


The background image is a black and white photograph of a worker in a white protective suit, viewed from behind. The worker is wearing a helmet with a communication system and is standing in a mining or industrial environment. In the background, there are large pieces of heavy machinery, including a truck. The overall scene is hazy, suggesting a dusty or smoky atmosphere.

Société Suisse des Explosifs

Fatal incident investigation, root cause and learning

F. Venetz, Director Operations Switzerland

www.sse-group.com

A red graphic element consisting of three parallel diagonal lines, similar to the SSE logo, located in the bottom left corner of the slide.

Content

- Brief introduction
- Finechemicals - Phosgene
- Incident
- Root cause
- Learnings
- Aftermath



ABOUT THE GROUP

The Société Suisse des Explosifs (SSE) was founded in 1894 in Brig (Switzerland) to supply explosives for the Swiss Alps Simplon tunnel.

The opening of this strategic connection between Switzerland and Italy sparked the consequent industrial development.



ABOUT THE GROUP

SSE GROUP is

- a manufacturer and service provider of civil explosives and solutions
- a Custom Manufacturer of Intermediates and APIs for the fine chemical and pharmaceutical industry



ABOUT THE GROUP

High-quality standards and assets as well as the extensive know how, allowed SSE to develop a wide network of activities in different European countries.

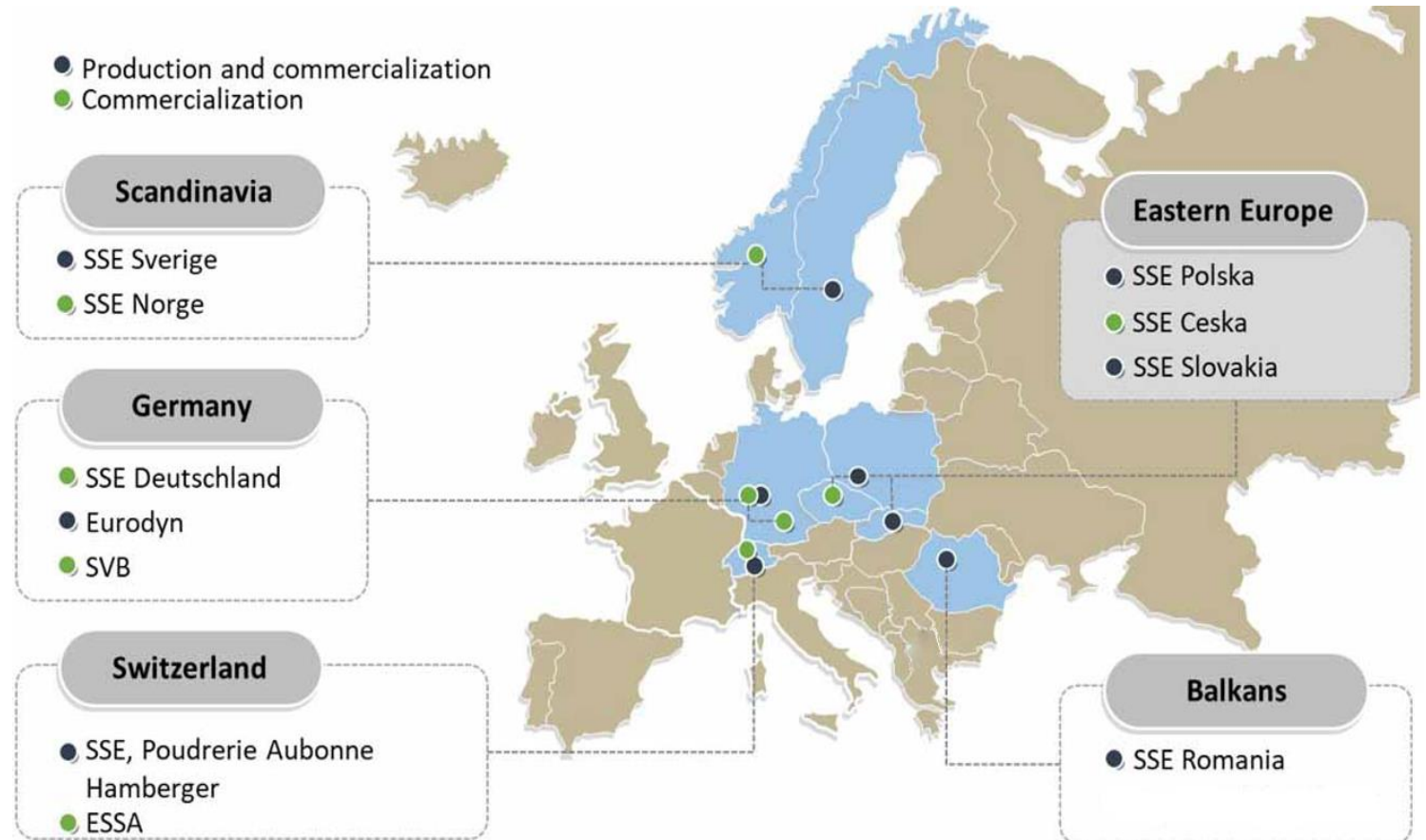
17 Affiliated Companies

Independent Swiss group

Global Sales in 40+ countries

Operations in 8 European countries

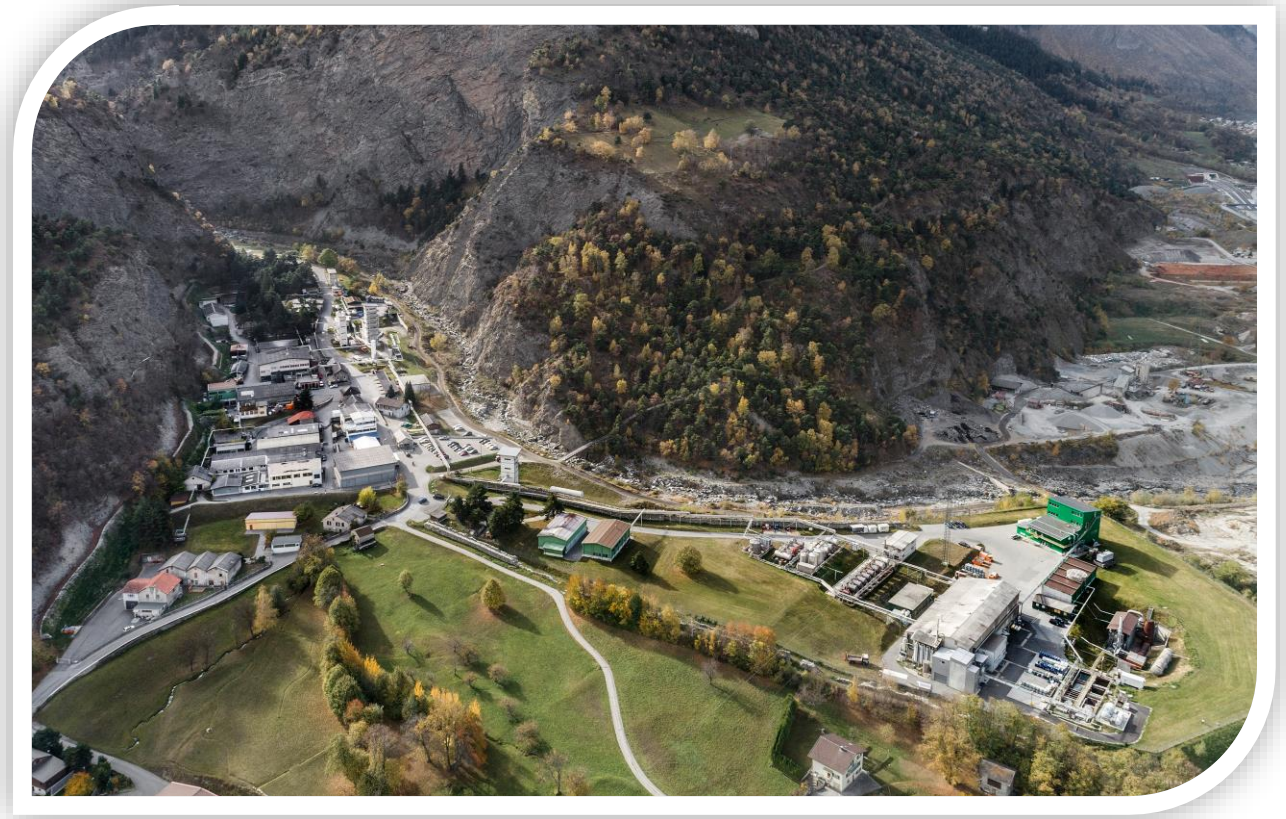
Over 700 Employees



BU EXPLOSIVES – MAIN PRODUCTION CENTER

GAMSEN – BRIG (CH)

- Explosives Manufacturing
 - PETN*
 - Detonating Cord «Detonex»*
 - Cartridge «Tovex»*
 - Emulsion*
 - Anfo*
- Distribution Center for Explosives and Detonators
- Fine Chemicals Manufacturing
 - Multipurpose Plants (Kilo Lab, Pilot, Production)*
 - Lab Units (R&D, Quality Control)*



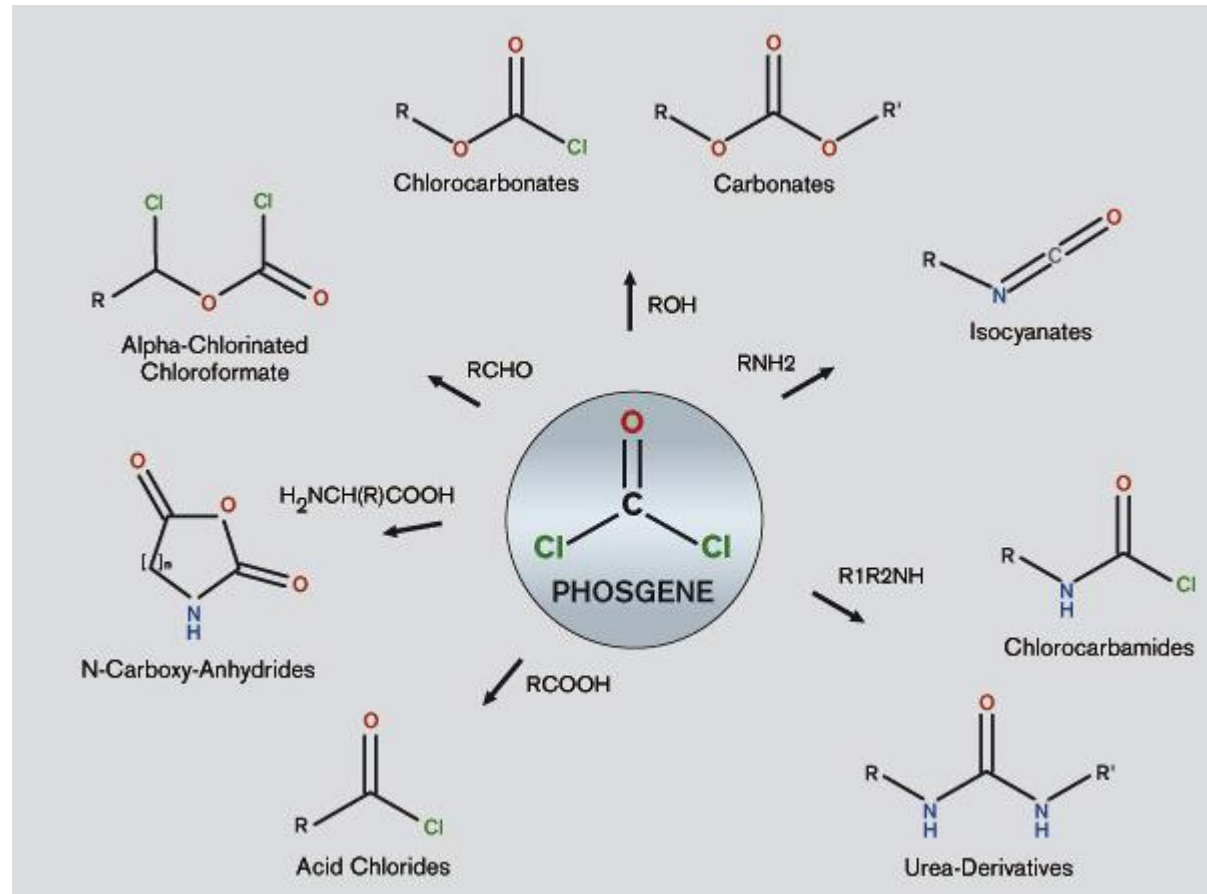
BU FINE CHEMICALS**VALSYNTHESE** 

Valsynthese is active in the fields of custom synthesis and contract manufacturing for the chemical and pharmaceutical industries.

The core capabilities are focused on high energetic and highly hazardous chemistry.



Phosgene and basic reactions



My thoughts before the accident (09.2020)

1. In the office of Marcel, the production Manager („luck“ till now)
2. Renato is coming back to work (50 %)

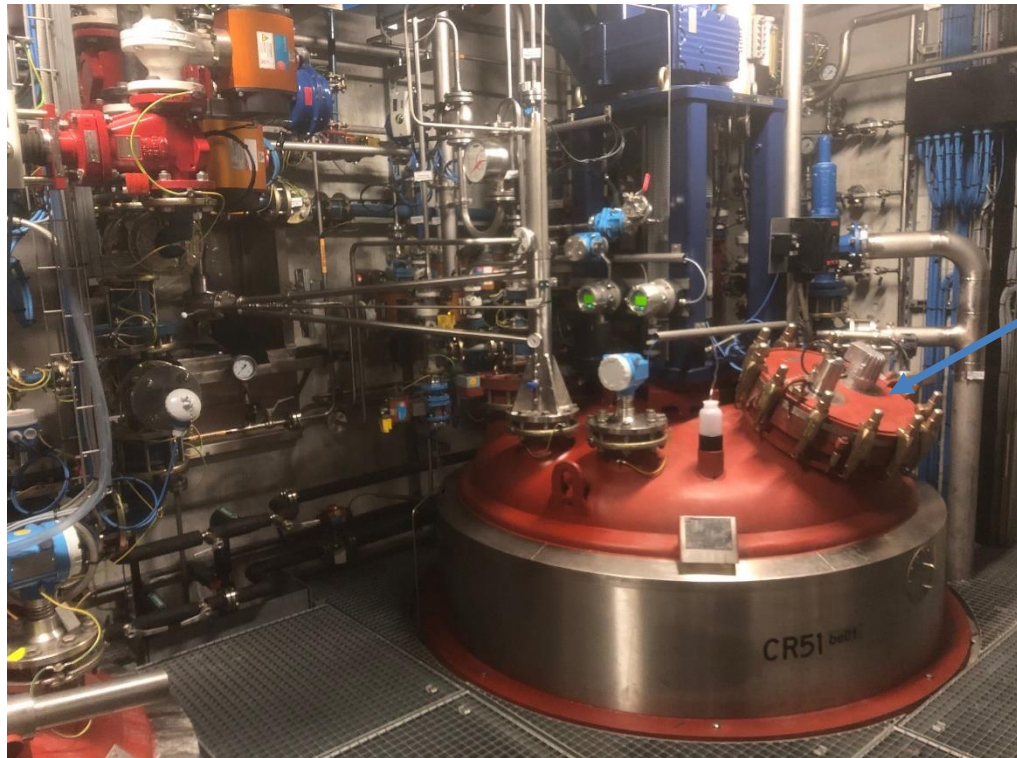
Fatal incident in our Phosgene plant on 19th October 2020



Phosgene plant at our site in Gamsen / Switzerland



Phosgene plant at our site in Gamsen / Switzerland



manhole

What happened?

- A technical employee was given the task on visual checking a pump in the phosgene bunker (routine check).
- The employee obtained the necessary permit and special key from the plant foreman as well as a mobile gas detector and entered the phosgene building alone.
- Since the inspection started shortly before the lunch break, the employee's absence was not further noticed.
- After the lunch break, the employee was missed and finally found dead in the phosgene plant.

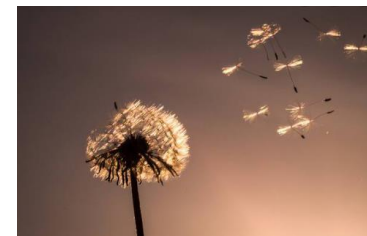
Status of the Phosgene plant

- The last production in the phosgene plant was almost a year ago.
- After the last production, the plant was made phosgene-free and cleaned and was considered chemical-free.
- The phosgene generator was not made phosgene-free but was encapsulated.

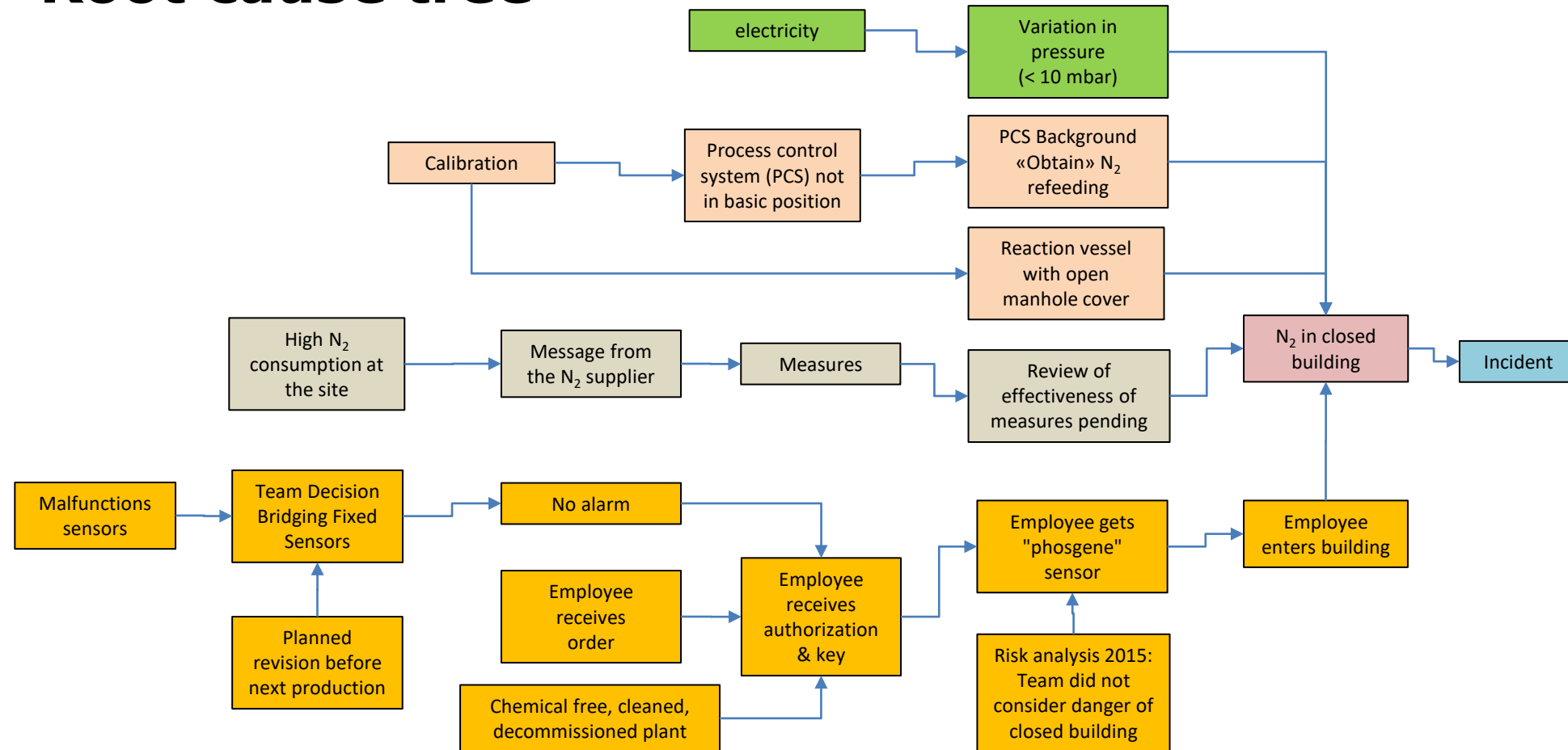
Cause of death

- The employee was not poisoned but suffocated
- In the atmosphere of the phosgene plant there were less than 5% Oxygen

**-> What exactly happened and why did it happen?
(Root Cause)**



Root cause tree



Root Cause

Fixed gas sensors

- As the CO sensors had falsely triggered many misleading alarms, they were taken out of service in March, the same for the oxygen measurements (because they also generated false alarms).
- A value of 20 % was automatically simulated for the oxygen
- The decommissioning of the CO-sensors was decided at a team meeting and documented in the folder of the measurement and control technology Engineer.
- A revision of the sensors was planned for 21st October (before next production campaign)

-> O₂ sensor was out of service and the decommissioning of the sensors was not well visibly documented

Root Cause

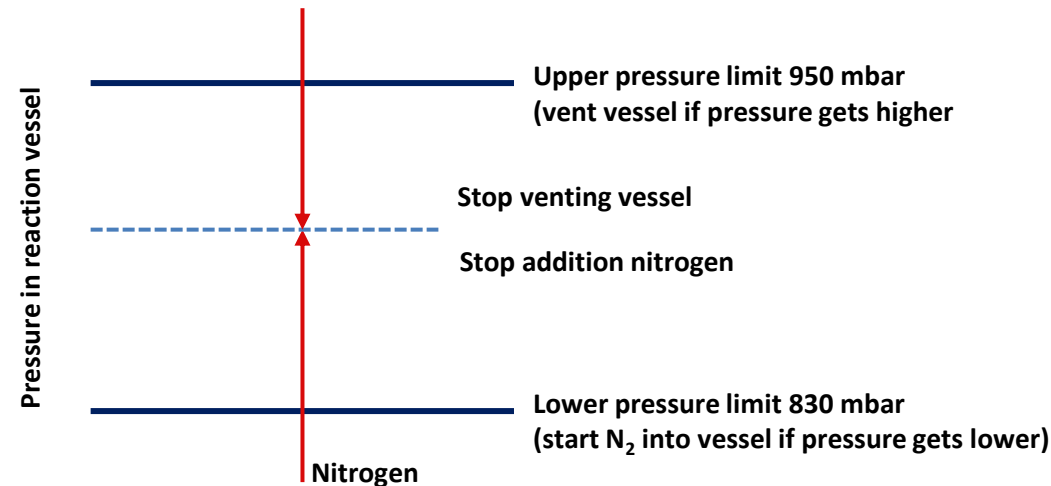
Calibration of the measuring points (Temperature, level control ...) – Status vessel

- GMP Plant -> yearly calibration necessary
- Manhole of the vessel must be opened for the calibration
- Tight closing of the manhole only by specialized technical personnel. This was not done immediately because the next production was scheduled only in 1 month.
- Manhole cover remained only loosely put on and not tightly closed (60 lbs)

-> Manhole of the reaction vessel was not tightly closed

Root Cause: Calibration of the measuring points – Status process control system (PCS) of vessel

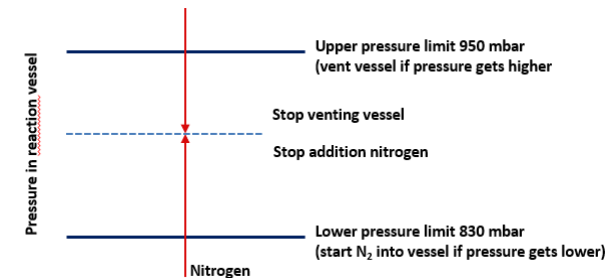
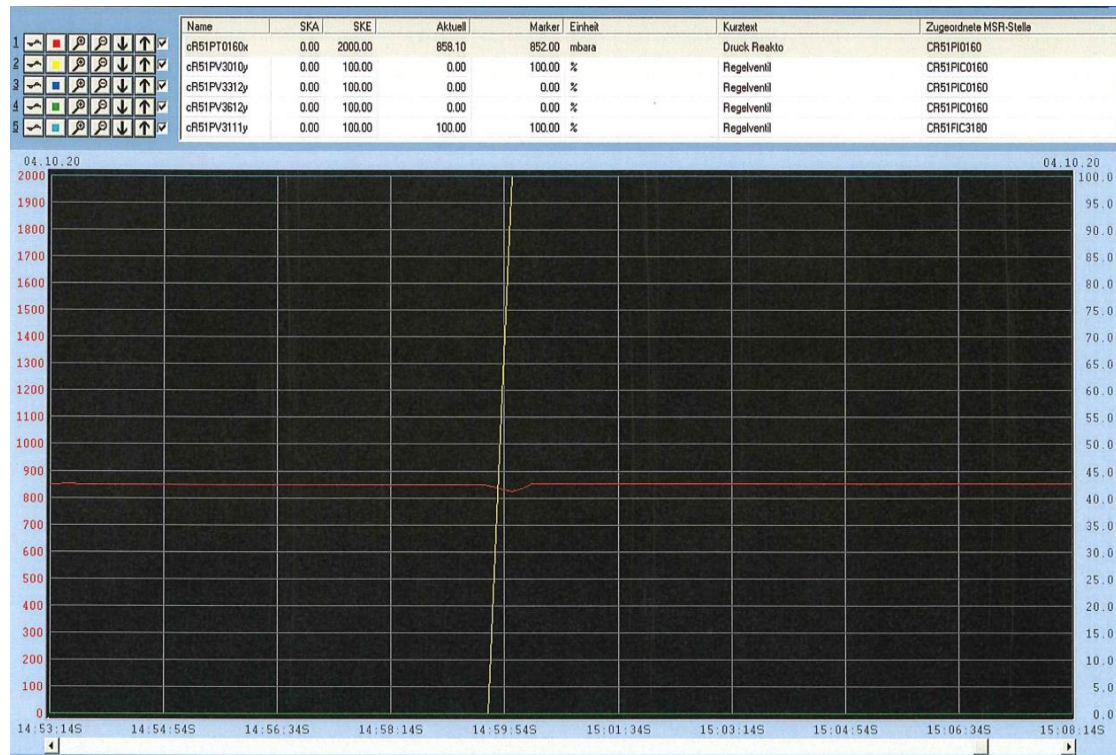
- At the end of the calibrations, the PCS remained in the "Hold pressure" position



-> PCS was not set back to basic position (no pressure control)

Root Cause: Weather / Storm

- Very stormy weather on 4th October led to a short atmospheric pressure reduction → drop approx. 5 mbar!!!



Root Cause: Weather / Storm

- This caused the pressure in the vessel to fall just below the target range and nitrogen began automatically to blow into the vessel
- Because of the open manhole, the stop limit of pressure in the reactor was never reached and nitrogen continued blowing

-> Stormy weather

Root Cause: Nitrogen consumption

- The nitrogen supplier informed about an increased nitrogen consumption (only qualitative).
- At that time, a new production started with increased nitrogen consumption.
- The process was then optimized, and the nitrogen consumption reduced. The evaluation of any results came too late.

-> No quantitative information about nitrogen consumption

Root Cause: Mobile sensor

- The employee was equipped with a mobile sensor (phosgene, chlorine, CO).
- The sensor didn't measure Ex and oxygen (no common equipment)



-> No measurement of oxygen



Root Cause

Several causes led to the accident:

- Malfunction of fix sensors
- Reaction vessel not in basic position (PCS) after calibration
- Not tightened manhole of reaction vessel
- Stormy weather with one pressure fluctuation
- Mobile sensor not equipped with oxygen indication
- <5% oxygen in the phosgene plant

-> Only the interaction of all factors led to the accident. If only one of these factors had not occurred, there would have been no accident.

Conclusion

- > Everyone knows the dangers of phosgene, chlorine and CO**
- > But all other hazards must also be included in the safety considerations**
- > Take care of closed rooms**

Question of guilt

- Forensic Institute Zurich (Police & Justice Centre)
- Police Department
- Public Prosecutor's office
- The Swiss Accident Insurance Fund

-> Before startup of the phosgene plant, a safety risk analysis was performed in a team together with external specialists

-> Multiple employees were involved in the root cause

-> Transparency and helpfulness by company with root cause

-> A tragic chain of various causes led to the accidental death

-> Therefore, there is no guilty person for this accident

Corrective actions

- Restricted access → mobile oxygen sensor
- Upgrade all mobile sensor (oxygen)
- HAZOP and definition of closed rooms
- Training and adaption SOP with nitrogene (special danger)
- Improve LockOut/TagOut (training, visualization)
- Contact with manufacturer of sensors
- Definition and Training of «state of an equipment»
- Install fix sensors with alarming in closed rooms
- Definition procedure for high nitrogen consumption

→ Share learnings

....Aftermath

1. Everybody on site would have (and also shortly after the incident) step into the building w/o hesitation
2. („political“) hierarchical thoughts of the company
3. Thoughts of the employees
4. Communication internally and externally
5. Strong interest of learning in Switzerland and Europe

...with all our combined experience and knowledge we felt so „safe“...

Coworkers and Family



There is probably not a day that goes by that I, like many others, do not think about Renato...



LET'S GROW TOGETHER!

Thank you!