TATA STEEL

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Process Safety in projects at Tata Steel IJmuiden

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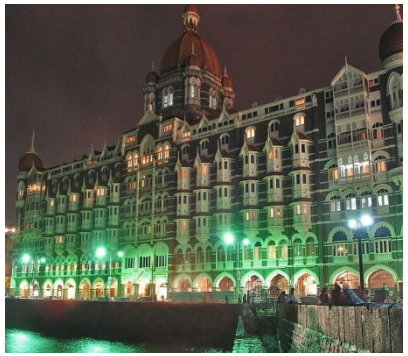
Together we make the difference

Introduction to the Tata Group

One of the world's fastest-growing and most reputable corporations



Tata Group

- Founded in 1868
- Operations in more than 100 countries and 700,000 employees
- Total revenues of more than $110,7 billion (68% from outside India)
- Promoter company Tata Sons 66% owned by philanthropic trusts
- £100 million invested in community projects every year

Tata Steel IJmuiden

Products and services that create advantage

Site characteristics

- Integrated steel works (ore and coal → coated steel coils)
- 850 ha site in 4 municipalities (IJmuiden, Velsen-Noord, Heemskerk and Beverwijk)
- About 7 mtpa crude steel production
- About 9000 employees
- Research and Development

Our key markets

Serving the most demanding markets worldwide

Aerospace

Consumer products

Automotive

Construction

Lifting & excavating

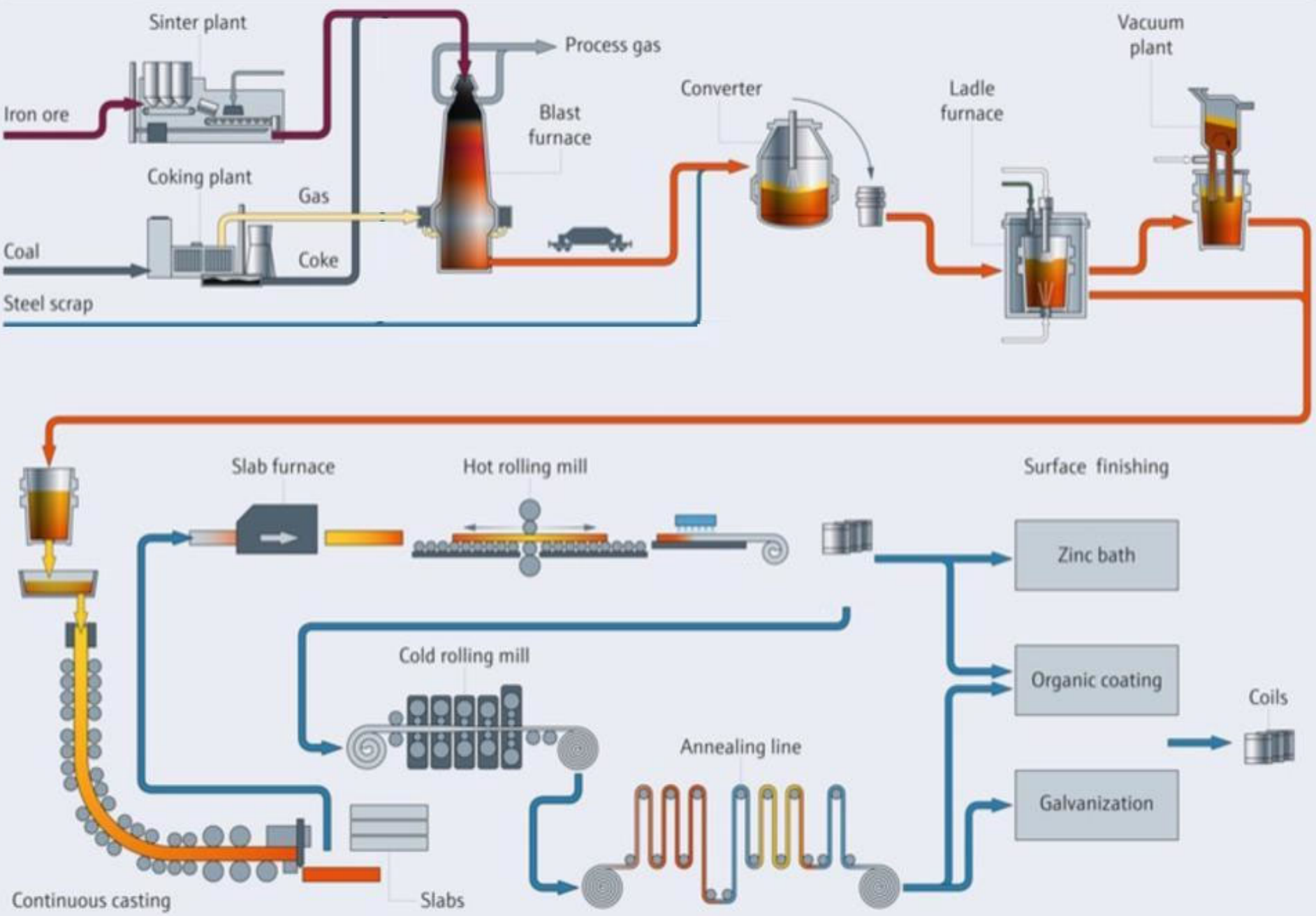
Defence & security

Energy & power

Packaging

Tata Steel in IJmuiden

Metal integrated steel works plant



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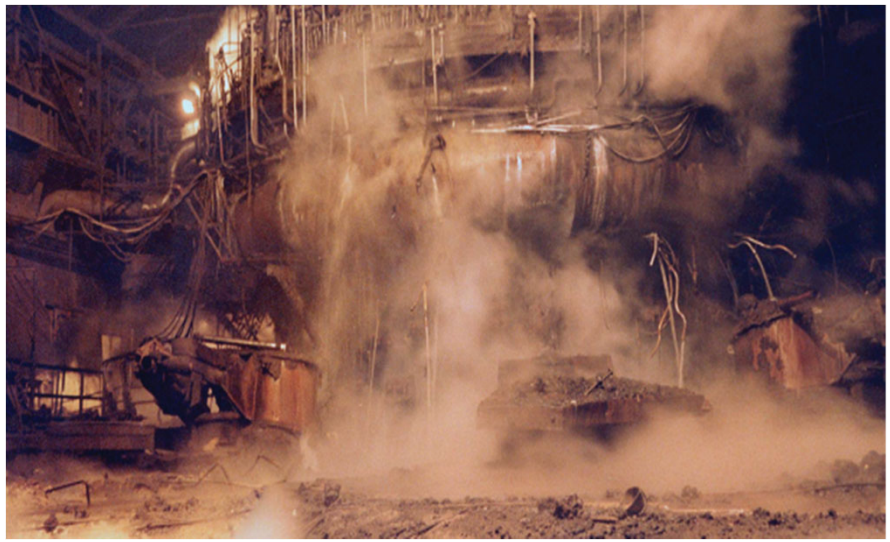
Process Safety in the Steel Industry

Blast furnace no.5 Port Talbot



Explosion in blast furnace no.5 in Port Talbot 18 November 2001.

An explosion in the blast furnace resulted in lifting the shaft of the furnace with 75 cm (± 5000 tonnes of weight) 75 cm opgetild. About 200 tonnes of hot matter was released.

3 fatalities, 12 serious injuries.

Direct cause: Water into the blast furnace. The exact mechanism is still not fully understood.

The accident was the start of structured programme to improve process safety within Tatasteel Europe.

Lessons learnt:

Management

- Role and function if the safety department is essential (involvement in process risk evaluation).
- In the steel industry efforts on preventive process safety studies were insufficient.

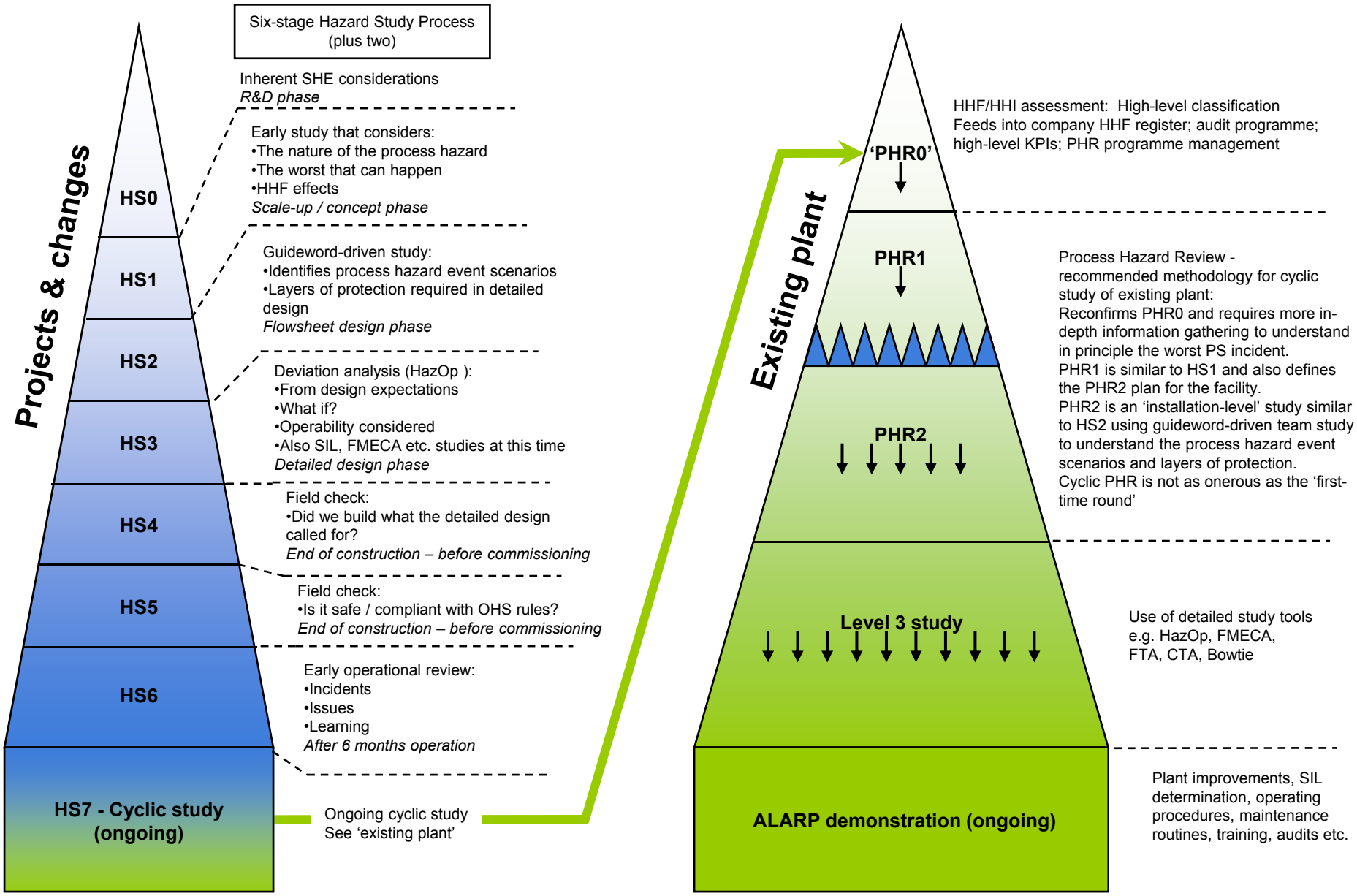
Operational

- Cooling of the blast furnace was not reliable enough.
- Fast detection of cooling water leakage and procedures for corrective measures and training on these procedures was insufficient.

Engineering

- Engineering did not pay sufficient attention to process safety risks (reliability engineering).
- Safety critical equipment was not identified and treated as such (e.g. cooling water pumps).

The full report can be found on:
http://www.hse.gov.uk/pubns/web34.pdf



Pictorial representation of recommended process hazards analyses through plant life cycle

Tata Steel IJmuiden risk grid

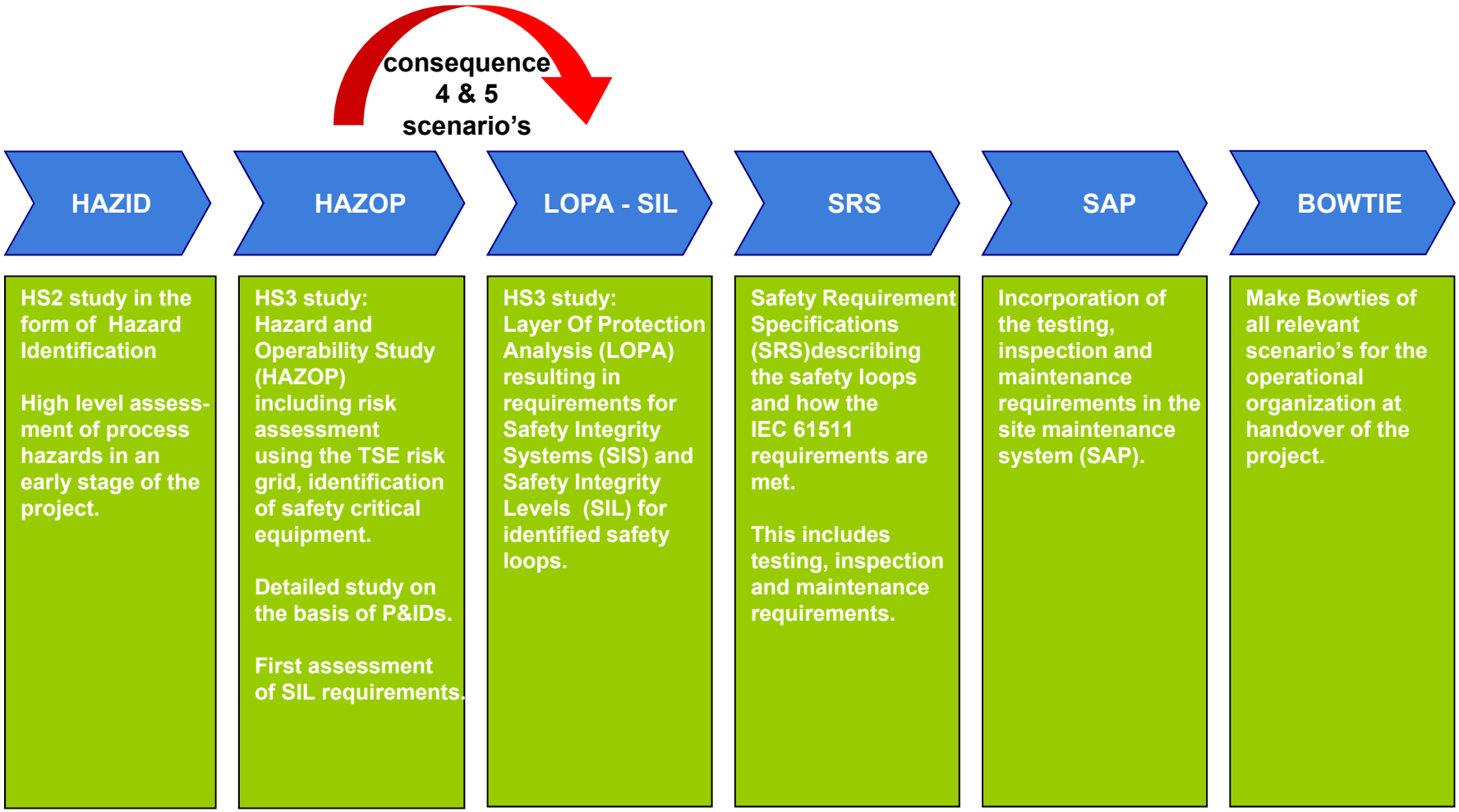
Consequence severity		consequence word model												
Category	Description	Safety and health	Environment	Financial	A	B1	B2	C1	C2	D1	D2	E1	E2	F
5	catastrophic	Off-site fatality; multiple on site fatalities (≥5)	MATTE; Very large excess of allowable emissions; Very serious contamination of ground or water course; Long term loss of aquatic life	> € 100 mln	5A	5B1	5B2	5C1	5C2	5D1	5D2	5E1	5E2	5F
4b	major	On-site fatalities (2 to 4)		€ 10 - 100 mln	4bA	4bB1	4bB2	4bC1	4bC2	4bD1	4bD2	4bE1	4bE2	4bF
4a		Single on-site fatality; one or few on-site major injuries; high level of carcinogen exposure	Excess of allowable emissions and serious damage to the environment MATTE at EC threshold	€ 10 - 100 mln	4aA	4aB1	4aB2	4aC1	4aC2	4aD1	4aD2	4aE1	4aE2	4aF
3	severe	One or few off-site MTCs; one or few on-site major injuries (LTIs, disablements); distressing exposure, irreversible effects	Repeated limited excess of allowable emissions disturing visual evidence; fish killed, vegetation killed; possible MATTE	€ 0,5 - 10 mln	3A	3B1	3B2	3C1	3C2	3D1	3D2	3E1	3E2	3F
2	moderate	Off-site distress; one or few on-site MTCs (serious injuries); release 2-5 times OEL; sustained or repeated nuisance, noise, smell, dust, flaring or venting; LoC with safety consequences	Excess of allowable emissions; notifiable release, possible warning from Competent Authority	€ 100.000 - 500.000	2A	2B1	2B2	2C1	2C2	2D1	2D2	2E1	2E2	2F
1	minor	Off-site nuisance; one or few on-site FACs; release above OEL, short duration nuisance, noise, smell, dust, flaring, venting, LoC	Small amount relased to water course; reelease may be notifiable to Competent Authority	€ 10,000 - 100,000	1A	1B1	1B2	1C1	1C2	1D1	1D2	1E1	1E2	1F
0	not significant	Incident leading to no injuries or exposure on site; minor damage only; no off-site effects	Incident with no significant or persistent environmental effects	< € 10.000	0A	0B1	0B2	0C1	0C2	0D1	0D2	0E1	0E2	0F

		A	B1	B2	C1	C2	D1	D2	E1	E2	F
Likelyhood	Category	A	B1	B2	C1	C2	D1	D2	E1	E2	F
	Frequency range (/yr)	10^{-9} to 10^{-8}	10^{-8} to 10^{-7}	10^{-7} to 10^{-6}	10^{-6} to 10^{-5}	10^{-5} to 10^{-4}	10^{-4} to 10^{-3}	10^{-3} to 10^{-2}	10^{-2} to 10^{-1}	10^{-1} to 1	1 to 10
	Description	barely conceivable	extremely unlikely		very unlikely		unlikely		possible	probable	regular
	Likelyhood word model	Never heard of	Theoretically possible but never heard of in our industry	Foreseeable event but extremely rare in industry	Foreseeable event but chance of occuring is very low - requires the failure of many layers of protection	Foreseeable event but chance of occuring is low - requires the failure of several layers of protection	Incidents known in industry; Unlikely event not expected during lifetime of installation; Probably requires two layers of protection to fail.	Incidents known in industry. May require two layers of protection to fail	Could occur during remaining lifetime of installation. Root causes have been seen during lifetime of the installation	Has occured during lifetime of facility	Has occured in recent lifetime of installation and likely to recur in the next year

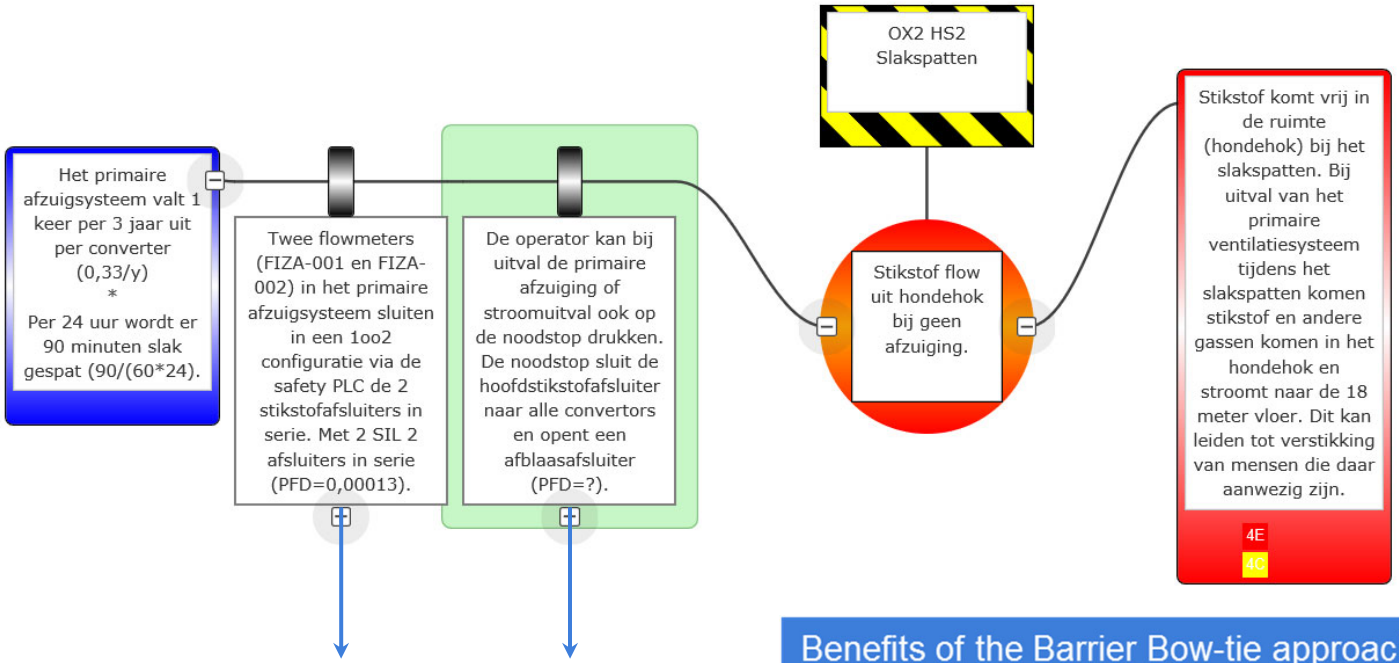
Key		
		Process Hazard Event Frequency NOT tolerable
		Process Hazard Event Frequency tolerable only if ALARP (Tif ALARP zone)
		Process Hazard Event Frequency broadly acceptable

Source: Tata Steel Europe; Process Safety Guidance Document PSG-03.2.10; Process Safety Risk Grid; Completed with a financial column from the TS IJM Process Safety Risk Grid

Process Safety approach for projects in high hazard installations



Bowties for high consequence scenario's



Designed , maintained and operated according to standard ?

Maintained, inspected, tested or trained in time ?

Benefits of the Barrier Bow-tie approach:

1. Allows us to communicate complex situations simply and effectively
2. Brings the key elements, "barriers" into sharp focus
3. Allows greater capacity for sharing and learning
4. Data generated can be dynamically shared across the company within the software server application
5. Enables focused and effective PSM tours in the field
6. Improves layer of protection understanding and Risk analysis

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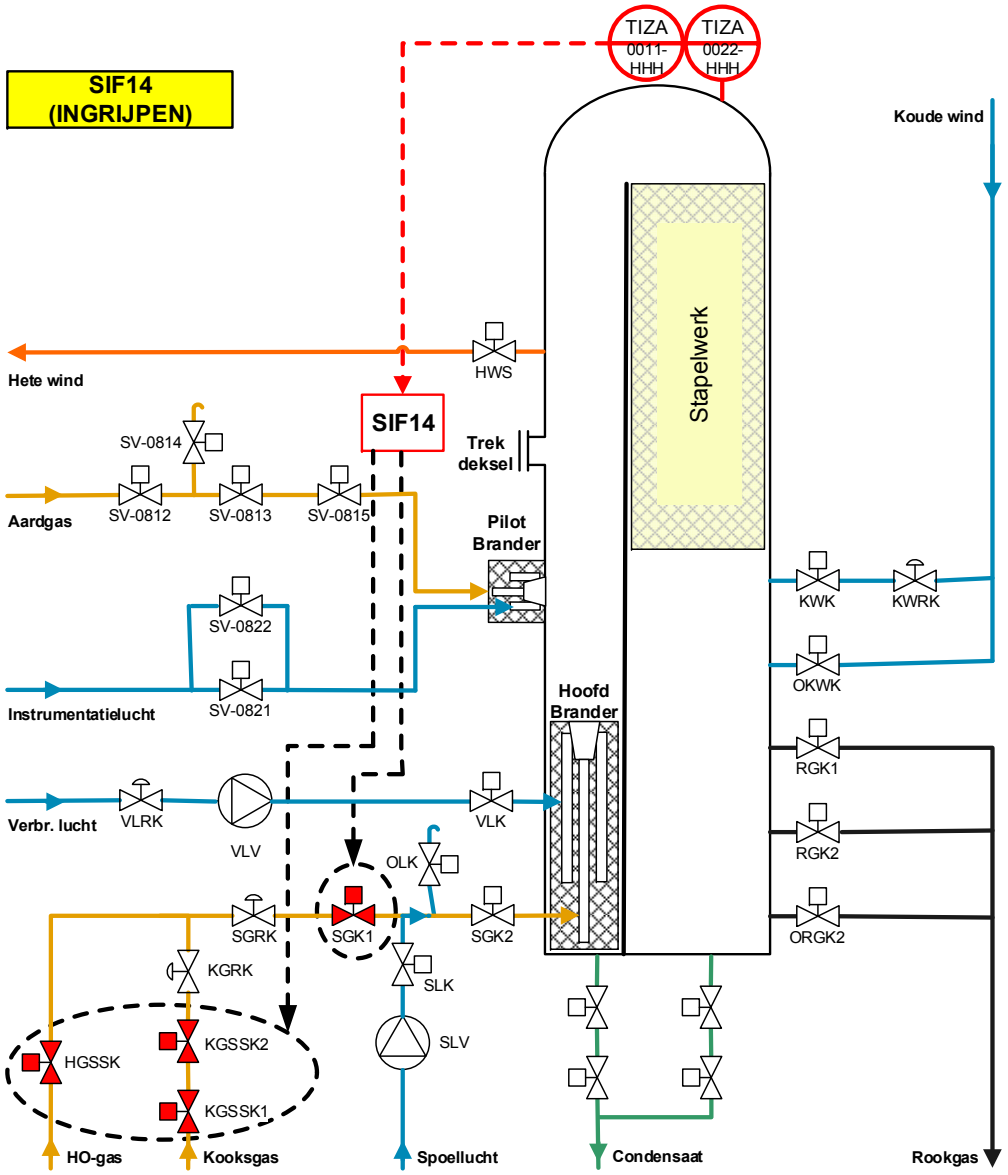
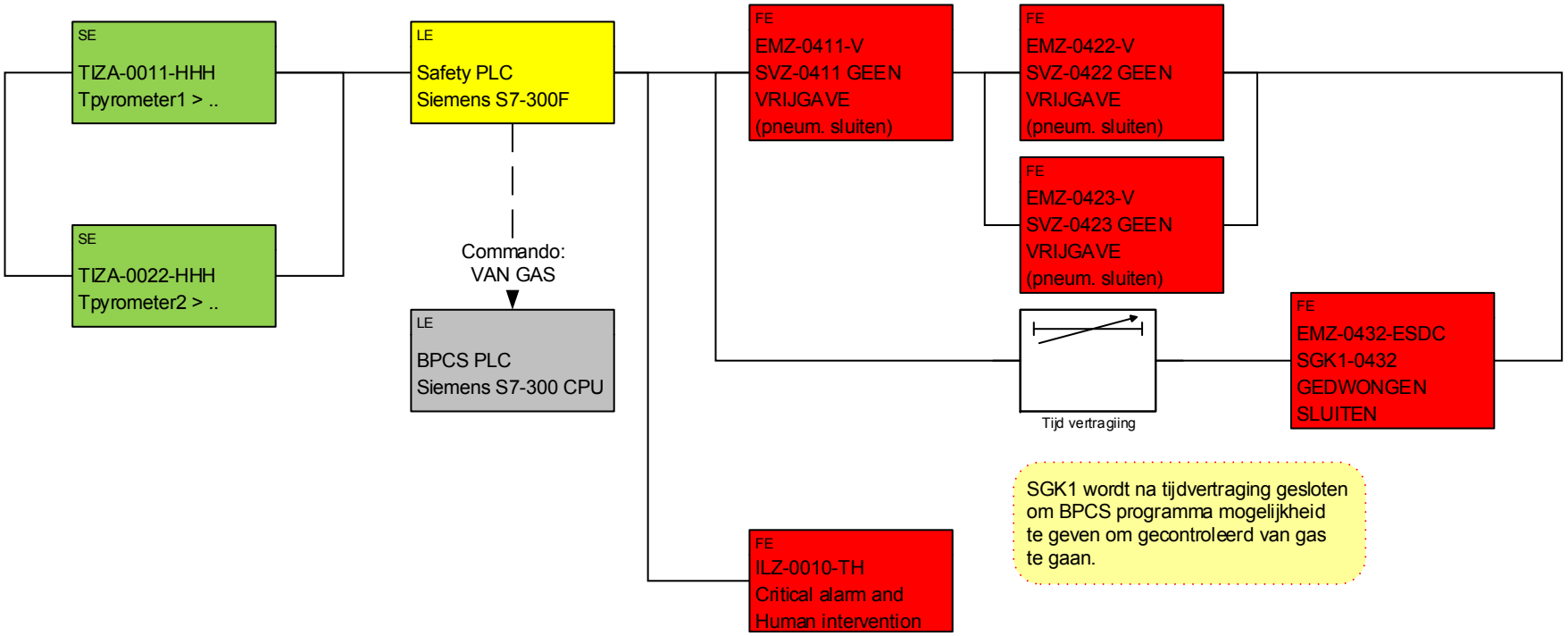
Process safety
Hot stove 64 project

Hot stove 64 (example SIF)



Hot stove 64 (example SIF)

- Interlocks and safety trips at alarm levels higher than the control system.
- Intervention !! Example: SIF14 High dome temperature



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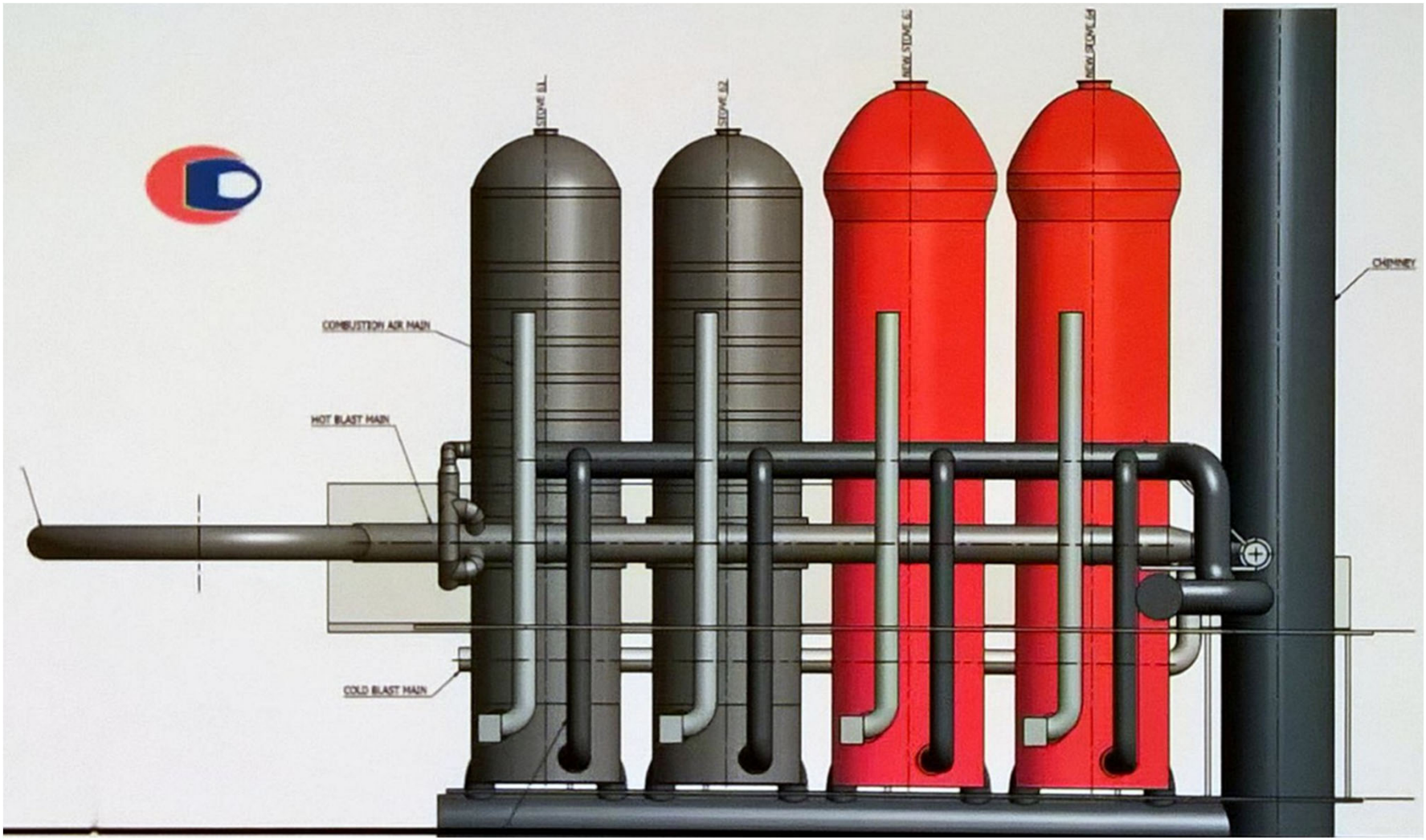

New Cokes Oven Gasholder

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