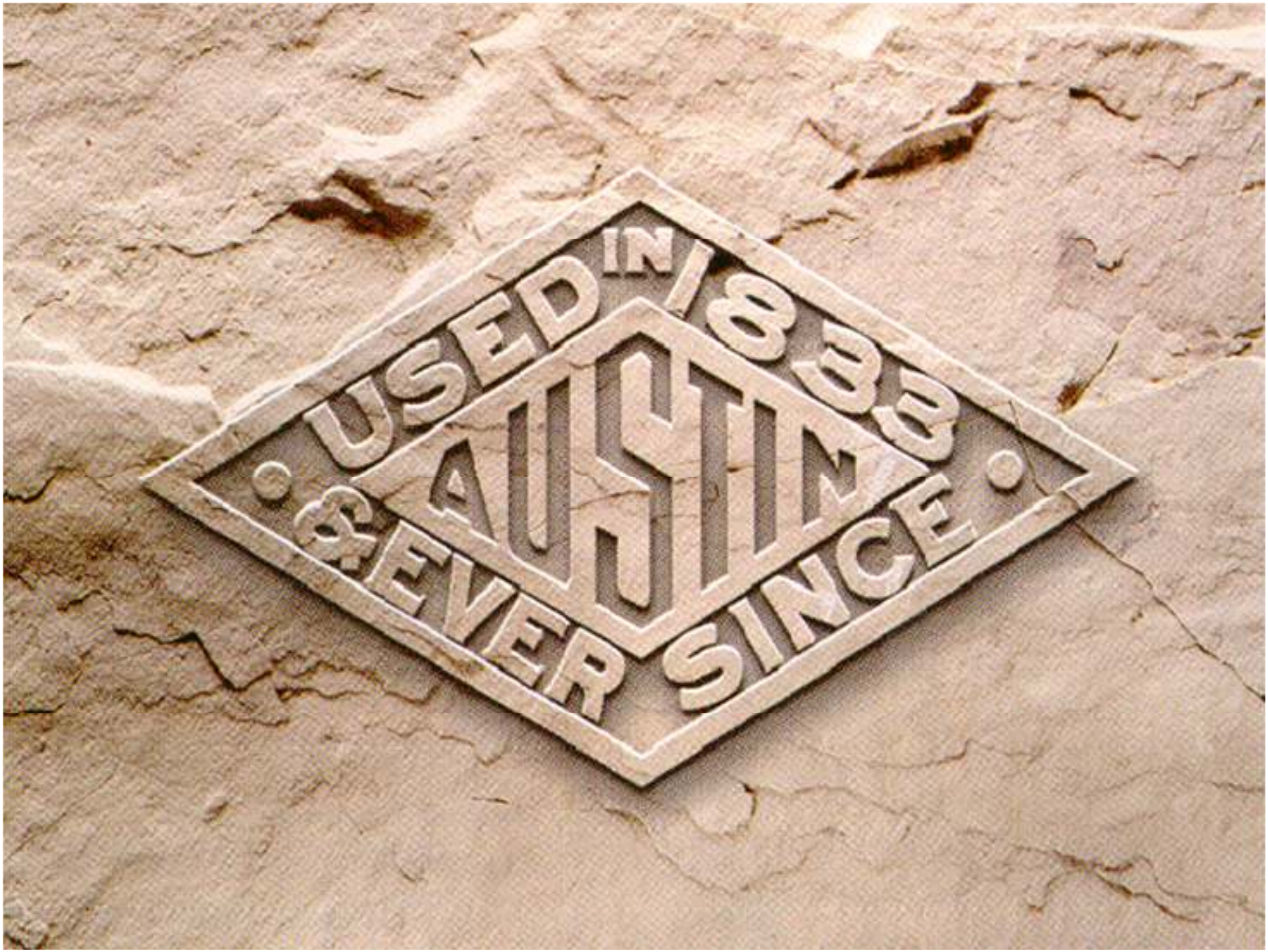

USED IN 1888
AUSTIN
EVER SINCE

Austin

Powder GmbH

Austria

Heinz Krätschmer

Deflagration of Nitrocellulose in the Lab

What happened?

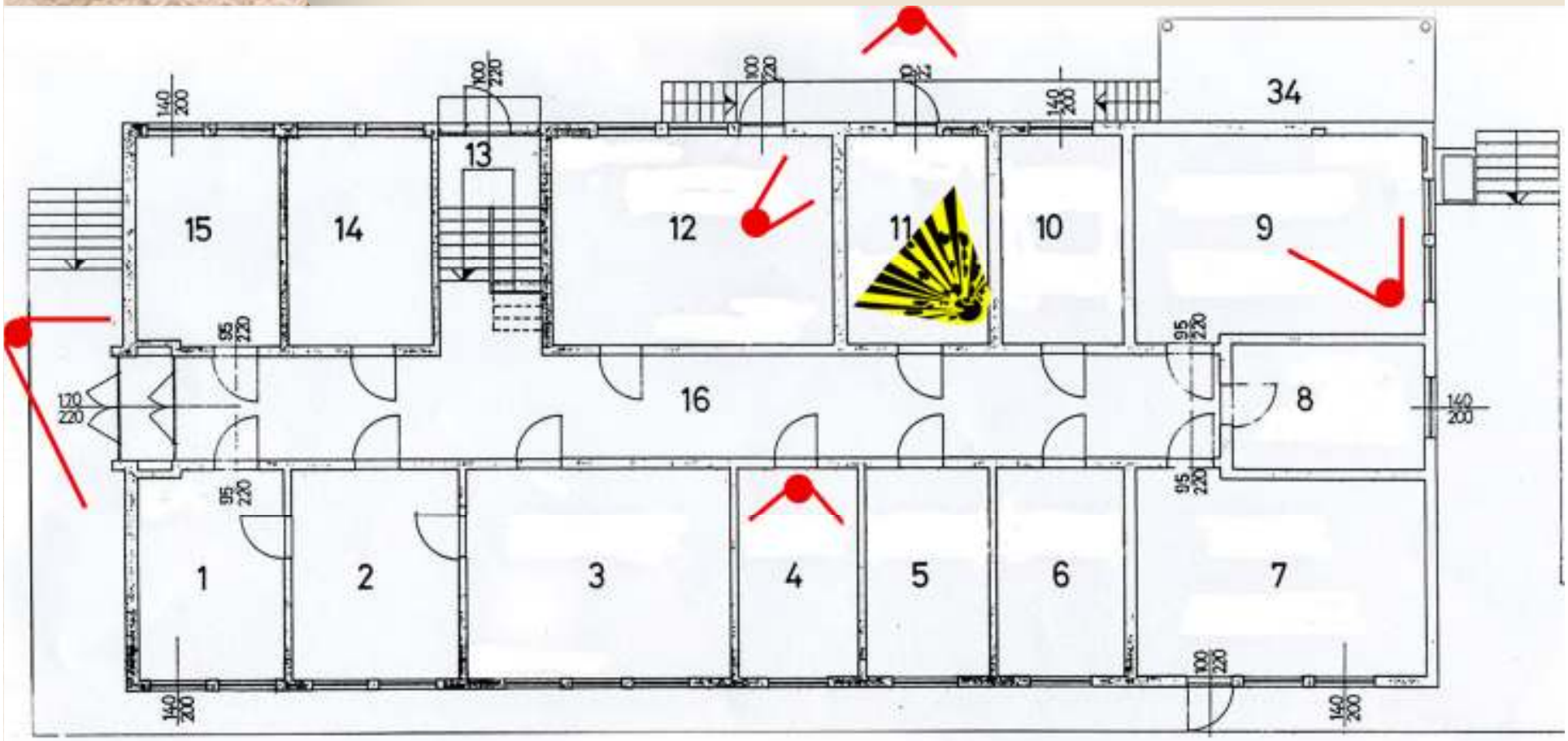
- January 7th 2002, 07:56 am
- Explosion in room #11 of the lab
  - deflagration of app. 800 g NC

    inside a convection oven
    - temperature in the lab 18 °C (64 °F)
    - outside temperature –3 °C (27 °F)
    - relative humidity 55 %

Injuries/Damages

- no people injured
- room #11 extensively damaged
- rooms #10 and #12 and ceiling of the building damaged
- most windows of lab building broken
- some smaller damage in the lab
- total cost app. $ 180,000

Plan of the laboratory



Room #11

Room #11 convection oven

Room #11 drying tray

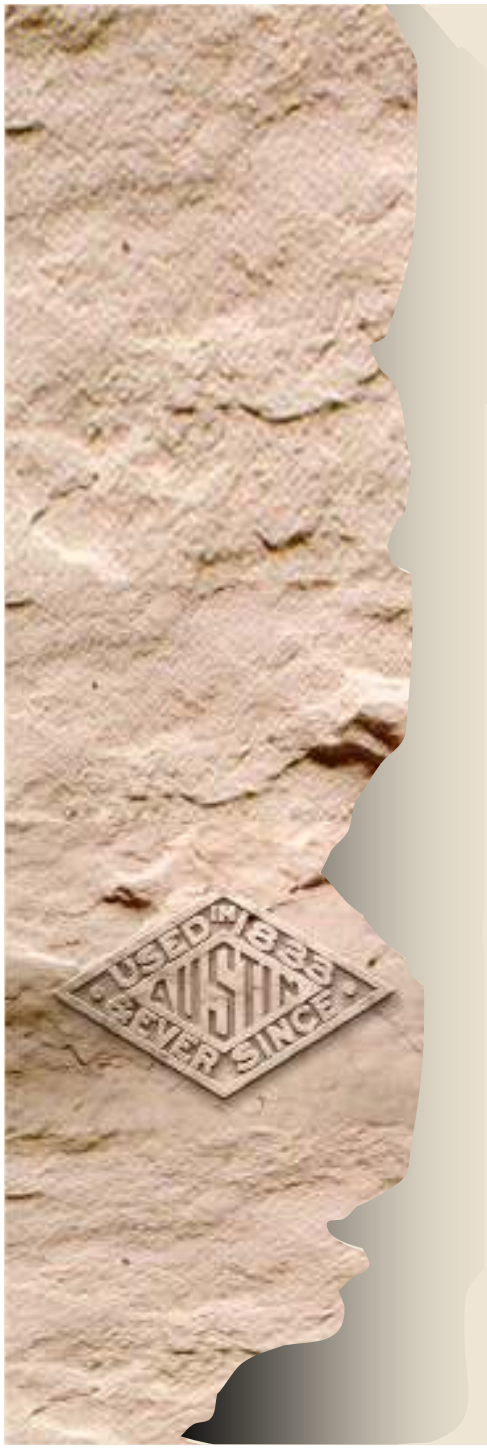
Room #11 outside view

Room #12 wall/ceiling damage

Room #4

Room #9

Lab main entrance



Process Description

- NC (wetted with 35 % Ethanol) dried in convection oven at 50 °C (122 °F, 1 week)
- NC in the oven placed on an aluminum tray
- Dry NC used for lab scale manufacturing process
- Excess dry NC added to next batch for drying
- 10 years at DNW, before 40 years in another company without any problems

Possible Causes

- overheating of convection oven
- electrical defect in convection oven
- inhomogeneous temperature dispersion in the convection oven
- electrostatic discharge
- fire outside convection oven
- explosion of ethanol vapors
- too long drying period (Xmas)
- thermal instability of NC

Investigation Results 1

- no overheating, temperature checked some minutes before, thermal fuse 80 °C (176 °F)
- no electrical defect according to examination by expert
- identical oven showed homogeneous temperature dispersion

Investigation Results 2

- no electrostatic discharge according to examination by expert
- no fire outside the oven according to examination by expert
- no explosion of ethanol vapors because no ethanol left after 2 weeks

Investigation Results 3

- Investigation of thermal stability of the NC batch showed a decrease in stability when stored on aluminum trays at elevated temperatures
- traces in the drying tray show some evidence of a starting explosion
- manufacturer of NC reduced shelf life of NC type to one year, but did not inform us
- batch used was app. 2 years old

Actions

- adaptation of a separate building for drying and further processing of NC
- drying process remote controlled
- special drying oven with hot water heating and explosion proof ventilation
  - oven temperature 30-35 °C (86-95 °F)
  - NC dry after 20 hours
- stainless steel drying trays
- excess of dry NC is destroyed

Actions

- NC batch used for 1 year max.
- manufacturer of NC asked for MSDS at regular intervals
- inspection of process building by responsible manager at regular intervals
- use of safety glass for all lab windows

Lessons learned

- Do not take over a process designed outside the company without doing an in house risk assessment
- Audit the process for possible changes on a regular basis