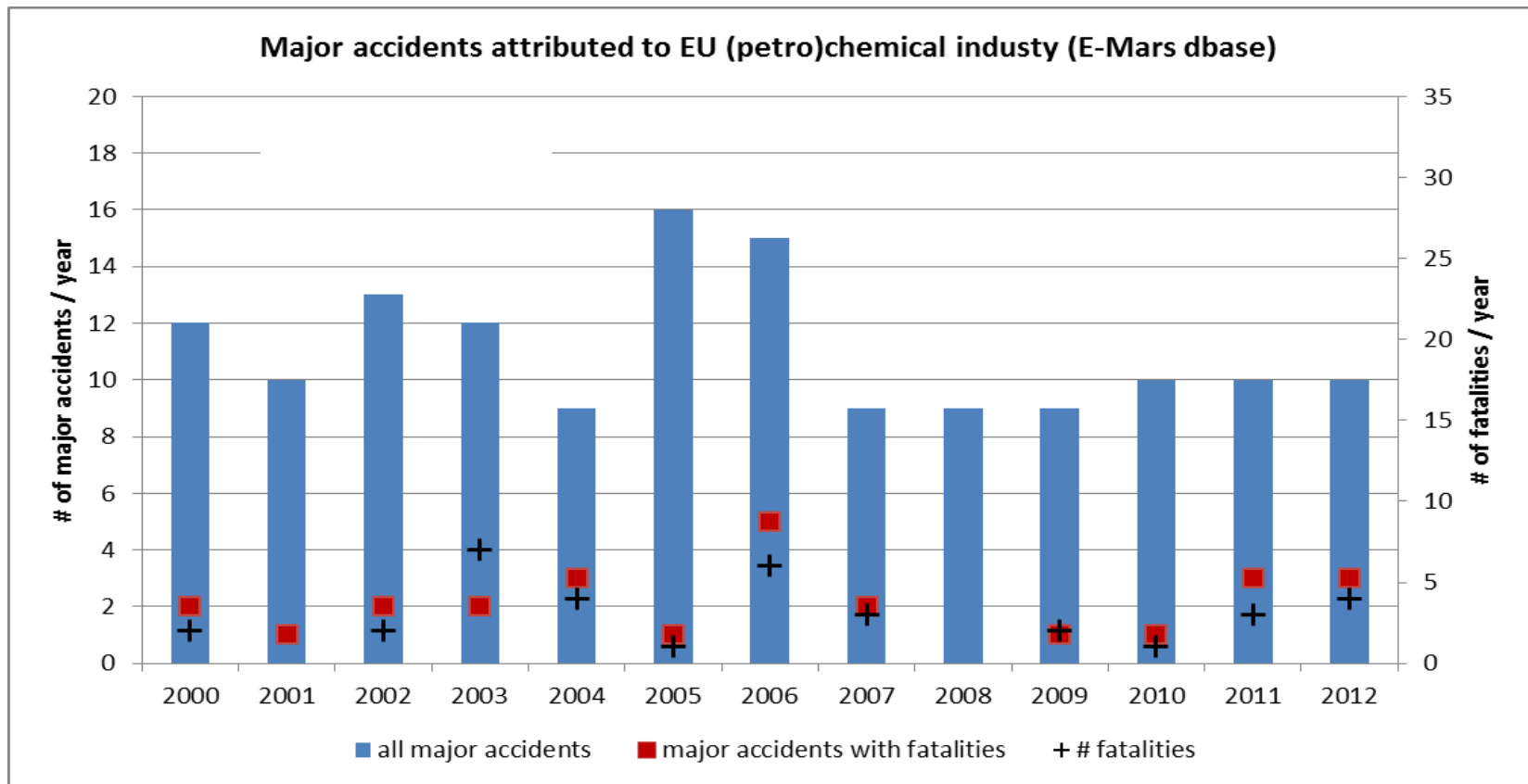


TODAY: Reporting of Major Incidents in Europe

eMARS Database of the Joint Research Center (EU Commission)



eMARS Database – E.g. Incidents Attributed to (petro)Chemical Industry



Reporting of Incidents depends on participation
Not “trending” possible with absolute numbers

Summary of Status Quo



Several Databases

BUT no comprehensive overview

EU-wide reporting

BUT not up-to-date

Completeness questionable

Counting of incidents

BUT no “indicators”

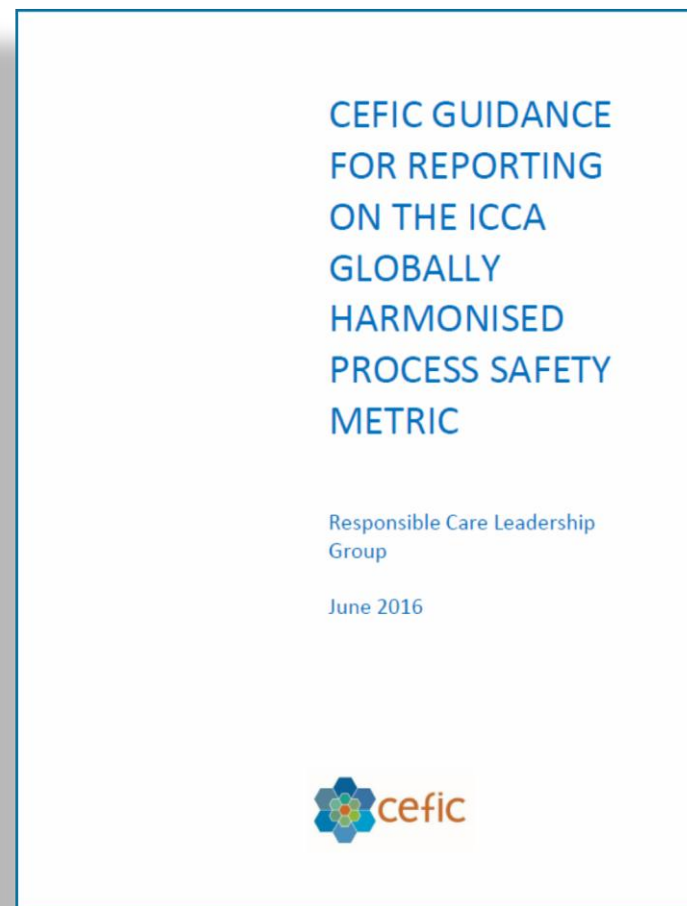
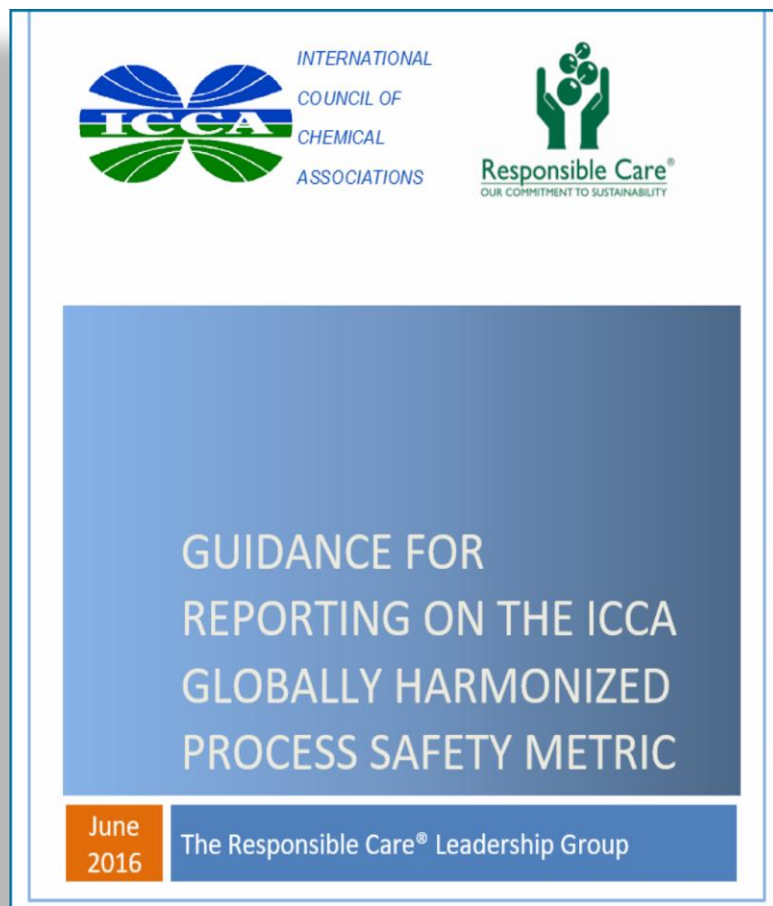
Tracking of trends impossible

Reacting rather than acting

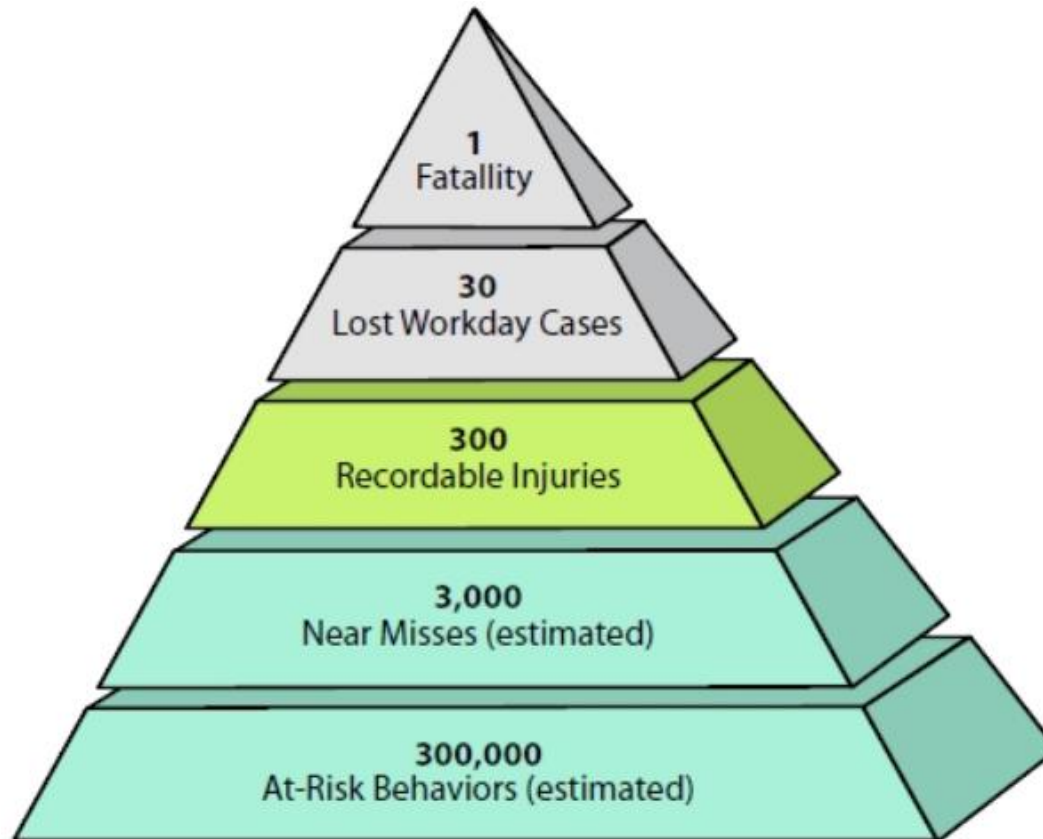
No link between occupational and
process-safety related incidents

Today we manage a system which allows us to follow
But not to be PROACTIVE

ICCA/Cefic Guidance for the Reporting of Incidents



You probably all know this picture

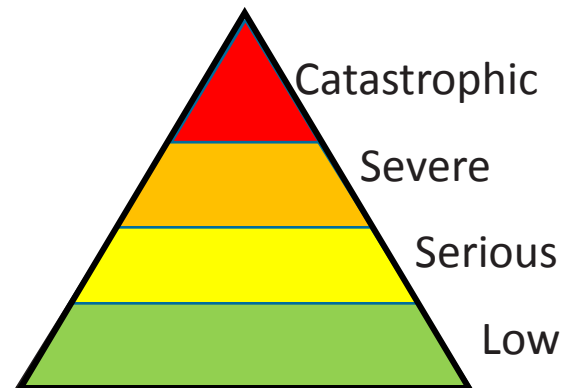


Fighting the “small issues” prevents the “big ones” from happening

ICCA Guidance issued in 2016: Comprehensive database across EU



- Comprehensive reporting of **process safety** incidents
 - **Bottom-up** approach → all member companies to report
 - Develop Indicators (PPS KPIs) → independent of participation
 - (Leading instead of lagging) → discover trends
 - Using Resp. Care database → build up on existing structure



You cannot control what you do not know

Reporting of Just Two Numbers



Total Work Hours

+

Number of Process Safety Events



Process Safety Event Rate
(PSER)*

* **PSER: NORMALIZED** per 100 employees,
working 2000 hrs/yr

$$\text{PSER} = (\text{Total Events} / \text{Total Hours}) \times 200.000$$

Reporting of Total Work Hours



Total Work Hours

=

Total number
of employee* hours

+

Total number
of contractor* hours

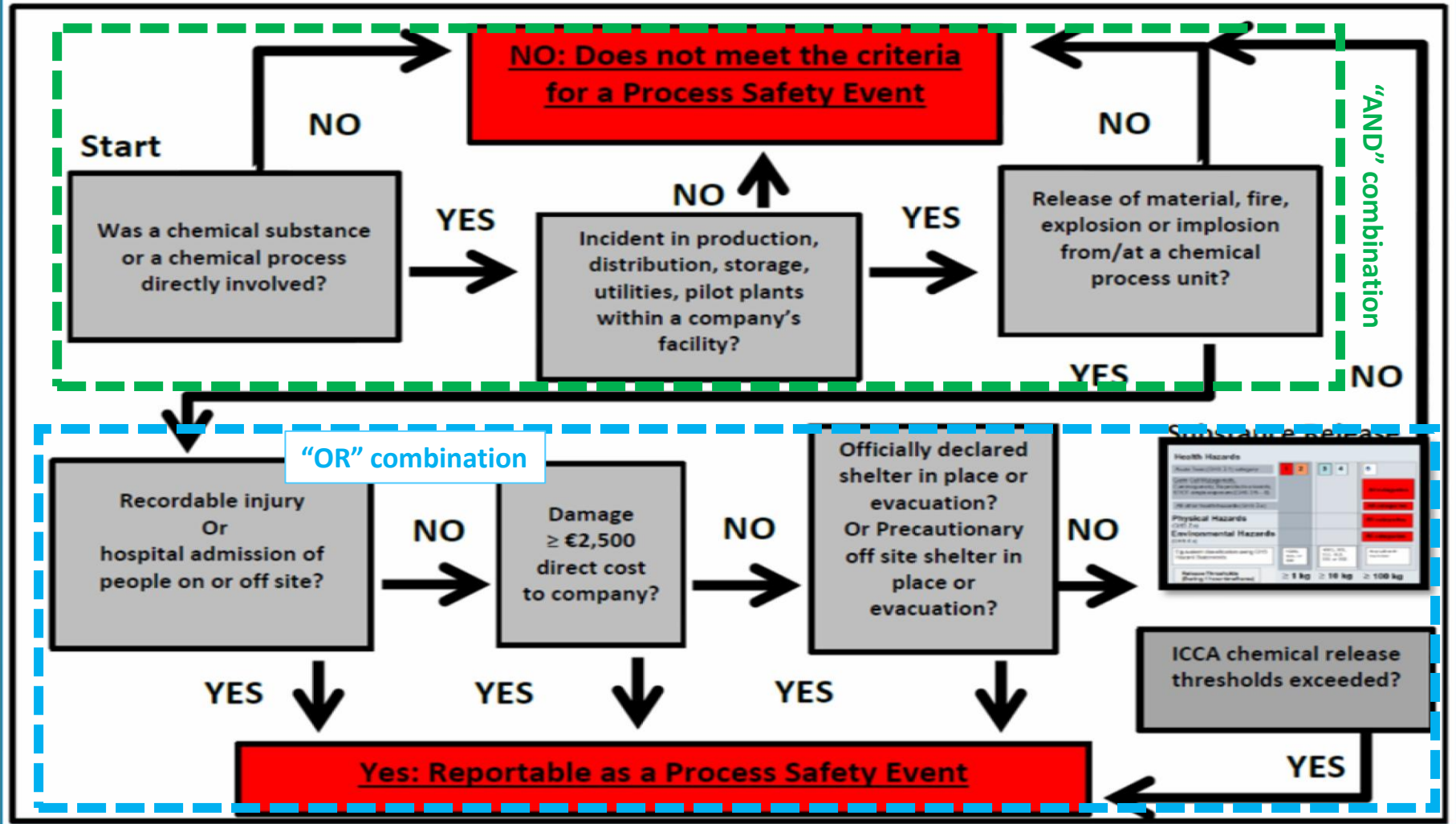
* **INCLUDES: All individuals** who are involved with chemical manufacturing. When reporting total worker hours, companies should report the same hours used for reporting **personnel hours**. This way, companies can have the same data set for occupational and process safety

* **EXCLUDES: All individuals** who are tasked with major construction projects such as large scale investments with specific, one-time project organizations created for design, engineering, and construction of new or significant expansion to existing process facilities

Reporting of Process Safety Events



Overview of ICCA Process Safety Event Criteria as a Flow Chart

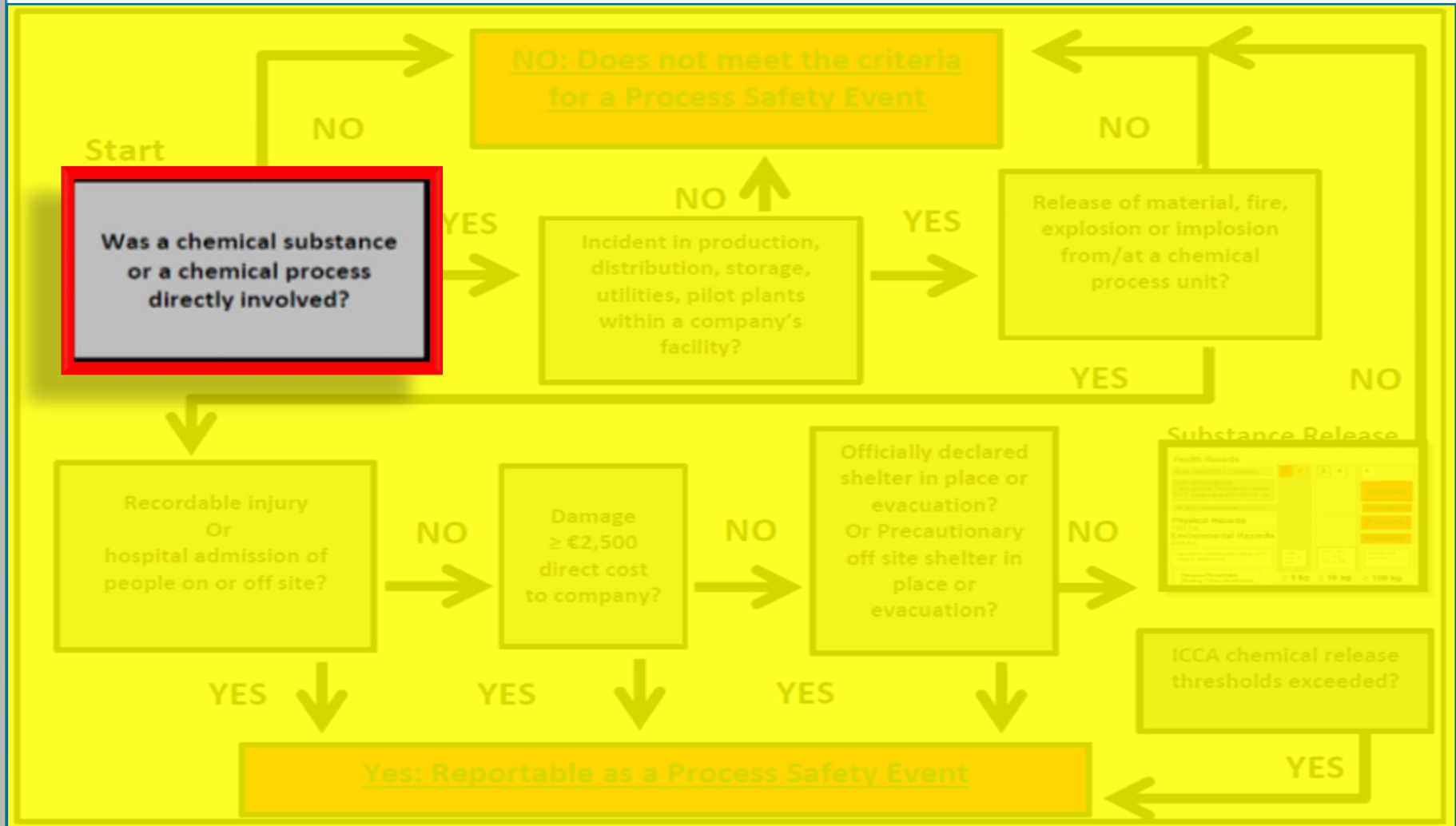


Reporting of ALL levels of Process Safety Incidents

Reporting of Process Safety Events



Overview of ICCA Process Safety Event Criteria as a Flow Chart



Reporting of ALL levels of Process Safety Incidents

Chemical Involvement



A. Chemical Involvement

When a chemical substance or chemical process is directly involved

A chemical or chemical process must have been directly involved in the event or incident. For this purpose, the term "process" is used broadly to include the equipment and technology needed for petrochemical production, including reactors, tanks, piping, boilers, cooling towers, refrigeration systems, etc.

Not included are consequently:

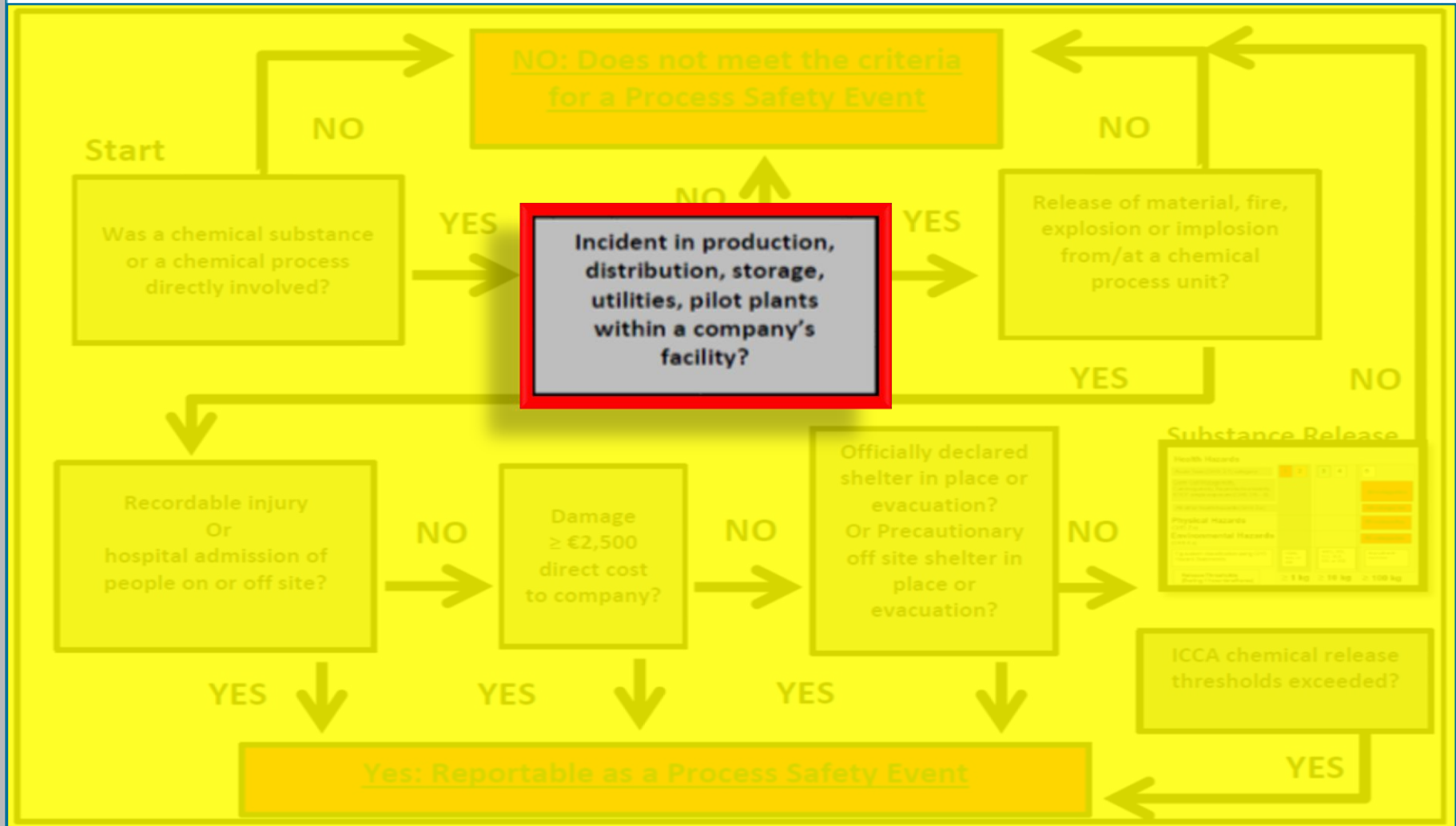
Incidents not involving chemicals

Incidents e.g. fires in e.g. office buildings or electric substations (even if located at a production site)

Reporting of Process Safety Events



Overview of ICCA Process Safety Event Criteria as a Flow Chart



Reporting of ALL levels of Process Safety Incidents

Location of the Incident



B. Location

The incident occurred in production, distribution, storage, utility, pilot plant within the site boundaries of company's facility

The incident occurs in production, distribution, storage (including active storage areas such as warehouses – see FAQ section), utilities or pilot plants of a facility reporting metrics under these definitions. This includes tank farms, ancillary support areas (e.g., boiler houses and waste water treatment plants) and distribution piping under control of the site. All reportable incidents occurring at a location will be reported by the company that is responsible for operating that location. This applies to incidents that may occur in contractor work areas as well as other incidents. At tolling operations and multi-party sites, the company that operates the unit where the incident initiated should record the incident and count it in their reporting.

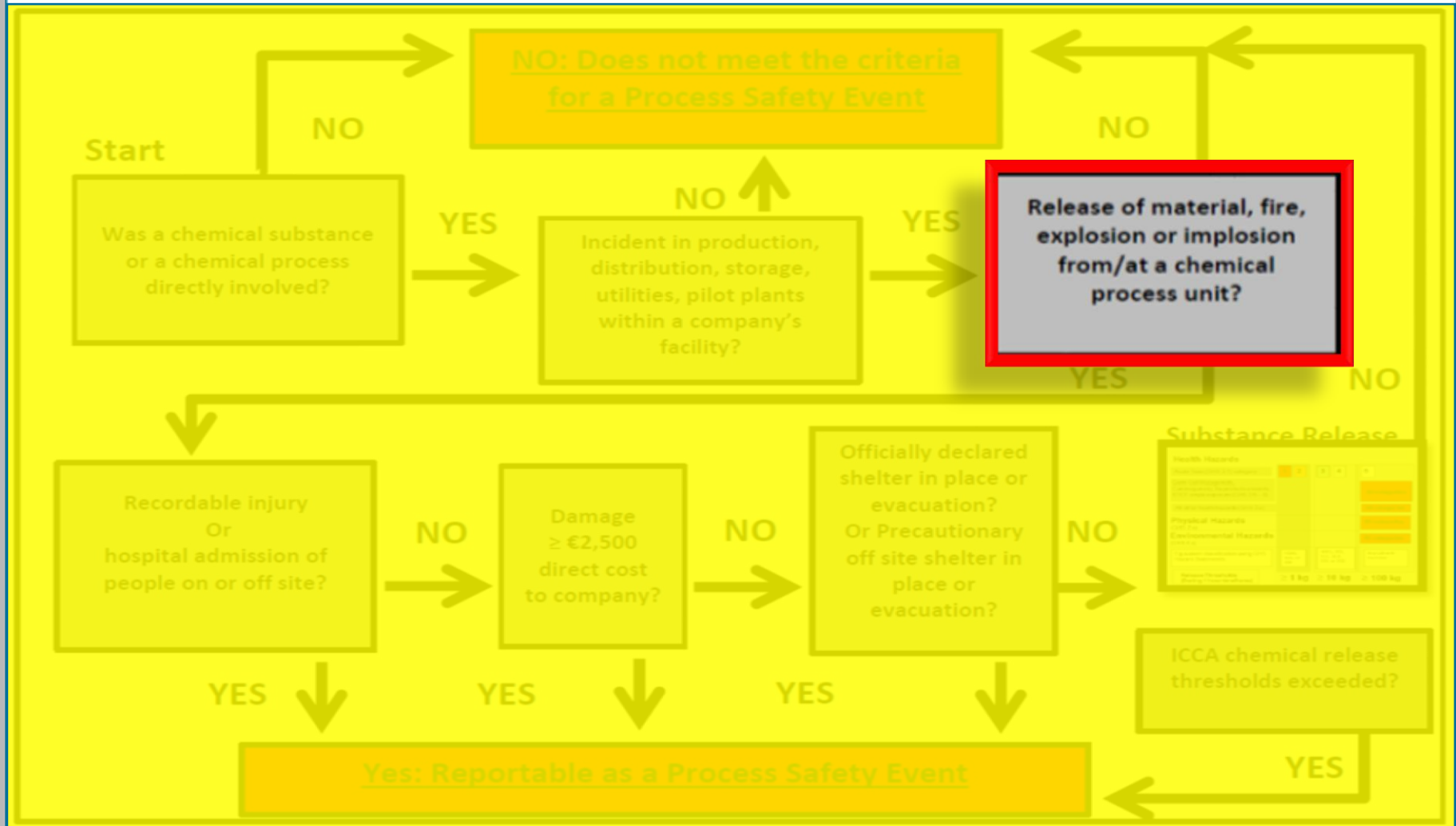
Not included are consequently:

Transportation incidents (on the road, rail, water or air)

Reporting of Process Safety Events



Overview of ICCA Process Safety Event Criteria as a Flow Chart



Reporting of ALL levels of Process Safety Incidents

“Release of Material” means....:



Release of Material – 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 consequences that exceed one or more of the 4 Reporting Thresholds listed in this document.

A release to a flare or scrubber is still considered to be within the primary containment as long as the mitigation system (e.g. scrubber, flare) is operated under normal conditions without any release above the thresholds defined for normal operation. A release to a secondary containment (e.g. waste water treatment or dike) will qualify as a process safety event because the substance is leaving the primary process system.

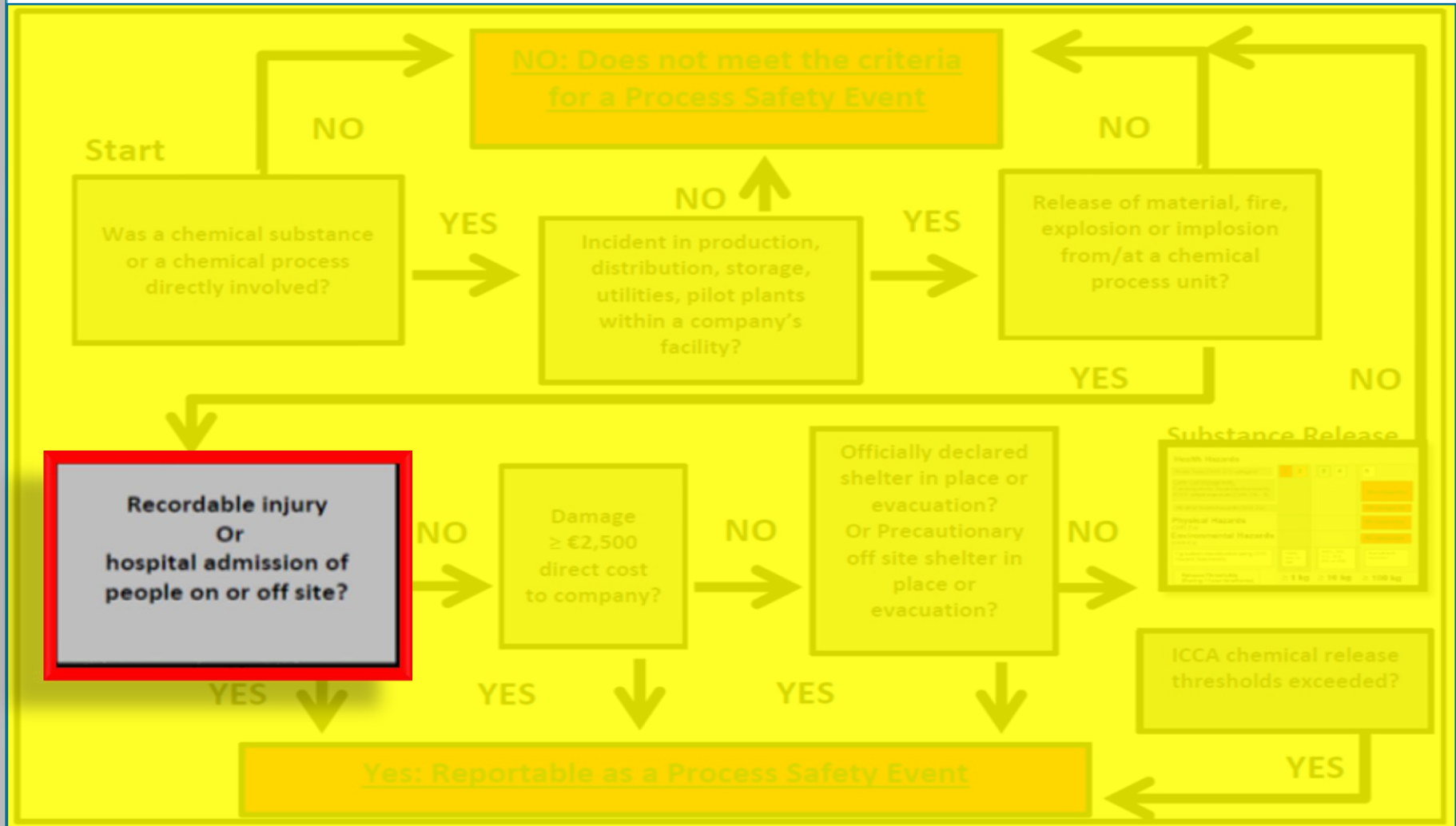
Not included are consequently:

E.g. a release through a flare (if release is within permissible thresholds)

Reporting of Process Safety Events



Overview of ICCA Process Safety Event Criteria as a Flow Chart



Reporting of ALL levels of Process Safety Incidents

“Recordable Injury” means....:



Recordable injuries (Recordable injuries according to OSHA) are work-related injuries 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.

Lost time injuries and fatalities that occur as a result of process related loss of primary containment, fire, or explosion are those that fit into one of the following categories:

- Employee (Lost time and/or Fatality)
- Contractor and Subcontractor (Lost time and/or Fatality)
- Third Party (Injury/illness resulting in Hospital Admission or Fatality)

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.”

Involving
a
substance

Not included are consequently:

Trips or falls, cuts or lacerations

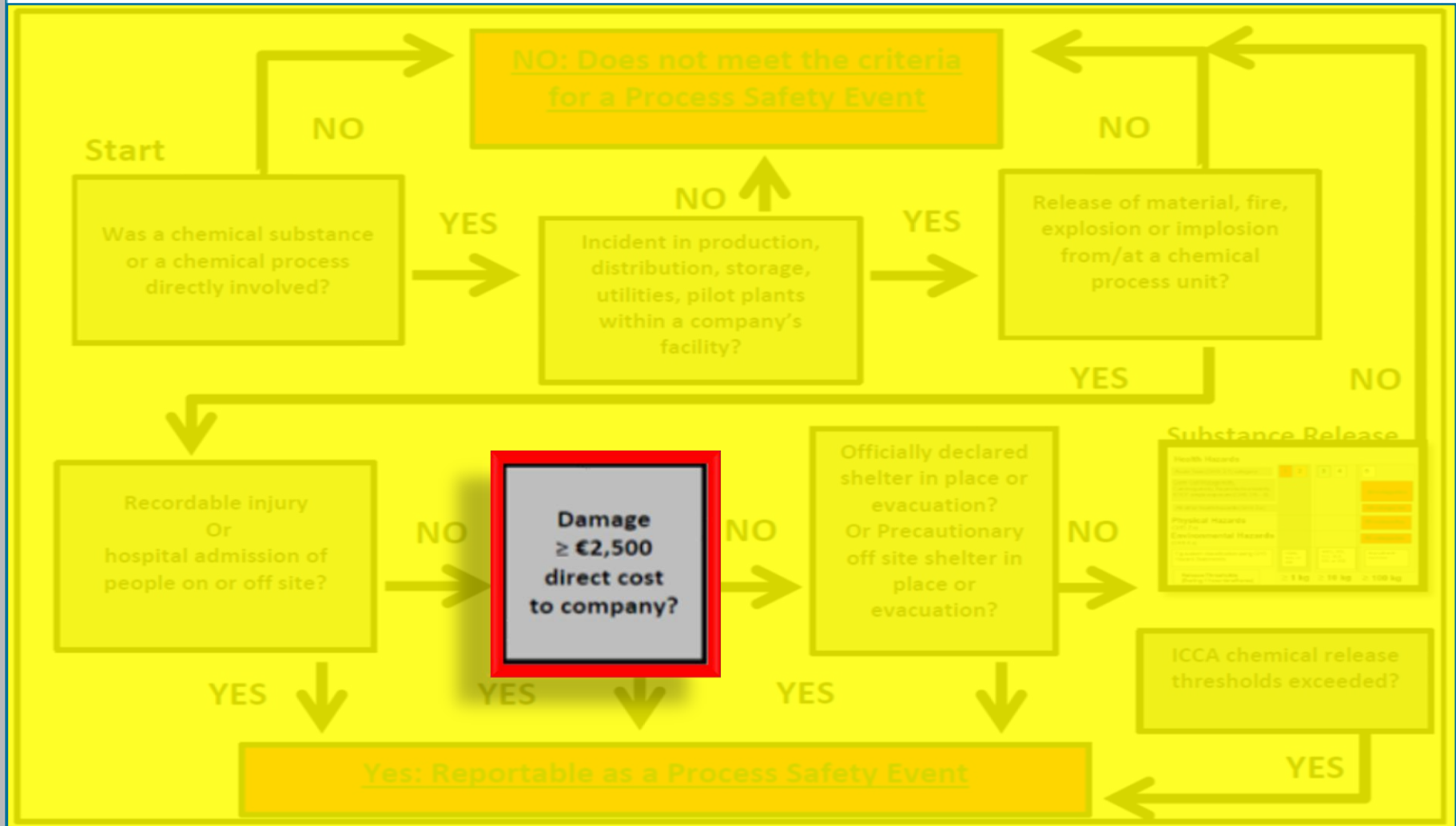
Fire in an office building

Traffic accidents.....

Reporting of Process Safety Events



Overview of ICCA Process Safety Event Criteria as a Flow Chart



Reporting of ALL levels of Process Safety Incidents

“Costs” are.....:



Costs to be considered for this threshold should be those costs directly attributed to the fire and/or explosion, such as the replacement value of equipment lost, structures lost, cost of repairs, environmental cleanup (on and off site), emergency response and/or fines.

Not included are consequently:

Indirect costs, e.g:

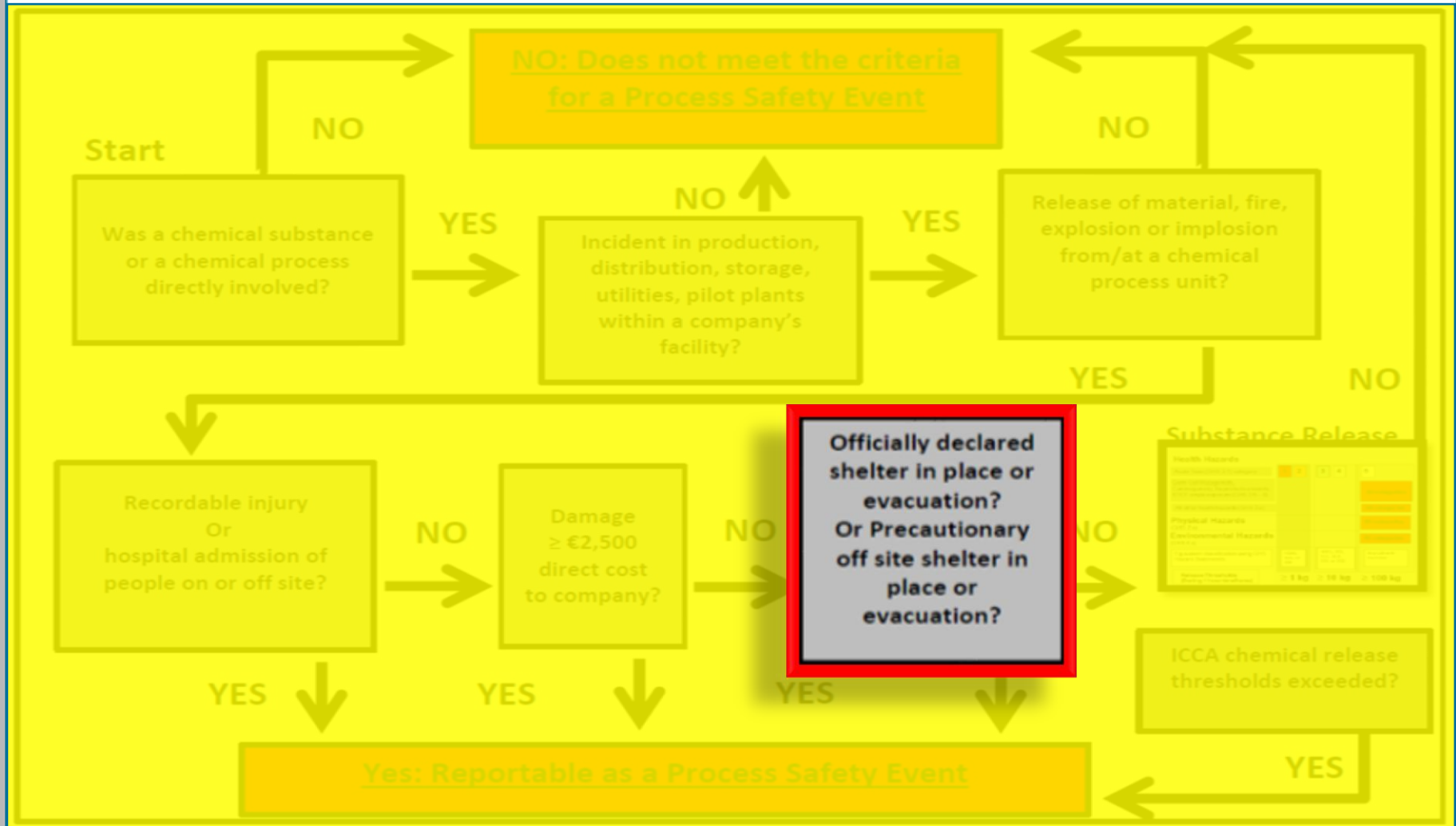
Loss of profits, loss of business

Costs of replacement of products

Reporting of Process Safety Events



Overview of ICCA Process Safety Event Criteria as a Flow Chart



Reporting of ALL levels of Process Safety Incidents

“Shelter in place” means....:



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).

Precautionary Declaration - A precautionary public response is a measure taken from an abundance of caution and issued by a recognized community official or delegate whom has reasonably determined that such an evacuation or shelter in place was necessary to protect the public health and safety.

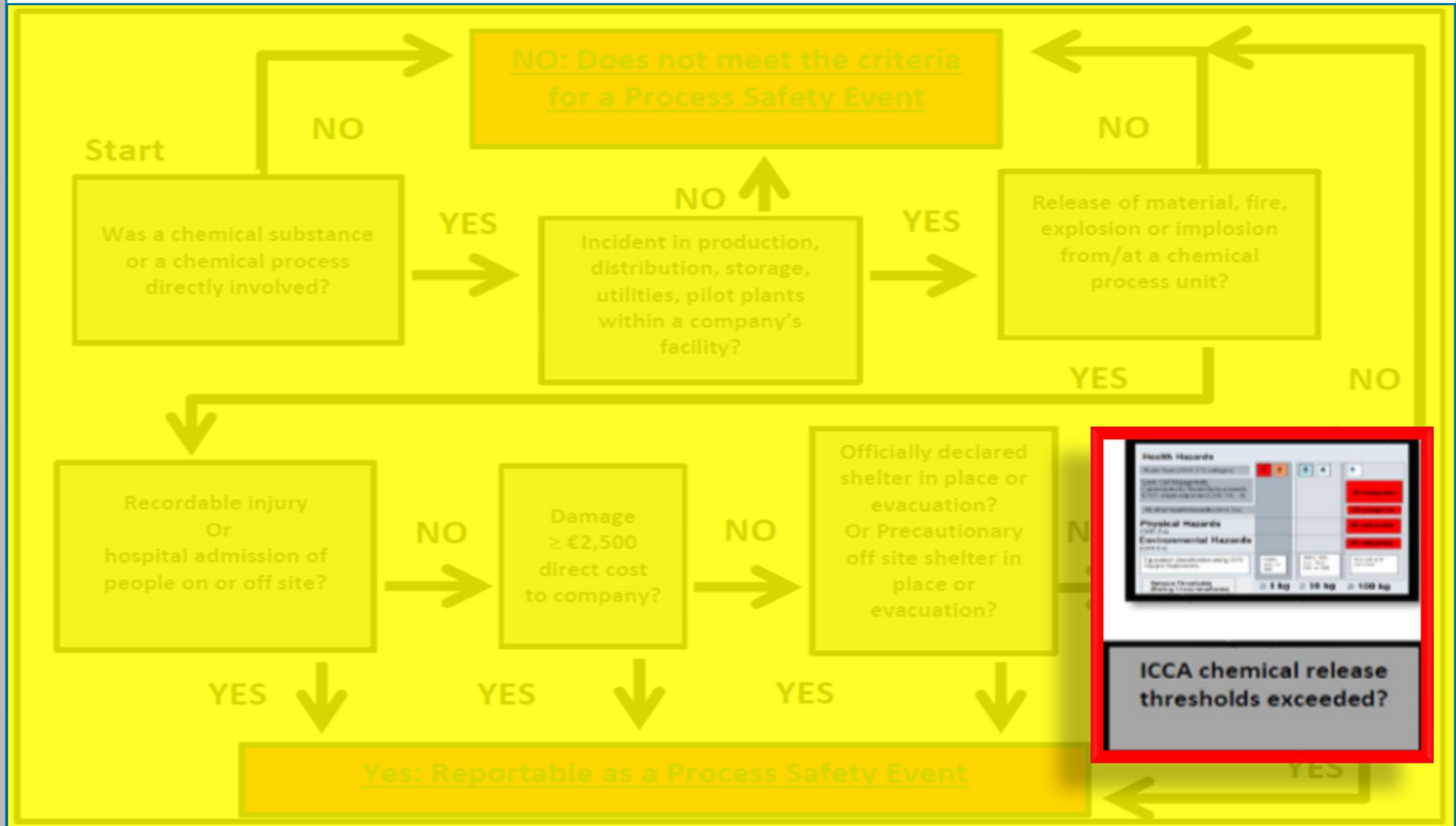
Shelter in Place – is the use of a structure and its indoor atmosphere to temporarily separate individuals from a hazardous outdoor atmosphere

Evacuation – the act or process of removing persons from a place for reasons of safety or protection

Reporting of Process Safety Events



Overview of ICCA Process Safety Event Criteria as a Flow Chart



Reporting of ALL levels of Process Safety Incidents

“Releases” are....:



Acute Release – A release of flammable, combustible, or toxic chemicals from the primary containment (i.e., vessel or pipe) greater than the chemical release threshold quantities is described for GHS Classification **Table 1**.

Primary Containment – A tank, vessel, pipe, rail car or equipment intended to serve as the primary container or used for the transfer of the material. Primary containers may be designed with secondary containment systems to contain and control the release. Secondary containment systems include, but are not limited to, tank dikes, curbing around process equipment, drainage collection systems into segregated oily drain systems, the outer wall of double walled tanks, etc.

This consequently also means:

If a substance has left the PRIMARY containment but is captured in the SECONDARY Containment, this is still a RELEASE

“Releases” are....:



Pressure Relief Device: Acute Releases, defined above, **include** releases to a properly designed and operating pressure relief device if a quantity is released greater than or equal to the threshold quantities in **Table 1** that results in one or more of the following four consequences:

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

Not included are consequently:

- Draining equipment on purpose
- Routine emissions allowed under permit (e.g. off-gases, waste water)
- Underground releases

Release Thresholds



Health Hazards			
Acute Toxic (GHS 3.1) category:	1	2	3 4 5
Germ Cell Mutagenicity, Carcinogenicity, Reproductive toxicity, STOT-single exposure (GHS 3.5 – 8)			All categories
All other health hazards (GHS 3.x)			All categories
Physical Hazards (GHS 2.x)			All categories
Environmental Hazards (GHS 4.x)			All categories
Equivalent classification using GHS Hazard Statements:	H300, 310, or 330	H301, 302, 311, 312, 331 or 332	Any other H-Number
Release Thresholds (During 1 hour timeframe)	≥ 1 kg	≥ 10 kg	≥ 100 kg

1 Hour Rule

For the purpose of the reporting under this metric, release thresholds are established for materials over a one-hour time frame. If the release amount of a material reaches or exceeds the reporting threshold in a 1-hour time period or less, it is reportable. Typically, acute releases occur in 1-hour or less. If the duration of the release cannot be determined, the duration should be assumed to be 1 hour.

Severity Weighting System



Appendix A – Severity Table: Using A Severity Weighting System is Encouraged for All Associations

	Event Incident Categories				
Severity Level	Safety/Human Health	Direct Cost from Fire or Explosion	Material Release Within 1-Hr Period	Community Impact	Environmental Impact [off-site]
Level 4 1 point	<ul style="list-style-type: none"> Injury requiring treatment beyond first aid to an employee, contractor, or subcontractor. <p>(Meets local regulations)</p>	<ul style="list-style-type: none"> Resulting in Direct Damage Cost of <p>€2.5 K ≤ up to €25 K</p>	<ul style="list-style-type: none"> Release volume between <p>1x ≤ TQ < 40x</p>	<ul style="list-style-type: none"> Officially declared shelter-in-place or officially declared evacuation (on or off site) Precautionary off site shelter in place or evacuation <p>≤ 3 hours</p>	<ul style="list-style-type: none"> Acute Environmental Remediation Cost <p>€2.5 K ≤ up to €25 K</p>
Level 3 3 points	<ul style="list-style-type: none"> Days Away From Work injury to an employee, contractor, or subcontractor, or Injury requiring treatment beyond first aid to a third party (Meets local regulations) 	<ul style="list-style-type: none"> Resulting in Direct Damage Cost of <p>€25 K ≤ up to €250 K</p>	<ul style="list-style-type: none"> Release volume between <p>40x ≤ TQ < 160x</p>	<ul style="list-style-type: none"> Officially declared shelter-in-place or officially declared evacuation (on or off site) Precautionary off site shelter in place or evacuation <p>3 hours ≥ up to 12 hours</p>	<ul style="list-style-type: none"> Acute Environmental Remediation Cost <p>€25 K ≤ up to €250 K</p>
Level 2 9 points	<ul style="list-style-type: none"> A fatality of an employee, contractor, or subcontractor, or A hospital admission of a third party <p>(Meets local regulations)</p>	<ul style="list-style-type: none"> Resulting in Direct Damage Cost of <p>€250 K ≤ up to €25 MM</p>	<ul style="list-style-type: none"> Release volume between <p>160x ≤ TQ < 640x</p>	<ul style="list-style-type: none"> Officially declared shelter-in-place or officially declared evacuation (on or off site) Precautionary off site shelter in place or evacuation <p>12 hours ≥ up to 24 hours</p>	<ul style="list-style-type: none"> Acute Environmental Remediation Cost <p>€250 K ≤ up to €25 MM</p>
Level 1 27 points	<ul style="list-style-type: none"> Multiple fatalities of employees, contractors, or subcontractors, or multiple hospital admission of third parties, or A fatality of a third party (Meets local regulations) 	<ul style="list-style-type: none"> Resulting in Direct Damage Costs of <p>≥ €25 MM</p>	<ul style="list-style-type: none"> Release volume <p>≥ 640x TQ</p>	<ul style="list-style-type: none"> Officially declared shelter-in-place or officially declared evacuation (on or off site) Precautionary off site shelter in place or evacuation <p>≥ 24 hours</p>	<ul style="list-style-type: none"> Acute Environmental Remediation Cost <p>≥ €25 MM</p>

Additional Metrics (No Mandatory Reporting)



Process Safety Total Incident Rate (PSTIR):
$$\frac{\text{Total event incidents} \times 200,000}{\text{Total Worker Hours}}$$

Process Safety Incident Severity Rate (PSESR) (i.e., severity-weighted Process Safety incident rate formula):

$$\text{PSESR} = \frac{\text{Total severity score for all events incidents} \times 200,000}{\text{Total Worker Hours}}$$

Severity Weighting System



Determining PSESR:

Appendix A – Severity Table: Using A Severity Weighting System is Encouraged for All Associations

Event Incident Categories					
Severity Level	Safety/Human Health	Direct Cost from Fire or Explosion	Material Release Within 1-Hr Period	Community Impact	Environmental Impact [off-site]
Level 4 1 point	<ul style="list-style-type: none"> Injury requiring treatment beyond first aid to an employee, contractor, or subcontractor. (Meets local regulations)	<ul style="list-style-type: none"> Resulting in Direct Damage Cost of €2.5 K ≤ up to €25 K	<ul style="list-style-type: none"> Release volume between $1x \leq TQ < 40x$	<ul style="list-style-type: none"> Officially declared shelter-in-place or officially declared evacuation (on or off site) Precautionary off site shelter in place or evacuation ≤ 3 hours	<ul style="list-style-type: none"> Acute Environmental Remediation Cost €2.5 K ≤ up to €25 K
Level 3 3 points	<ul style="list-style-type: none"> Days Away From Work injury to an employee, contractor, or subcontractor, or Injury requiring treatment beyond first aid to a third party (Meets local regulations) 	<ul style="list-style-type: none"> Resulting in Direct Damage Cost of €25 K ≤ up to €250 K	<ul style="list-style-type: none"> Release volume between $40x \leq TQ < 160x$	<ul style="list-style-type: none"> Officially declared shelter-in-place or officially declared evacuation (on or off site) Precautionary off site shelter in place or evacuation 3 hours ≥ up to 12 hours	<ul style="list-style-type: none"> Acute Environmental Remediation Cost €25 K ≤ up to €250 K
Level 2 9 points	<ul style="list-style-type: none"> A fatality of an employee, contractor, or subcontractor, or A hospital admission of a third party (Meets local regulations)	<ul style="list-style-type: none"> Resulting in Direct Damage Cost of €250 K ≤ up to €25 MM	<ul style="list-style-type: none"> Release volume between $160x \leq TQ < 640x$	<ul style="list-style-type: none"> Officially declared shelter-in-place or officially declared evacuation (on or off site) Precautionary off site shelter in place or evacuation 12 hours ≥ up to 24 hours	<ul style="list-style-type: none"> Acute Environmental Remediation Cost €250 K ≤ up to €25 MM
Level 1 27 points	<ul style="list-style-type: none"> Multiple fatalities of employees, contractors, or subcontractors, or multiple hospital admission of third parties, or A fatality of a third party (Meets local regulations) 	<ul style="list-style-type: none"> Resulting in Direct Damage Costs of ≥ €25 MM	<ul style="list-style-type: none"> Release volume ≥ 640x TQ	<ul style="list-style-type: none"> Officially declared shelter-in-place or officially declared evacuation (on or off site) Precautionary off site shelter in place or evacuation ≥ 24 hours	<ul style="list-style-type: none"> Acute Environmental Remediation Cost ≥ €25 MM

For PSESR: 1+9+3+27 = 40

RC Reporting

YOUR Action is required



- Comprehensive reporting of incidents is essential to improve process safety
- AFEM Members (e.g. ZCHFP) are in the LEAD:
 - ALL AFEM Members:
 - Start/continue setting up national reporting
 - Initiate national workshops with member companies
 - ALL Companies:
 - Start/continue providing data to your national association

Within Cefic:

- Program Council (PC) HSSE endorses the reporting
 - Member companies: insist on reporting to your association
 - Request reporting to PC, NAB and AFEM meeting on a quarterly basis

ICCA Reporting Schedule 2016-2020



Appendix D – Detailed Schedule of Events

2016	2017	2018	2019	2020
<p>Feb - April <i>RCLG PS Pilot Program</i></p> <p>May – Adjustments/clarification to guidance document</p> <p>June Report outcomes of pilot program to RCLG and ICCA Board</p> <p>July - December</p> <ul style="list-style-type: none"> RCLG associations consider guidance and develop reporting methodology for their memberships RCLG associations can request ICCA capacity building funds for PS reporting workshops for members, if needed 	<p>Jan - Dec RCLG Association membership begin collecting PS data from their members</p> <p>Jan – Dec Associations hold workshops on Process Safety and performance reporting, utilizing RCLG funds and experts if needed</p>	<p>Jan – Feb Reporting of process safety incidents to RCLG begins for associations with data (2017 data)</p> <p>April RCLG reviews outcomes, challenges and raw data from the first reporting cycle (internally)</p> <p>June RCLG share draft data with ICCA Board</p> <p>July - December Update and adjust guidance as necessary</p> <p>Associations hold workshops on Process Safety and performance reporting, utilizing RCLG funds and experts if needed</p>	<p>Jan – Feb Reporting of process safety incidents to RCLG begins for associations with data (2018 data)</p> <p>April RCLG reviews outcomes, challenges and raw data from the second reporting cycle (internally)</p> <p>June RCLG share draft data with ICCA Board</p> <p>July - December Update and adjust guidance as necessary</p> <p>Associations hold workshops on Process Safety and performance reporting, utilizing RCLG funds and experts if needed</p>	<p>Jan – Feb Reporting of process safety incidents to RCLG begins for all associations</p> <p>Process Safety incident reporting becomes part of the recommend base set of RCLG KPI metrics (2019 data)</p> <p>April RCLG reviews outcomes, challenges and raw data from the second reporting cycle (internally, consider external reporting)</p> <p>June RCLG share draft data with ICCA Board</p>

Comprehensive Reporting Starts NOW
Reporting established by 2020

ICCA/Cefic Guidance online



The ICCA Guidance and its application by Cefic can be found on Cefic's Responsible Care Platform:

<http://www.cefic.org/Industry-support/Responsible-Care-tools-SMEs/3-Plant--Process-Safety/>

Home > Industry Support > Responsible Care for SMEs > Plant & Process Safety

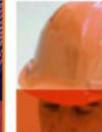
Plant & Process Safety

Prevention of chemical accidents in plants and processes

Tools in this category help companies implementing effective process safety management systems for chemical accident prevention, preparedness and response. They Tools enable the identification, elimination, reduction and mitigation of risks resulting from operations.

Showing 1 to 5 of 5 in order of most recently published

Cefic Guidance on Process Safety Indicators



This new guidance is based on a global ICCA guidance and introduces universally applicable process safety Key Performance Indicators (KPIs). It became effective September 2016. During a period of four years all chemical associations are requested to host national workshops in order to roll out this new guidance in their respective countries. Reporting of these new process safety KPIs has to be established by 2020. This new set of process safety KPIs ensures the transition from lagging to leading indicators as it captures process safety incidents at very low levels already. This is to ensure an increasing awareness of possible trends long before more significant incidents may happen – and to react accordingly.

[Cefic/ICCA Guidance on Process Safety Performance Indicators](#)

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[Original version of the ICCA Process Safety Guidance](#)

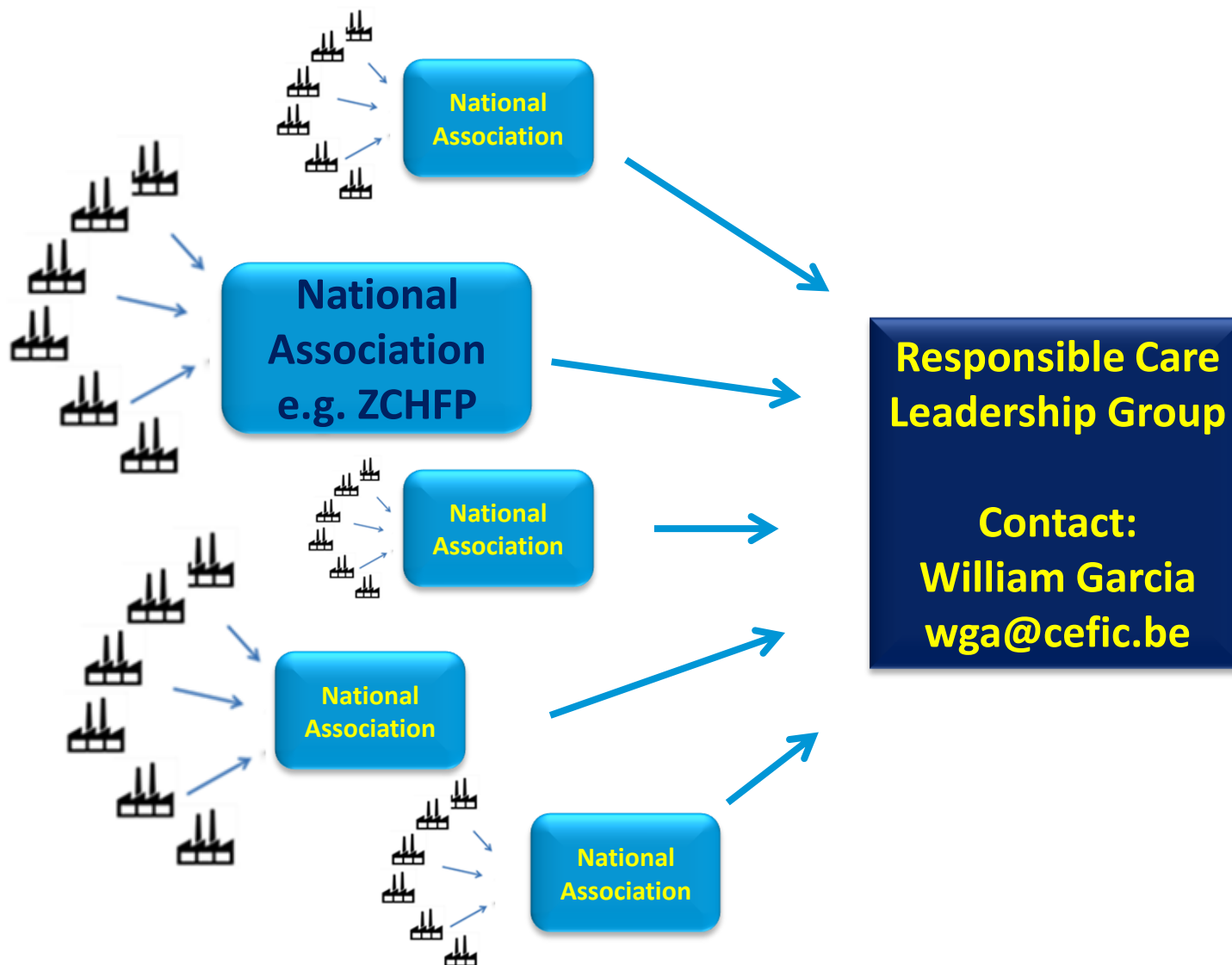
Share +

[Excel Template for Reporting](#)

Share +

Contact: [Stefan Drees](#)

How to report?





A little test

Now let us see what we have learned

1/4



A third-party truck loading a flammable product on Company Premises, experiences a leak and subsequent fire and property loss damages of €7,000 (direct costs). Although the truck is "Operated-by-Others", it is connected to the process.

PPS incident ?

YES

NO

The truck, although it does not belong to “your” unit is connected to “your” installation

Now let us see what we have learned

2/4



The same truck as in the example before is about to leave your site when it crashes and spills 1500 l of remaining product.

PPS incident ?

YES

NO

The truck is “in transit” now even though it is still on your property. Transportation incidents are not counted.

Now let us see what we have learned

3/4



A faulty tank gauge results in the overflowing of a product tank containing “flammable liquids”. Luckily the spill of approximately 700 kg of liquid overflows into the tank's diked area.

PPS incident ?

YES

NO

The product has left the “primary containment”. The diked area is the secondary containment and hence this is a PPS incident.

Now let us see what we have learned

4/4



An operator is walking between two production buildings when he slips and falls to the floor. He suffers a lost time injury. The slip/fall is due to weather conditions and inattention.

PPS incident ?

YES

NO

The injury is not related to a product release and hence this is not a PPS incident.

The same operator slips while cleaning up a small (not recordable) spill of a flammable substance. He falls to the floor and suffers a lost time injury.

PPS incident ?

YES

NO

The injury is related to a product release and hence this is a PPS incident.

Last slide....



If you haven't done yet → Please start reporting now

Benefits:

Establish a harmonized and GLOBAL system for all process safety related incidents

Transparent reporting based on NORMALIZED numbers

Leading the process → another major step to achieve further improvement of process safety

A method introduced and lead by chemical industry!

Thank you

If you have questions:
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