Assessment of the condition of underground collector lines

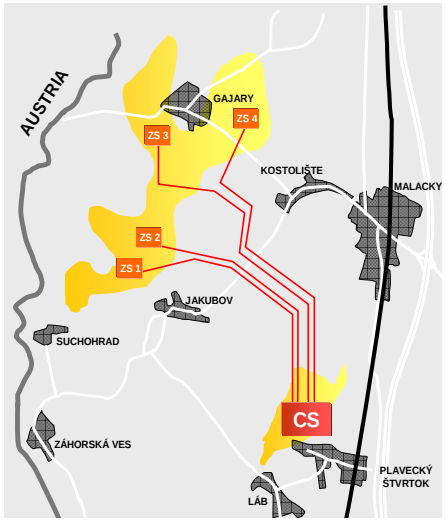
situated inside the technological complexes of underground storage facilities

Agenda

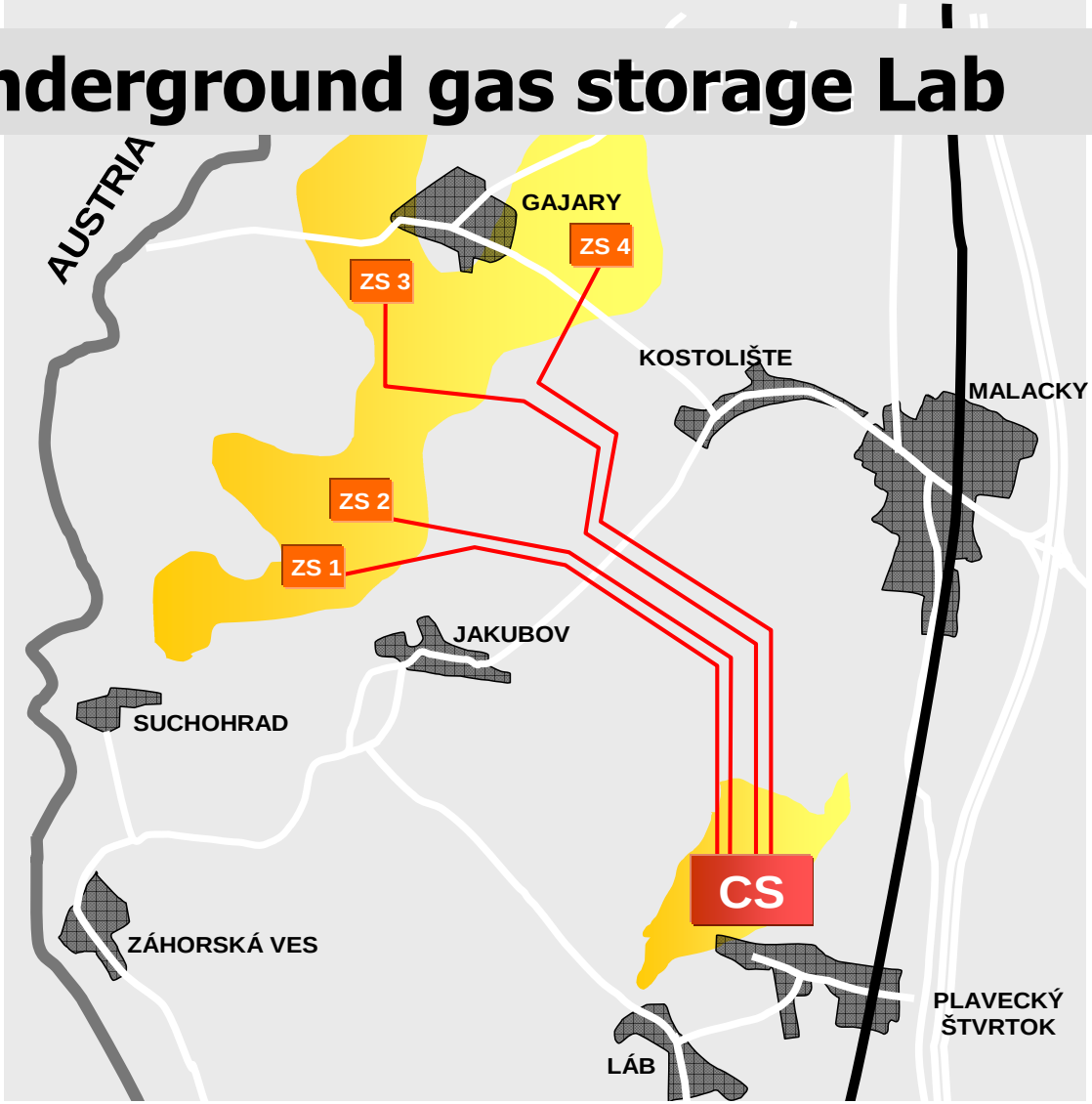
- General information
- Reasons , methodology, planning, execution
- Details from inspection
- Results

Underground gas storage Lab

- 30 years of a solid track record
- Located in the south-western part of Slovakia
- Technical infrastructure
  - Central station
    - Dispatching center
    - Compressor fleet including 8 centrifugal compressors
    - Gas metering
    - Piping and gas collector lines
  - Gathering stations and pipelines



Underground gas storage Lab



Gas collector lines at Central station

- 9 gas collector lines for wet or dry gas
- Nominal diameter from 500 to 700 mm
- Design pressure from 40 to 100 bars
- Age from 20 to 25 years
- Length 13 to 140 m
- Installed either at concreted trenches or buried

Reasons for gas collector lines assessment

- Importance for storage facilities operation
- Age in the middle of their life-cycle
- No specific methodology set by authorities
- Unfavoured access as the most are collectors are buried
- No cathodic protection of buried lines within Central station

All these facts represented unacceptable risk, which forced us to set up **a project aimed at definition of remaining useful life of gas collector lines**

Methodology

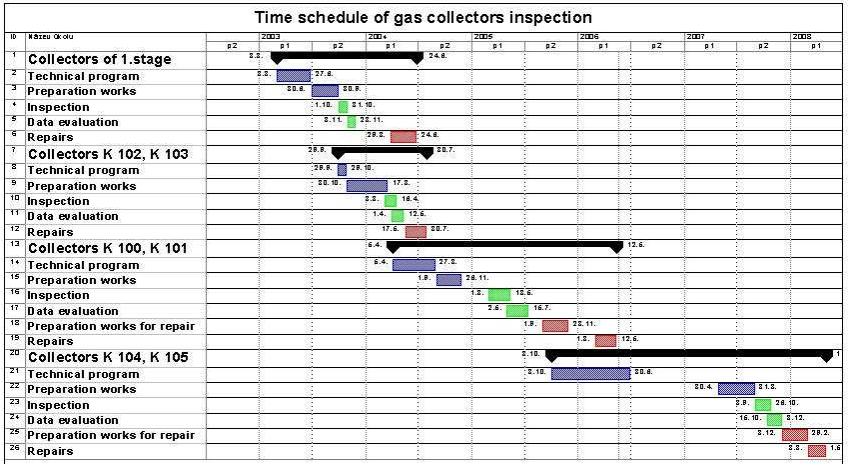
1. **Pressure tests**
   - Statement on current status
   - Additional stress at spots with wall thickness losses, affected by corrosion or defects
   - No prediction of remaining lifetime

2. **Non destructive testing (NDT)**
   - General perspective of collectors conditions
   - Data for forecasting useful life and future inspection program
   - However, requires an extensive preparation (excavation, modification, cleaning...)

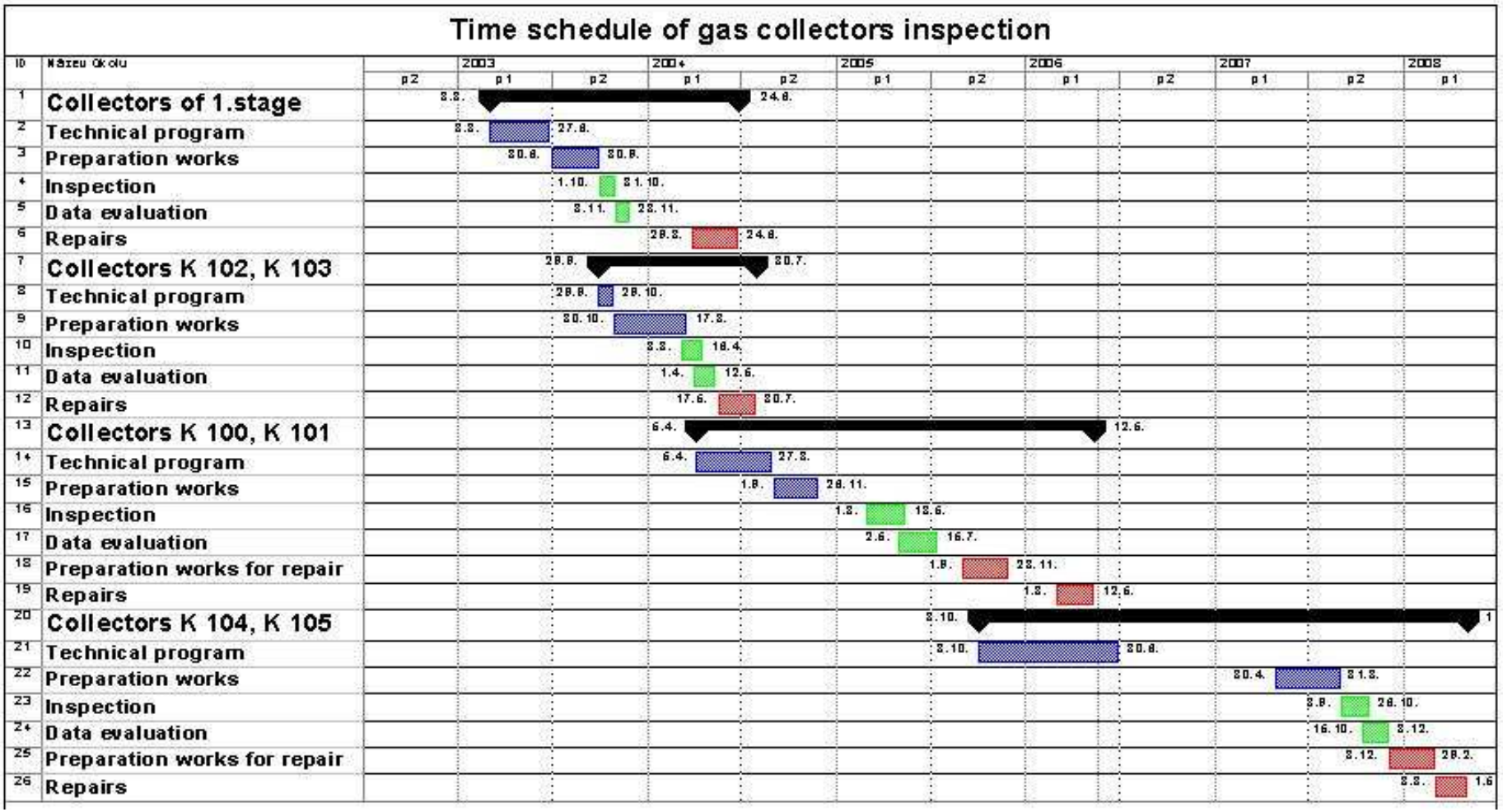
Planning

Specifically tailored inspection program was processed in close co-operation with external suppliers for every gas collector line split into the following:

- Technical program
- Preparation works
  - Excavations
  - Modifications
  - Cleaning
- Inspection
- Data evaluation
- Contingency planning
- Repairs (if needed)



Time schedule



Inspection of collectors K 102, K 103

K 102
Nominal diameter 700 mm
Length 57 m
Nominal pressure 10 MPa

K 103
Nominal diameter 700 mm
Length 26 m
Nominal pressure 10 MPa

Findings on collectors K 102, K 103

- **No serious defects were revealed**
- Only lamination defects (mill defects), originating from manufacturing process were found
- There were no relevant indications of internal and external corrosion
- There was not an immediate risk for safety of operation
- However, lamination parts were reinforced by installation of ´hot sleeves´
- **Based on simulation, safe operation forecasted until year 2025**
- The next inspection with assessment planned 2025

Repairing of collectors K 102, K 103

Inspection of collectors K 100, K 101

K 100
Nominal diameter 700 mm
Length 136 m
Nominal pressure 10 MPa

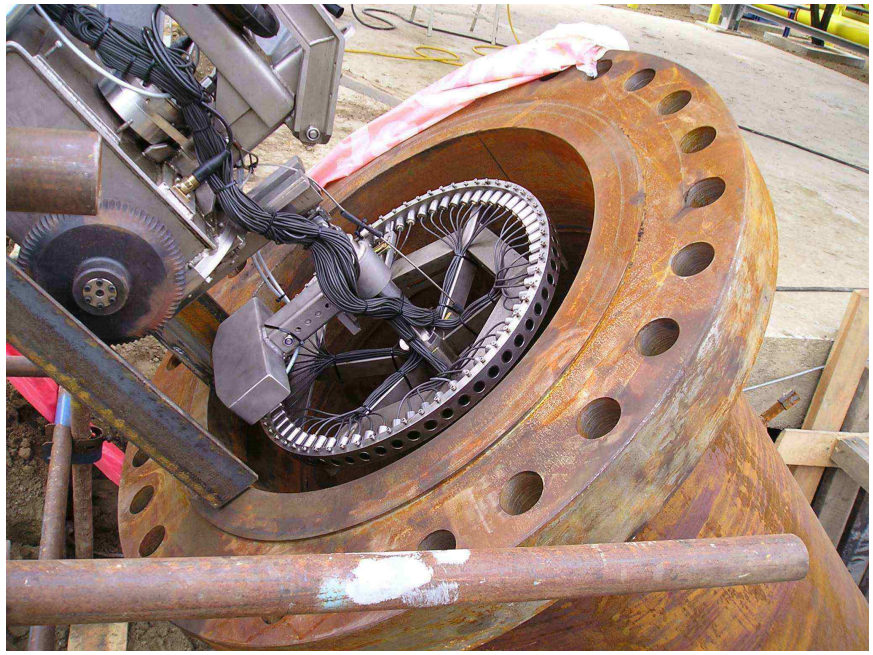
K 101
Nominal diameter 700 mm
Length 105 m
Nominal pressure 10 MPa

Inspection of collectors K 100, K 101

- Excavation and preparation for bends´ installation
- Inspection of all off-takes
- Material shop preparation
- Modifications of collectors´ entries
- Ultrasonic in-line inspection by an external company

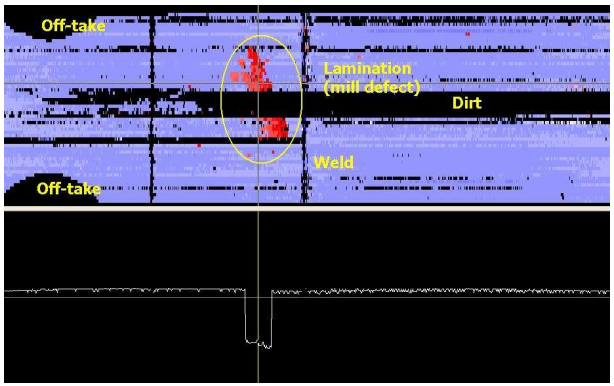
Inspection of collectors K 100, K 101

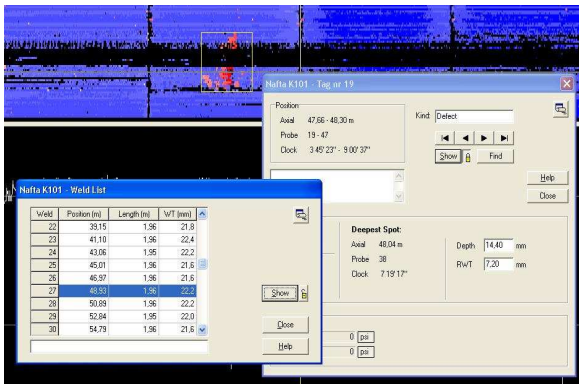
Inspection of collectors K 100, K 101

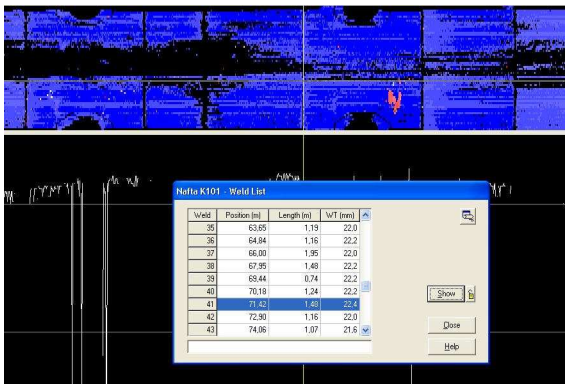


Findings on collectors K 100, K 101

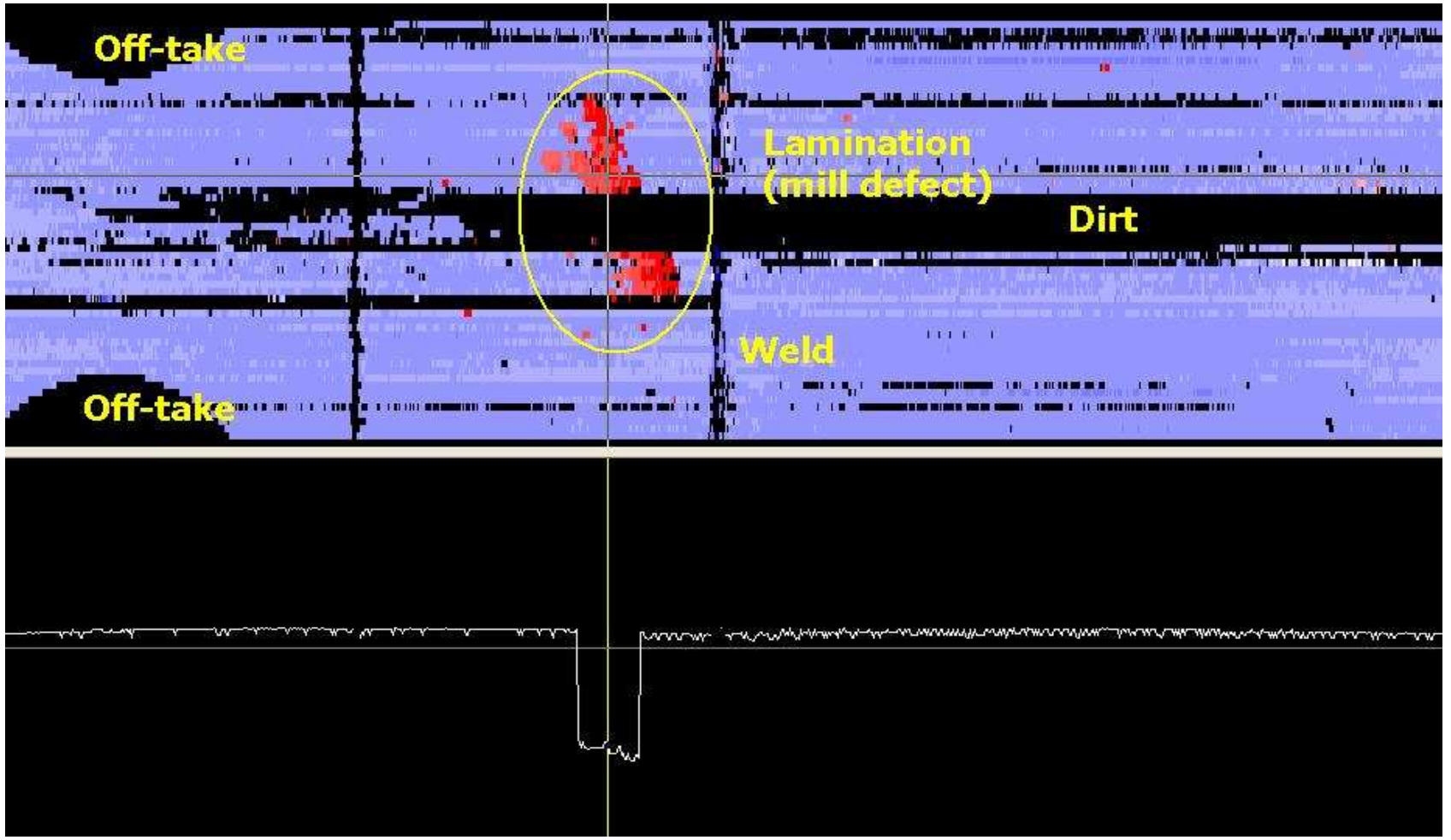
- **No serious defects were revealed**
- Only lamination defects (mill defects), originating from manufacturing process were found
- Lamination parts were reinforced by installation of ´hot sleeves´
- **Based on simulation, safe operation forecasted until year 2015, the next inspection with assessment planned 2015**



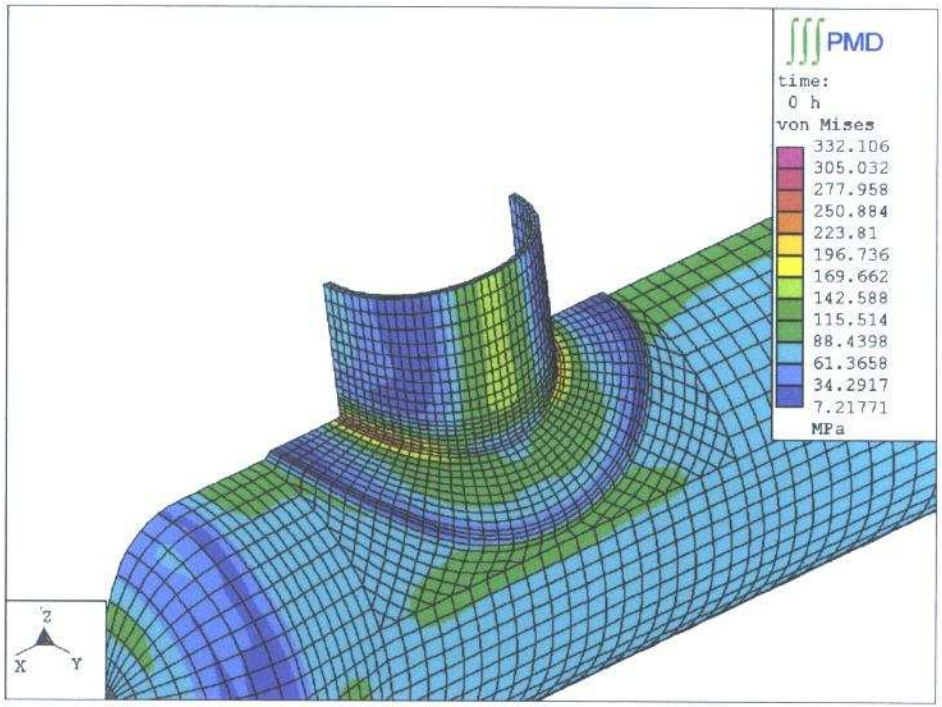


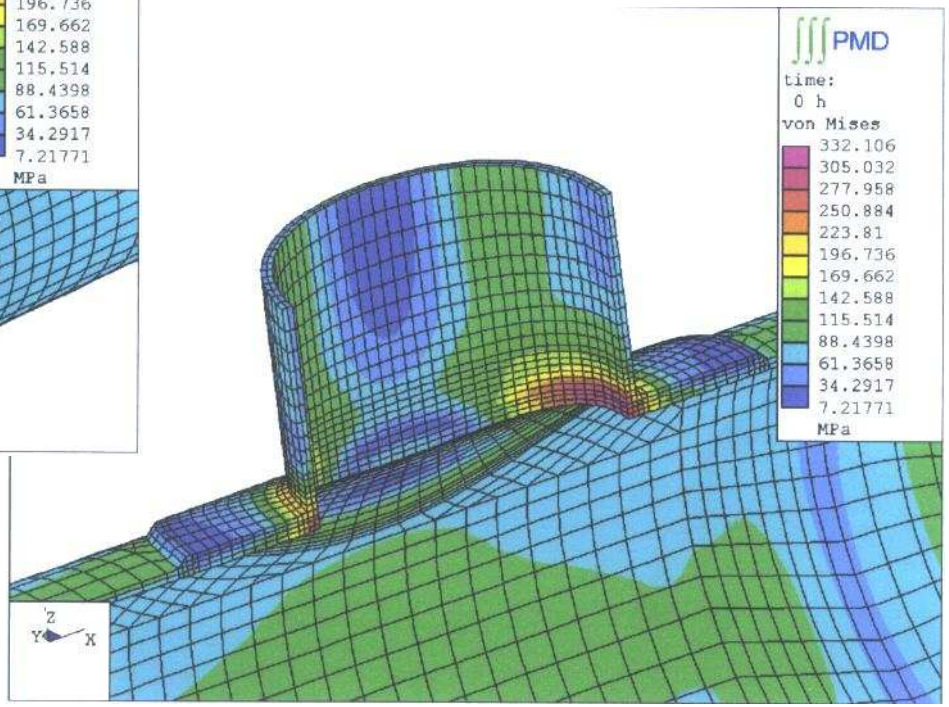


Findings on collectors K 100, K 101



Analysis of material stress





Repairing of collectors K 100, K 101

Lessons learned

- Gas collector lines installed at concreted trenches were more defected than those buried ones
- No rele ctor lines
- Defects only from the manufacturing process
- No corrosion was detected inside
- Minimal degradation of material

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