



Science For A Better Life

THE BAYER AG EXPERIENCE, 2019

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INTRO

- BSc. & MSc., University of Nairobi
- PhD, State University of New York
- Lecturer, University of Nairobi
- Senior Lecturer, Technical University of Kenya
- National Secretary, Kenya Chemical Society (KCS)
- IUPAC, Safety Training Programme (STP)



KCS PARTNERS



BAYER, AG BERGKAMEN GERMANY

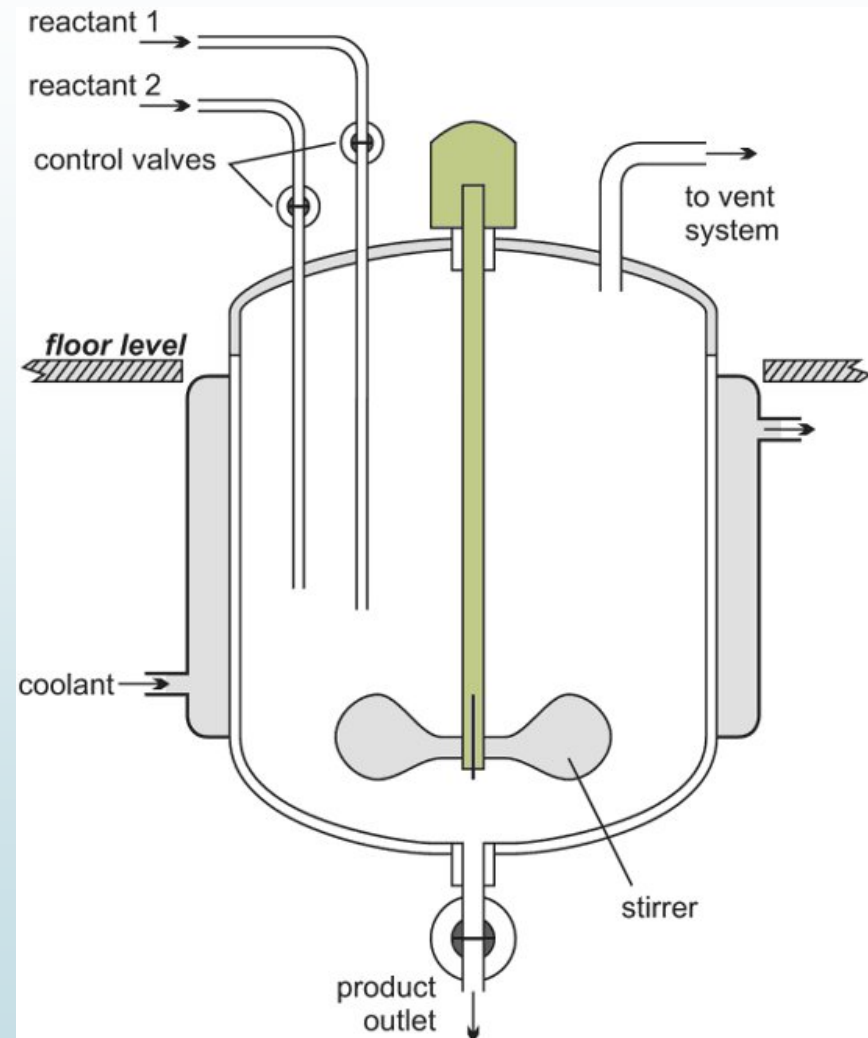
- Awesome experience facilitated by awesome people
- Senior managers spent whole days with me
- Great company and safety culture
- Special **Thank you** to:
- Thomas in der Weide
 - Coordinating the Training
 - Visit to the Coal mines, Old Castle and Dortmund

SITE VISITS

- Production Unit A (PUA)
- Production Unit B (PUB)
- Production Unit E (PUE)
- Microbiology Plant
- Production Unit F (PUF)
- IT
 - Cybersecurity
- Waste Water Treatment Plant
- Security / Emergency Response
- Security / Emergency Response
- Distillation Plant / Solvent Recovery
- Waste Disposal / Incinerator / Sodium Iodide

CONTROLLING EXOTHERMIC RUNAWAY REACTIONS

- ▶ **All reactor are standardized**
 - ▶ V25 dosing valve for all reactors
- ▶ **Semi Batch reaction**
- ▶ **Control Stirring (S)**
 - ▶ If stirring rate is low, V25 is switched off
- ▶ **Temperature (T)**
 - ▶ Dosing is run only when reaction temperature us reached
 - ▶ Temperatures above or below the reaction temperature, switch off V25



STOPPING EXOTHERMIC RUNAWAY REACTIONS

► Pressure

- Any pressure above the reaction temperature releases the safety valve
- The reactors are designed to withstand vacuum, hence low pressure is not an issue
- All safety valves are connected to catch tanks to stop product overflow to the environment or onto workers

► Redundancy for all safety switches (S), (T) and (P)

- They are two switches. If one fails V25 is closed system stops dosing

PPE / SAFETY CULTURE

The production building is a chemical plant and the following must be adhered to:

- Wear helmet and safety glasses!
- Do not use your cell phones!
- Switch off electric devices, which are not explosion proven!
- Keep distance to the walls inside the elevator!
- Don't touch pipes and vents!
- Do not smoke!
- Use hand rails



CLOSED SYSTEM / CLEAN ROOM

- All production is done in a closed system
 - No raw materials or product is exposed to the environment or to the workers
- Clean rooms with negative pressure in use
 - to load raw materials and collect final product (in sealed drums)
 - Operators wear special PPE
- Production Unit B has a completely closed system
 - Here the shop floor operators do not need special PPE

GMP / AUDITS

- Manufacturing done under cGMP
- Over 15 audits conducted annually by various authorities:
 - German Authorities
 - US Federal Drug Administration (FDA)
 - Japanese authorities
 - Korean authorities
 - Russian Authorities
 - Evonik (Responsible Care)
 - OPCW



OPCW



SECURITY / CYBER ATTACKS

- Drone detection system is in place
- Access control
- Advanced Inventory management system in use
- Elaborate firewalls and partitioning system to stop cyber attacks
 - WWW and process systems are separated with specific access granted to those with some very specific credentials and traffic
- A layered security systems is employed with regular patrols in and outside the perimeter walls
- CCTV in use

SECURITY

- Public address system in place
- Emergency messages can be sent to all employees via the intranet
- A dedicated crisis center, with role allocation and training/meeting every two weeks
 - Center has phones, computers, meeting room, communication to the authorities
 - Roles of members mimic those of the government authorities, to ease communication
- State of the art fire fighting equipment
- Drone detection system is in use

RECYCLING / WATER TREATMENT

- ▶ 60% of the solvents used are recycled
- ▶ Membrane is used to remove biological materials
- ▶ Activated Carbon is used to remove non-biological materials
- ▶ Rainwater is harvested and used for non-pharmaceutical production processes

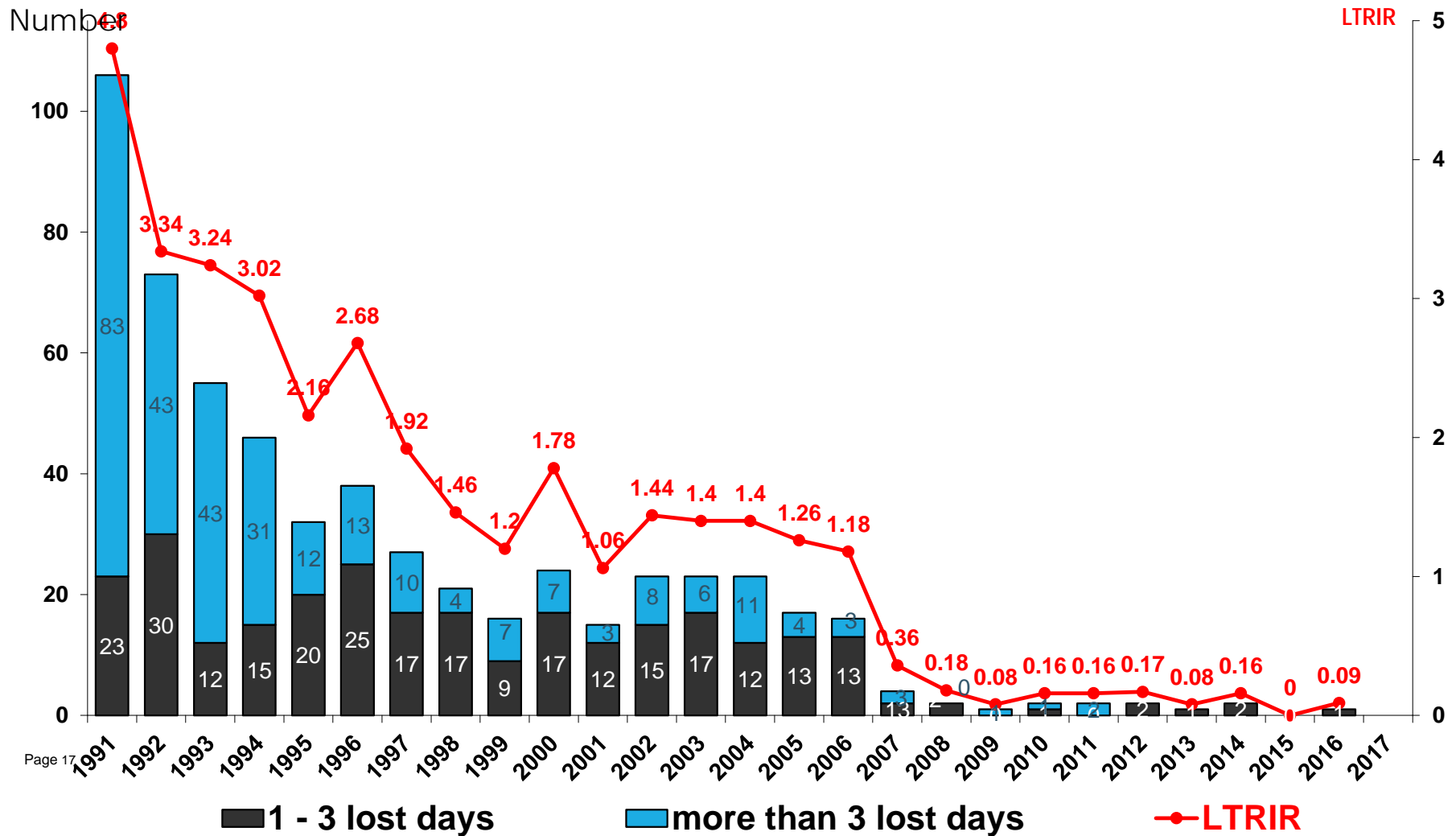
WASTE MANAGEMENT

- ▶ 14000 tons total waste, of which 12500 tons liquid waste and 1500 tons of solid waste
- ▶ Sodium Iodide is recovered from the waste and sold as a product
 - ▶ Iodide is used in PUF during the production of contrast media
- ▶ Incinerator is a rotating kiln which burns at 900 degrees Celsius
 - ▶ German authorities have 24/7 online access to the gases releases during incineration

LATER THIS WEEK

- Bayer Training Center
- Quality Control (QC)
- Quality Assurance (QA)

SAFETY STATISTICS (LTRIR)



FUTURE PLANS

➤ Ministry of Education

- Industry based Learning

- NITA

➤ School of Chemistry

- Department of Industrial Chemistry Technology

➤ DAAD

- Support initial industrial based trainers in Germany industries such as Bayer

➤ Study on the Discharge of API in water bodies

- E.g. River Rhine with multiple industries

Asante Sana !

Danke !

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