



# Deflagration during nightshift

and a short digression about safety culture

Alexander Thomas



## Structure

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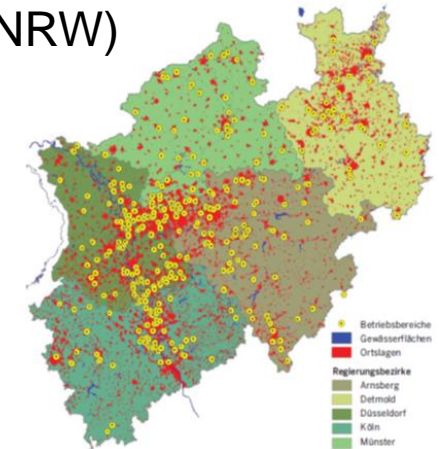
- **the administrative district Arnsberg from the major hazard point of view**
- **deflagration during nightshift**
- **safety culture (a very brief comparison)**
- **conclusion**



## the administrative district Arnsberg from the major hazard point of view

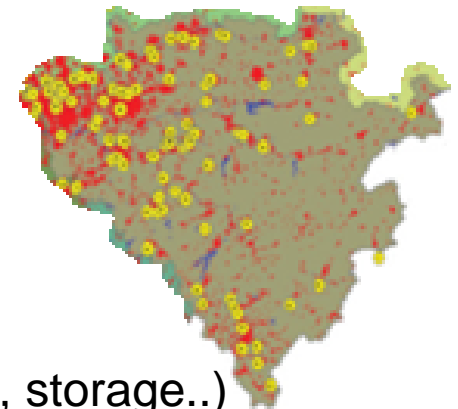
### 127 operating ranges under Seveso directive (637 in NRW)

- 69 lower-tier establishments
  - 58 upper-tier establishments
- thereof: 40 surface planting and 10 in which explosives are dealt with*



### branches overview

- surface planting, staining
- chemical industries (pharmaceutical, varnishes, special chemistry,...)
- powerstations
- biogas facilities
- storage (petrochem., fl. gases, explosives, fertilizer,...)
- waste management facilities (chemical-physical treatment, storage..)
- miscellaneous





## the administrative district Arnsberg from the major hazard point of view

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### Tasks of the major hazard team / Störfallteam (2 senior service, 5 inspectors)

- participation on preliminary discussions on legal obligations
- „preliminary examination“ on behalf of article 15 Seveso-III-directive
- statement in approval procedures
- examination of notifications to Art. 7, Seveso-III-directive
- the „governmental duties“
  - *assessment of safety reports*
  - *reporting duties to the EU*
  - *identification of domino effects*
  - *implementation a system of inspections*
- accident investigation
- statement to safety distance issues
- if appropriate participation on IED inspections
- participation on national & international exchange of experiences



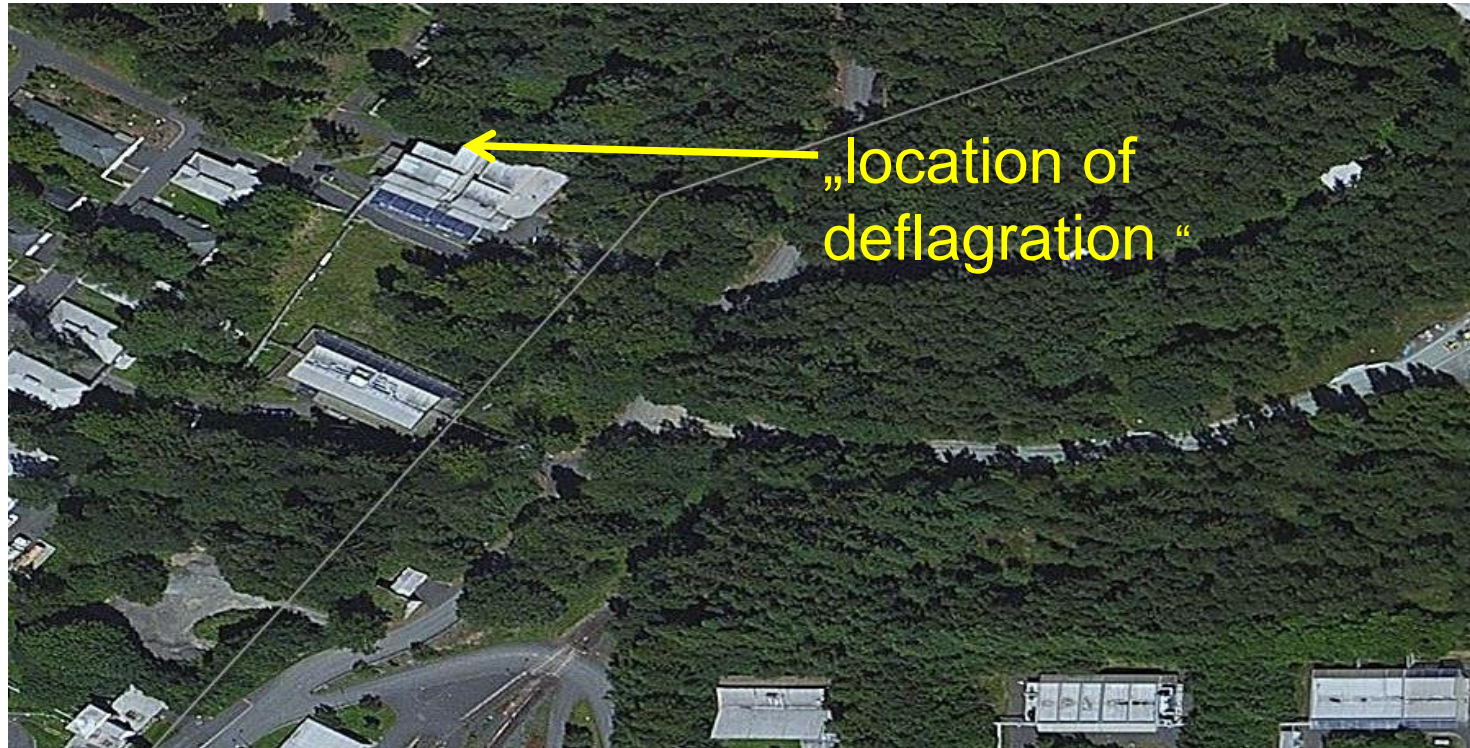
## the „big bang theory“

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- deflagration: subsonic combustion propagating through heat transfer and pressure  
→ pressure resulting from emerging and expanding gas
  
- explosion: supersonic combustion with shock wave

## Deflagration during nightshift - overview

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Upper-tier establishment

Under umbrella of an authorization holder and several other companies



## Deflagration during nightshift - event

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- facility to produce solid fuel during the recondition of raw materials in a kneader (homogenization & desorption of water remains)
- **rapid implementation/deflagration**
- fire was under control after about one hour (about 80 men and women emergency personal, fire fighter, first responder etc.)
- 02:48 : UV-flame detector triggered signal towards fire alarm system  
activation of spray extinguishing system
- 02:56 : first fire engine in action



## Deflagration during nightshift - effects

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- destruction of operational infrastructure due to the deflagration (pressure wave)
- further destruction due to fires within the building (basement and lower outside) as a result of flame front and flame propagation
- one injured operator
- material damage is estimated at 150.000 € (at the time of the incident)





## Deflagration during nightshift - analysis

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- **preserved data**
  - performance data from drive motor of the kneader was stored
  - raising power consumption logged (16 instead of 15 kW) within an extreme short period before the incident
- **first indicator of a possible cause**
- **Ignition?**



## Deflagration during nightshift - analysis

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- BAM (federal institution of material testing) is appointed with incident investigation by the company (almost on the spot)
- material testing by a chair for material science of a nearby university



## Deflagration during nightshift analysis

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### **conclusion:**

- breakaway at the edge of the kneader shaft lead to increased friction, because the fragment disabled the concentricity
- breakaway due to changed hardness courses and structural changes

### **measures taken:**

- increase of production safety - primary measures
- increase of structural safety level- secondary measures

## Deflagration during nightshift pictures

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production unit *before*

## Deflagration during nightshift pictures

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**production unit / box afterwards**

## Deflagration during nightshift pictures



**neighboring boxes afterwards**

## Deflagration during nightshift pictures

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**exterior view from box to wall**

## Deflagration during nightshift pictures

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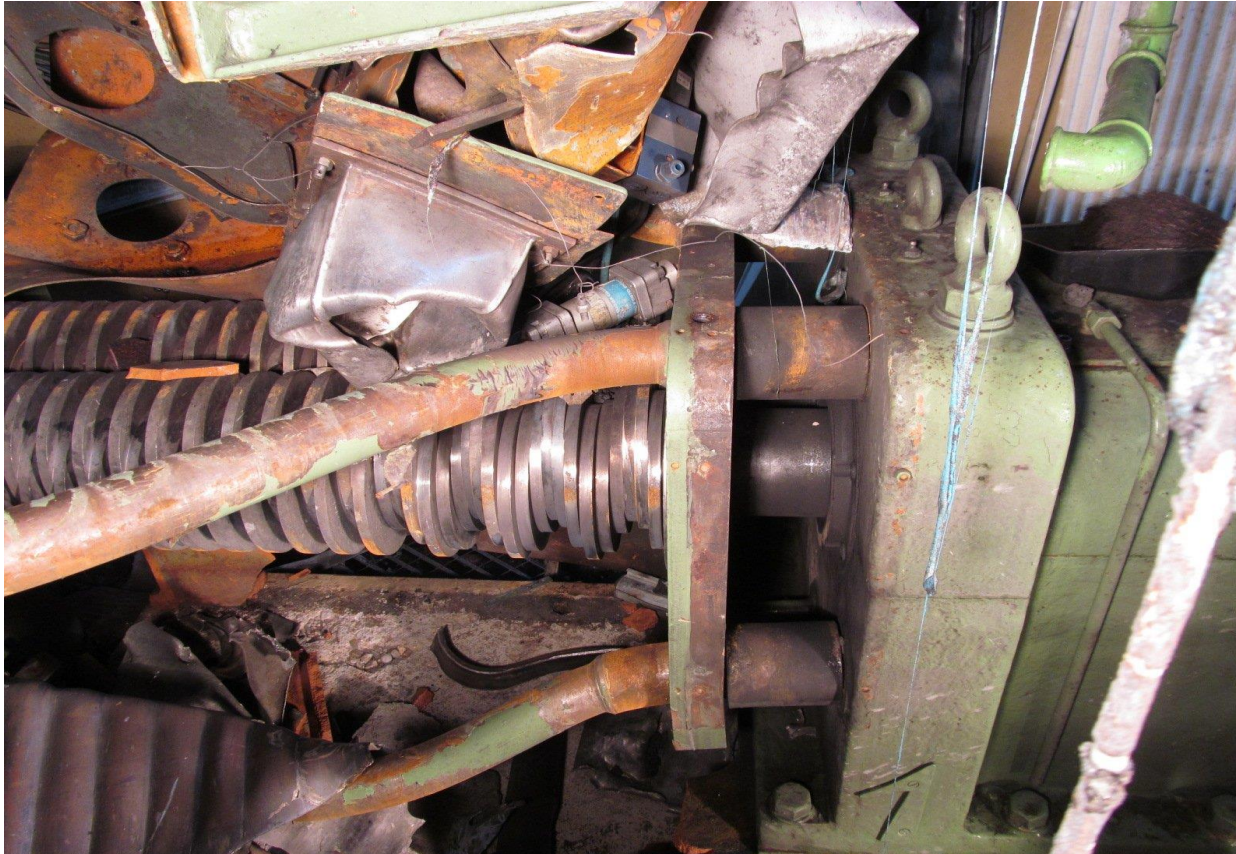


**inside view box,  
kneader and housing devastated**



## Deflagration during nightshift pictures

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**inside view kneader, housing devastated,  
corrosion due to spray**

## Deflagration during nightshift pictures

emergency exit



exterior view: access to basement

escape route



## Deflagration during nightshift pictures

escape route



exterior view: access to basement

## Deflagration during nightshift pictures

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**exterior view:** access to basement

## Deflagration during nightshift pictures



**inside basement:** result of flame front propagation squeeze water barrels filled

## Deflagration during nightshift pictures

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**inside basement:** result of flame front propagation remains of empty squeeze water barrels

## Deflagration during nightshift pictures

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**kneader waves removed**



## Deflagration during nightshift pictures

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„Corpus Delicti“?

a piece from the kneader, found during the examination



## safety culture (a very brief comparison)

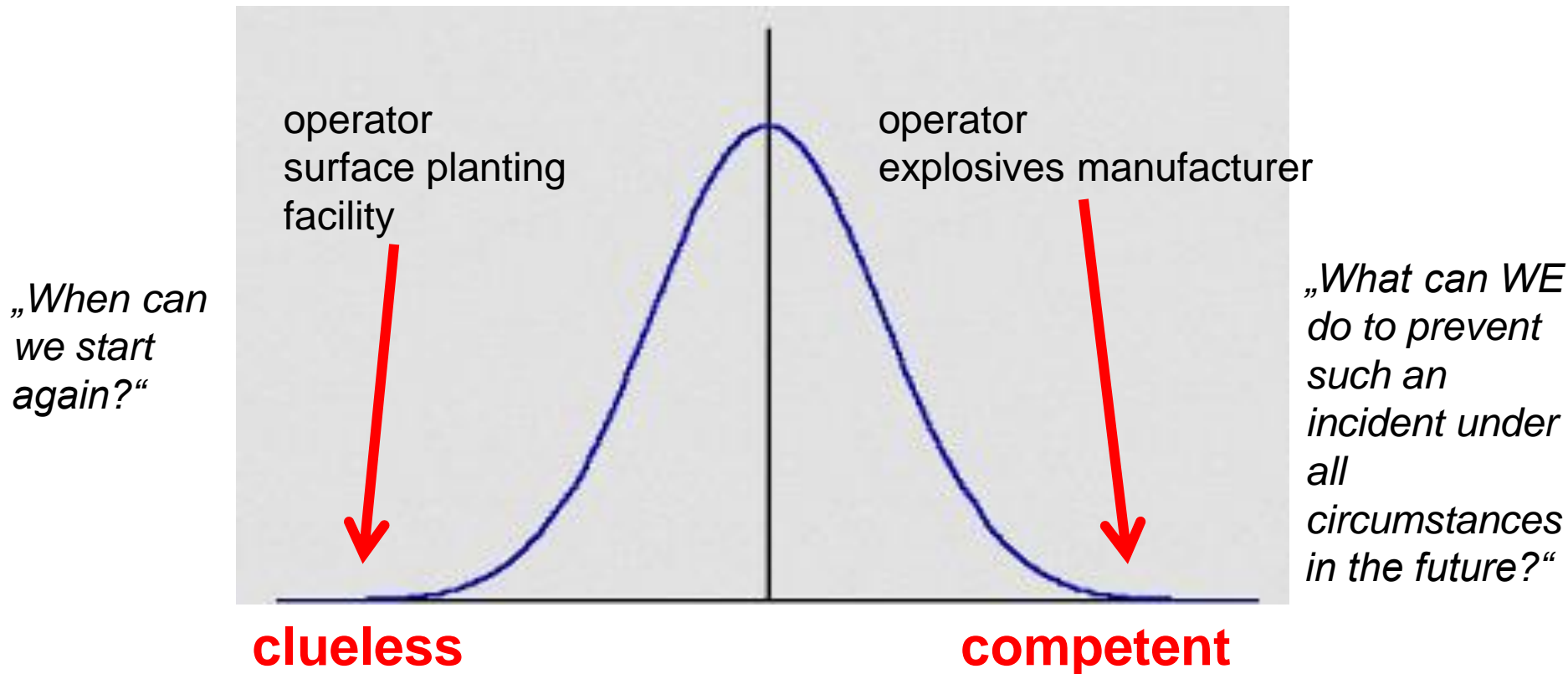
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- Extreme short comparison with a catastrophic fire in a surface planting company





## safety culture ( a very brief comparison)



Vgl. Vortrag: ErFa Berlin 2015, Sicherheitskultur



safety culture ( a very brief comparison)

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**safety management reflects  
safety culture**



# Thank you for your attention!

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