Una panoramica delle attività e obiettivi del TWG2, con illustrazione dei contenuti delle linee guida prodotte

Fabrizio Vazzana

Introduzione

📌 Per quasi due decenni gli Stati membri hanno fornito un forte sostegno a uno scambio tecnico a livello dell'UE associato alle attività di controllo sugli stabilimenti Seveso, sostenuto dal “Major Accident Hazards Bureau” presso il JRC di Ispra (VA), che gestisce due attività correlate ai fini dell'attuazione da parte degli Stati membri (compresi Norvegia e Islanda) degli obblighi di controllo derivati dalla Direttiva

Introduzione

- Queste attività sono il Technical Working Group on Seveso Inspections (meglio conosciuto come "TWG 2") e il Programma di Mutual Joint Visit Workshop for Seveso Inspectors (il "Programma MJV"), quest’ultimo promosso in consultazione con il TWG 2. Lo scambio delle informazioni che si svolgono all'interno di queste due sfere di attività si riferiscono sia a buone pratiche di ispezione, di applicazione e recepimento della Direttiva, sia a buone pratiche di gestione dei pericoli e dei rischi che dovrebbero essere osservati nei siti Seveso
- Il link alla pagina principale:

https://minerva.jrc.ec.europa.eu/en/shorturl/minerva/web_page_twg_2

Introduzione

- Tra le attività principali del gruppo di lavoro si possono segnalare:
  - Raccogliere e documentare vari strumenti, pratiche, risultati e altre risorse che si sono rivelati utili nell'affrontare vari aspetti delle attività di controllo e condividere queste informazioni con la più ampia comunità di ispettori
  - Creare una maggiore consapevolezza sui punti di forza e di debolezza dei programmi di ispezione e controllo, per aiutare a definire la direzione delle attività a livello UE, nonché delle attività bilaterali e multilaterali, a sostegno dell'attuazione delle varie Direttive
  - Predisposizione dei CIC, i "Common Inspection Criteria", veri e propri bollettini contenenti linee guida di ausilio agli ispettori durante le attività di controllo, che raccolgono le varie esperienze e suggerimenti emersi da ciascun componente del TWG2.

Introduzione

📌 I CIC sono stati sviluppati dagli ispettori Seveso per contribuire alla diffusione di buone pratiche di applicazione e gestione del rischio per il controllo dei principali rischi industriali:

- No. 1 Safety Instrumented Functions
- No. 2 Permit-to-Work
- No. 3 Internal Audit
- No. 4 Process Hazard Analysis
- No. 5 Management of Change
- No. 6 Emergency Isolation Systems
- No. 7 Process Safety Performance Monitoring
- No. 8 Pressure Relief Systems
- No. 9 Maintenance of Primary Containment Systems
- No. 10 Natech Risk Management
- No. 11 Training of Personnel
- No. 12 Internal Emergency Planning
- No. 13 Management of Contractors
- No. 14 Avoiding Ignition Sources

European Commission

Number 12 2022 MAHB Major Accident Hazards Bureau Technology Innovation in Security Unit

seveso common INSPECTION series criteria

Internal Emergency Planning

Publication of Common Inspection Criteria is intended to share knowledge about technical measures and enforcement practices related to major hazard control and implementation of the Seveso Directive. The criteria were developed by Seveso inspectors to aid the dissemination of good enforcement and risk management practices for the control of major industrial hazards in Europe and elsewhere. This particular topic highlights the issues that are critical for limiting the consequences of accidents through effective internal emergency planning and response arrangements. Note that this document is not intended as a technical standard nor as a summary or replacement of any existing standards on the matter.

DEFINITION AND SCOPE

The internal emergency plan consists of measures to be taken inside an establishment in the event of an incident. This document provides guidance to inspectors on assessing the adequacy of internal emergency planning (IEP) arrangements by operators of Seveso III establishments for containing and controlling incidents so as to minimise the effects and limit damage to human health, the environment and property through:

- the preparation, review and testing of internal emergency plans prepared by upper tier establishment operators (Article 12 of the Seveso III Directive)
- planning for emergencies in the Major Accident Prevention Policy (MAPP) prepared by lower tier establishment operators (Article 8/ Annex 3 of the Seveso III Directive).

It provides a framework for the inspection of emergency response arrangements at Seveso establishments and a means to assess an operator's performance using defined success criteria.

OBJECTIVE AND FOCUS OF THE IEP INSPECTION

The inspection should verify that the IEP is equipped to respond to emergencies associated with the accident scenarios considered relevant for the site. The plan should be sufficient to prevent or mitigate the negative consequences associated with them. In this sense, the IEP should be aimed at meeting the criterion included in Article 5 of the Seveso Directive, that is to, limit the consequences to human health and the environment as well as, as much as possible, limit harm to the establishment itself. At least the following contents should be ensured:

- Systematic approach
- An established process for IEP preparation and revision
- Identification of roles and responsibilities
- IEP foresight and planning
- Detailed preparations and procedures
- Support to external intervention
- Coordination with the external emergency plan
- Communication during an emergency
- Warning systems
- Training
- Emergency drills programme

Figure 1. Firefighters checking their gas masks (Photo credit: Depositphotos.com)

Joint Research Centre

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Seveso sites and battery energy storage systems - Situation in Italy and risk assessment issues

Some thoughts on the possible risks associated with the use of BESS, in particular in industrial parks or in establishments already subject to the Seveso directive

Introduction

- Battery Energy Storage System (BESS) refers to an electrochemical device that can convert electrical energy into chemical energy or vice versa, depending on its operating mode: charge or discharge.
- The recent operational experience of BESS with lithium ions highlights a series of accidents which are also particularly significant in terms of effects (typically fires and explosions caused by thermal run-away) which severely re-propose the need for structured analyzes of these emerging risks.
- It is therefore necessary, for the operators of these increasingly numerous installations, to evaluate all the dangers given the presence, real or foreseen, of dangerous substances which it is reasonable to foresee that they could be generated, in the event of loss of control of the processes.
- In fact, in addition to the aforementioned effects, it is absolutely not possible to exclude during the actual accident phase also the development of toxic and flammable dispersions and during the response management phase the need to manage the water deriving from firefighting actions .

Introduction

Introduction

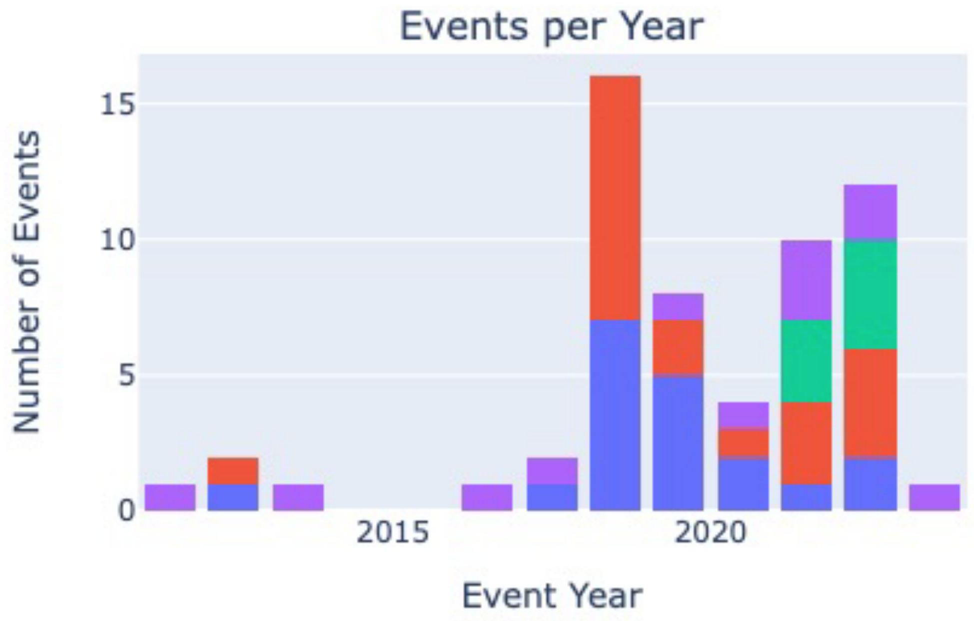
- Thermal runaway occurs when the amount of heat being generated by the battery reaction exceeds the batteries’ ability to dissipate heat. Thermal runaway in a battery cell can result in fire, explosion, and toxic gases.
  - The most common initiating events that cause short circuit and thermal runaway include the following:
  - Manufacturing defects in the cells,
  - Overcharging (e.g., inverter failure),
  - Overheating (e.g. cooling system failure), and
  - Mechanical abuse (e.g., seismic event or impact)

Introduction

- For lithium ion battery cells, the vented battery gas mix is flammable and typically consist of the following:
  - Carbon Dioxide (CO2)
  - Carbon Monoxide (CO)
  - Hydrogen (H2), and
  - Hydrocarbons (CxHx).
- The mixture of these gases can be ignited when exposed to an ignition source.

Introduction

📌 The BESS Failure Event Database (EPRI) provides an example where HF exposure resulted in several hospitalizations of first responders (i.e., the Neuhardenberg event). In addition, a lithium ion battery fire inside the battery room of a Norwegian ferry resulted in several hospitalizations due to the exposure to toxic chemicals



Introduction

📌 Some examples, excluding South Korea (29 events from 2018-2022)

Location	Capacity (MWh-MW)	Application	installation	Event date	System age (y)	status
US, CA Moss Landing	1,200-300	Solar Integr. (SI)	Power Plant	09-4-2021	0.8	
Australia, Moorabool	450-300	Grid Stability (GS)	Rural	07-30-2021	0	Construction/ commissioning
Germany Neuhardenberg	5-5	SI/ frequency reg. (FR)	Indoor/ hangar	07-18-2021	5	
China, Beijing	25- ?	SI+ other services	Mall	04-16-2021		Construction/ commissioning
France Perles-de-Castelet, Arège	0.5-0.5	Local demand mgt	substation	12-1-2020	0	testing
UK, Liverpool	10-20	FR	substation	09-15-2020	1.5	
US AZ, Surprise	2-2	Volt Reg, PQ, SI		04-19-2019	2	
SK,N.Geyongsang, Chilgok	3.7-?	SI	Mountains	05-04-2019	2.2	Charged, inactive
Australia, Brisbane		SI	Indoor, elevated floor	03-17-2020	6.7	
Belgium, Drogenbos	6(1;5)-4(1)	Test Center	Gas power plant	11-11-2017	0	

A possible approach on risk analysis

- There are various techniques that can be used to perform the hazard analysis. Most popular methods include quantitative risk assessment (e.g., with event trees), failure modes and effect analysis (FMEA), or the bowtie method.
- The bowtie hazard mitigation analysis identifies threats, hazards, and possible consequences. A bowtie diagram provides a visual representation of the mitigation features that are intended to prevent the undesired event and those mitigation features that prevent undesired consequences once that event has occurred. It should be noted that this is a consequence-based analysis, and the likelihood of the event is not considered.

A possible approach on risk analysis

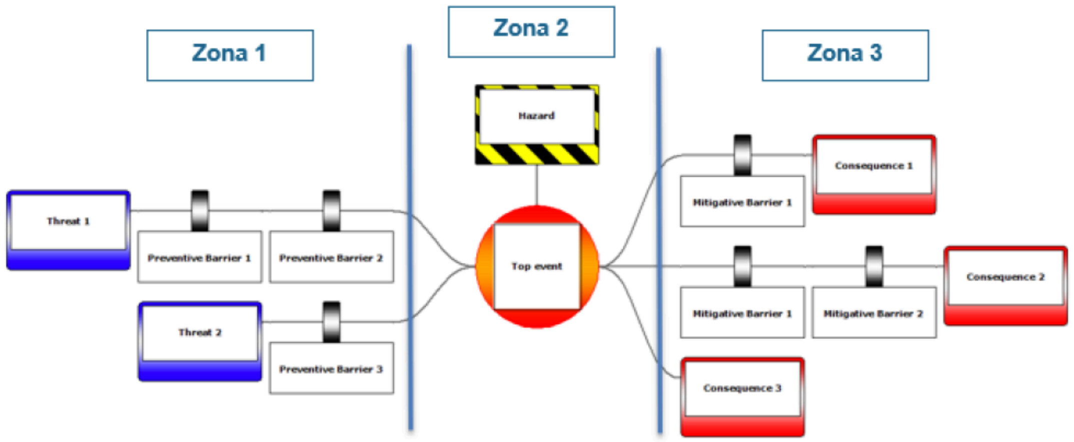
Required failure modes in hazard analysis.

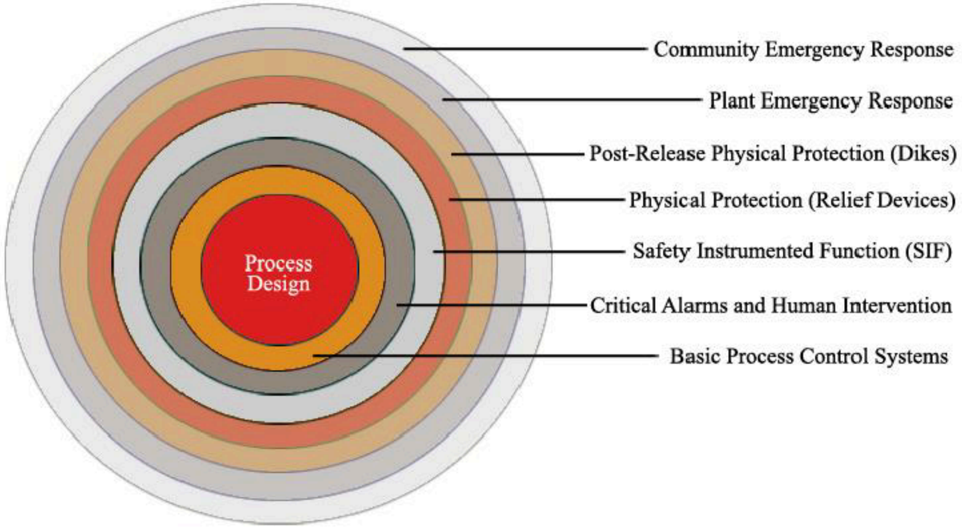
2020 NFPA 855	2021 IFC
• Thermal runaway condition in a single module, array, or unit • Failure of an energy storage management system • Failure of a required ventilation or exhaust system • Failure of a required smoke detection, fire detection, fire suppression, or gas detection system	• Thermal runaway condition in a single-battery storage rack, module, or array • Failure of any energy management system. • Failure of any required ventilation system • Voltage surges on the primary electric supply. • Short circuits on the load side of the stationary battery storage system. • Failure of the smoke detection, fire-extinguishing, or gas detection system. • Spill neutralization to being provided or failure of the secondary containment system

A possible approach on risk analysis

- These are the phases of the study conducted for a leading energy production company
  - Analysis of the reference documentation provided
  - Application of the Bow-Tie method for risk analysis, identifying the hazards, top events, causes, consequences and existing risk control measures
  - Application of Layer Of Protection Analysis for frequency quantification, using a semi-quantitative approach, of the results of the Bow-Tie analysis
  - Evaluation of the current risk, for comparison with the risk acceptability thresholds

A possible approach on risk analysis





Conclusions

- In brief, The following consequences were analysed:
  - Uncontrolled fire confined to a single BESS – Safety
  - Uncontrolled fire involving other BESS – Safety
  - Explosion and subsequent projection of fragments – Safety
  - Fire controlled by dry pipe activation and subsequent contamination - Environment
    - What about toxic release of HF?*
    - Quantification of hydrofluoric acid and other toxic off-gases emissions during the fire
    - In the absence of reliable information, rescuers-responders should be provided with the appropriate equipment.

* Journal of Loss Prevention in the Process Industries 81/2023

References

- Journal of Loss Prevention in the Process Industries 2023
- Application of the COMAH and Hazardous Substances Consents Regulations to Battery Energy Storage Systems (BESS) 2022
- Hazard Assessment of Battery Energy Storage Systems Atkins Ltd 2021
- BESS Failure Event Database
- CHEMICAL ENGINEERING TRANSACTIONS –AIDIC 2022

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Grazie