Higher Design Factor Review and Considerations

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Topics

- History of grandfathered U.S. pipelines operating with DF up to 0.87
- Incident histories for pipelines with DF > 0.72 and < or = 0.72
- Canadian application of 0.8 DF
- Results of PRCI research on requirements for > 0.72 DF pipelines

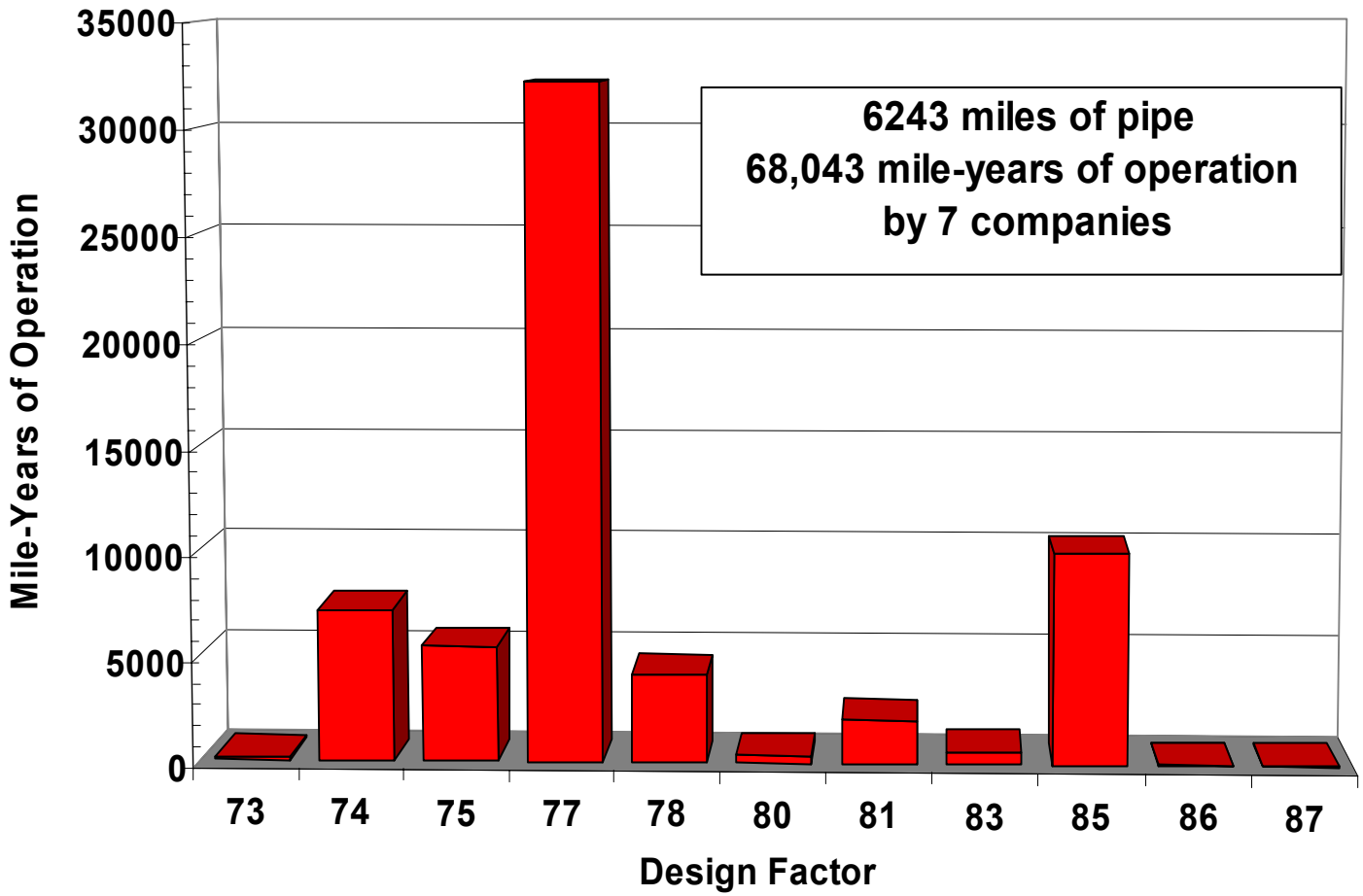
U.S. experience with DF > 0.72

- Pipelines have been designed based on a DF of 80% of the mill test pressure (90% SMYS) leading to a 0.72 DF.
- In 1968, PRCI issued a report from Battelle indicating that a preferred design approach was to base design on 80% of the hydrotest pressure leading to a DF of 0.8 based on a 100% SMYS Test.

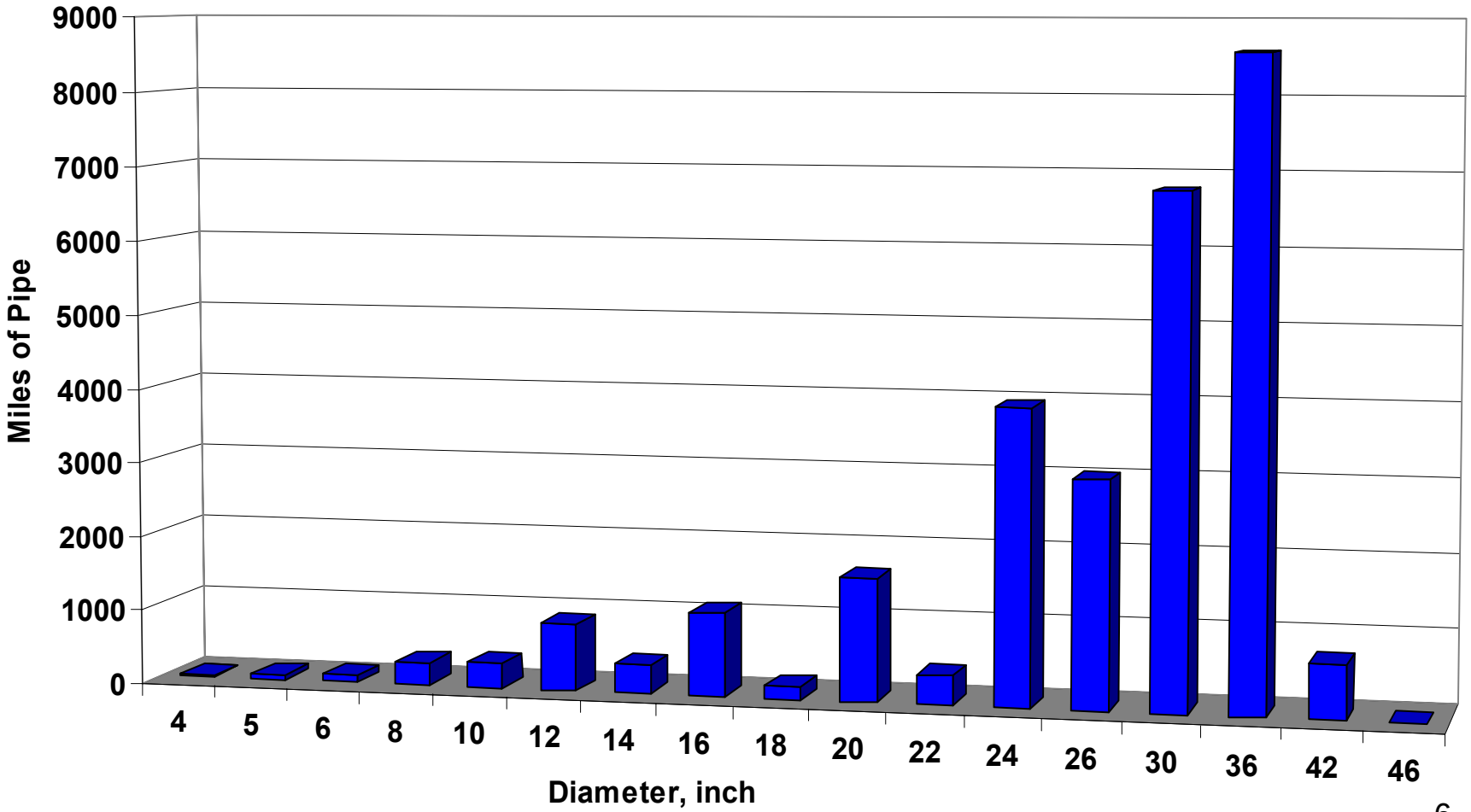
U.S. experience with DF > 0.72

- From 1953 to 1979, 6243 miles of “grandfathered” pipelines were operated with design factors (DF) from 0.73 to 0.87.
- Of 28,885 miles of pipe with DF from <0.72 to 0.87:
  - 21,953 miles (76 %) were tested from 100 to 139% SMYS
  - 6243 miles (22%) were operated with DF from 0.73 to 0.87

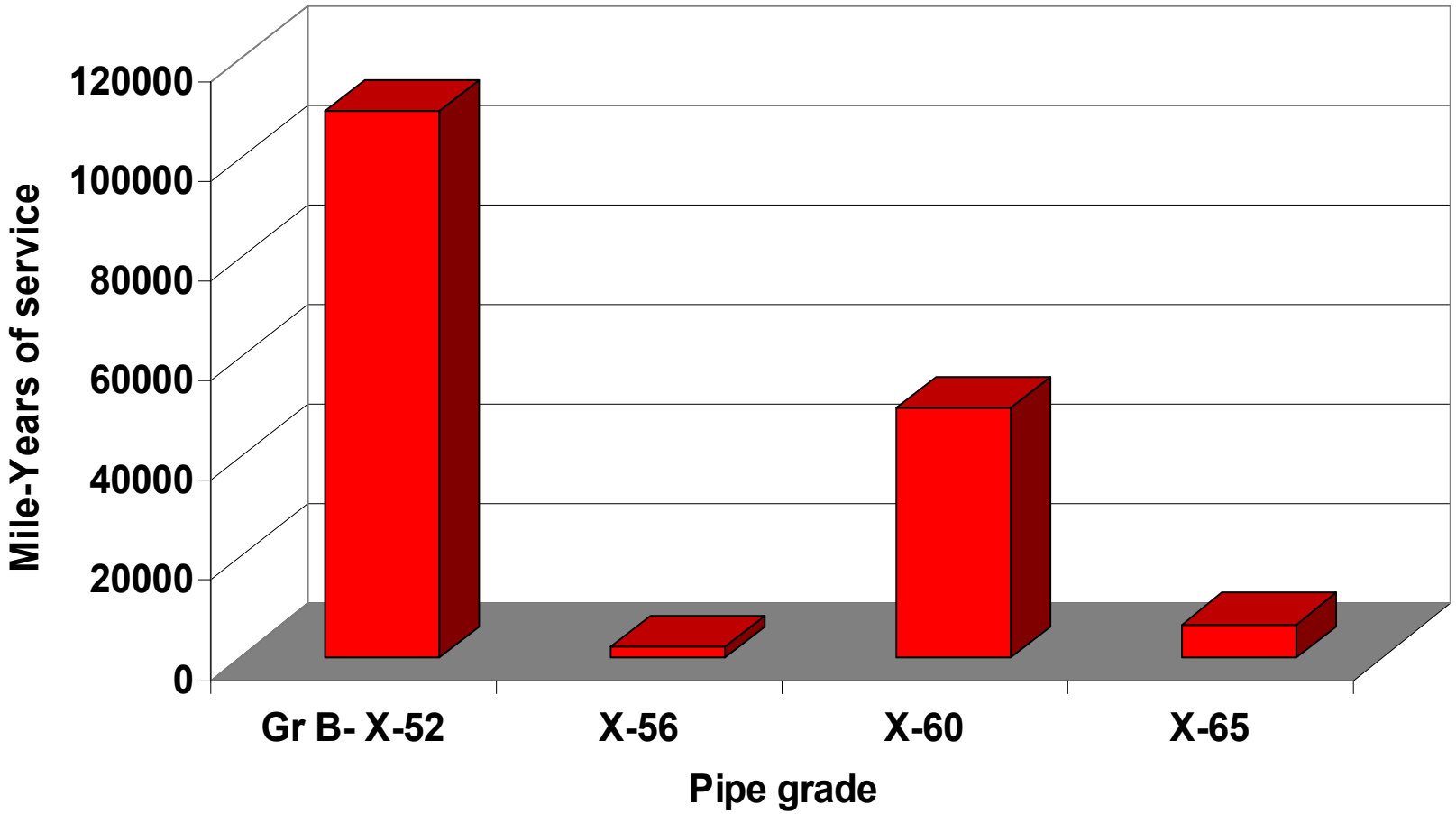
DF versus mile-years of operation



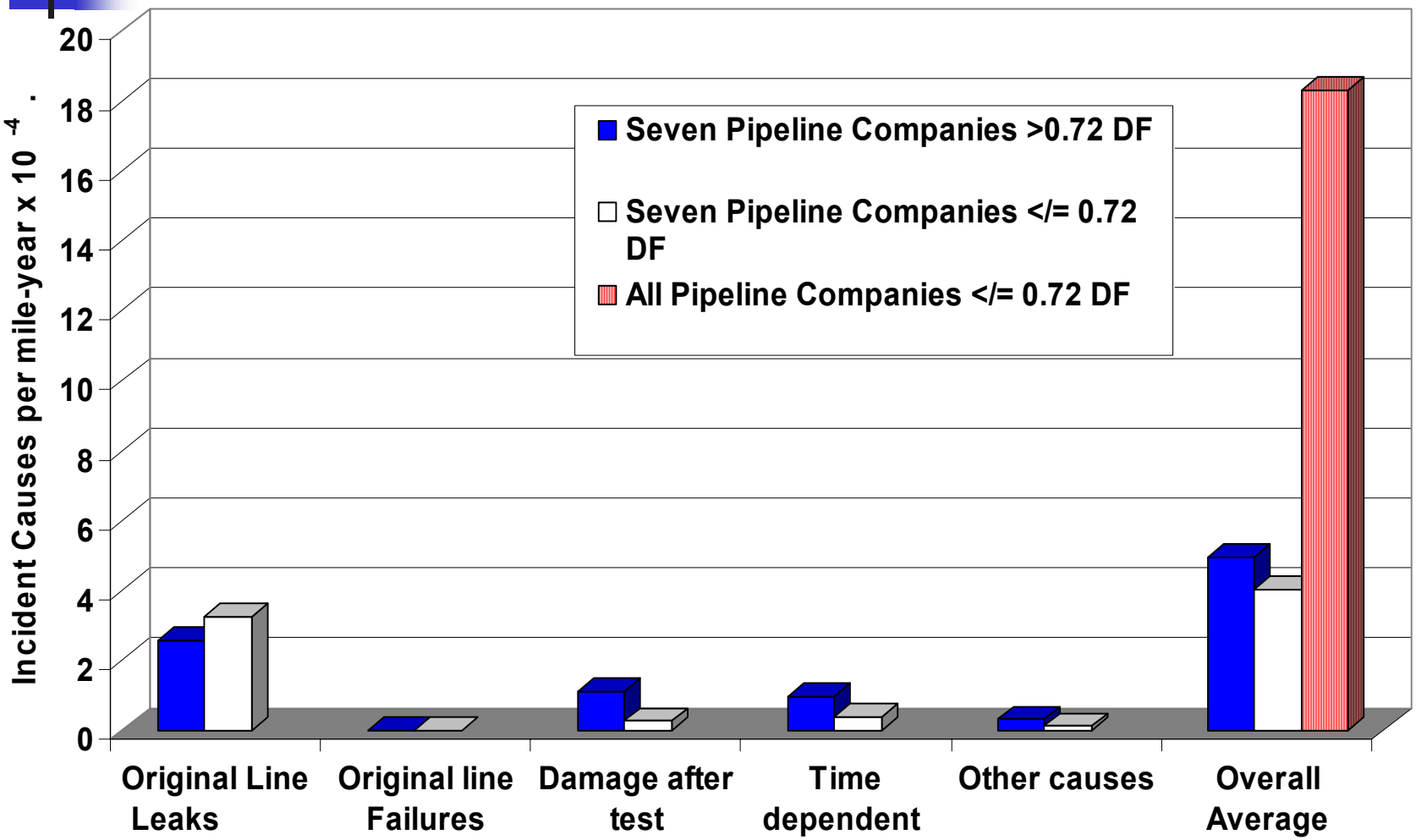
Diameter data on > 0.72 DF lines



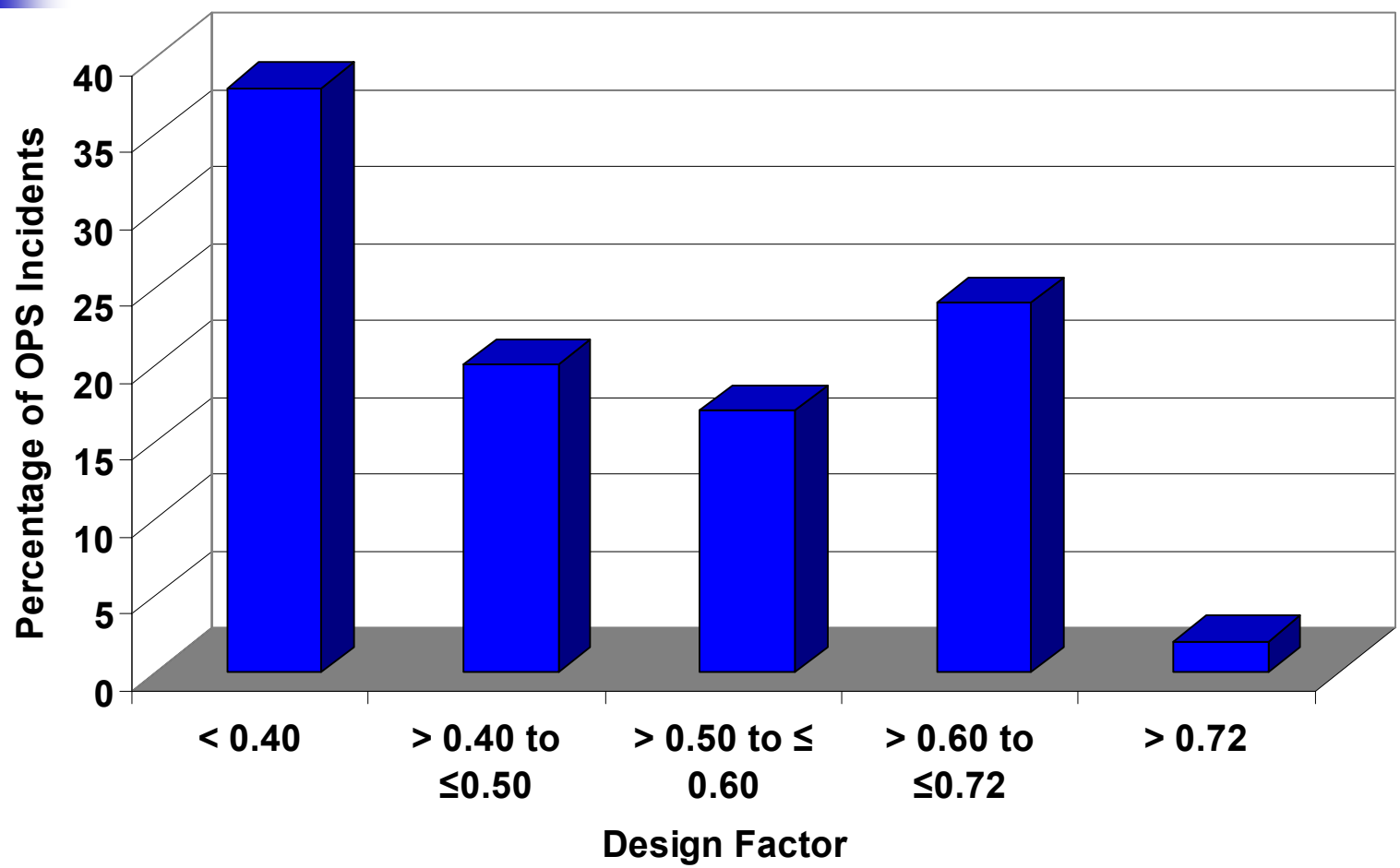
Pipe grade data on > 0.72 DF lines



Safety of DF > 0.72 lines



U.S. Overall Incident data



U.S. Operation of DF > 0.72

- Gas pipelines have been successfully operated with DF > 0.72 in the U.S.
- The pipelines were operated from about ‘53 to ‘79 with only 1/3 the incidents of all gas pipelines operated with DF < 0.72

U.S. Operation of DF > 0.72

- The seven companies involved were surveyed to determine the reason for their lower incident rates and it was found that they were applying integrity management to these lines and their pipelines with DF < or = 0.72.

U.S. Operation of DF > 0.72

- These data indicate that Grd. B to X65 pipelines produced in the 50's and 60's were operated safely with DF > 0.72.
- With the improved pipe properties, construction techniques and improved NDE inspection available today, there is no reason this concept should not be implemented in Part 192.

Canadian Application of 0.8 DF

- In 1968, PRCI issued a report on the merits of operating at 80% of the hydrotest pressure.
- In 1973, CSA issued a second edition of Z184 with:
  - test pressures limited to 0.2% offset,
  - 0.80 DF for Class 1 locations,
  - 0.72, 0.56 and 0.44 DF for Class 2-4 locations.

PRCI Research Results

- A study was conducted to define what was needed for operation at 0.80 DF.
- It was concluded that a risk analysis to an acceptable level was required.

PRCI Research Results (cont'd)

- In applying the concept to existing lines a number of factors were identified for assessment such as:
  - weld seam type
  - girth weld type and inspection
  - fracture control
  - wrinkle bends
  - pig ability of pipeline

PRCI Research Results (cont'd)

- With the publication of Subpart O of Part 192, I personally believe that a sound integrity management program should be required for the entire length of higher DF pipelines.
- Subpart O should be tailored to the needs of the specific pipeline making it more appropriate than meeting a global risk assessment value as it requires a detailed examination of the entire line length.

Conclusions

- **Prior U.S. operation of grandfathered pipelines has demonstrated the safety of high DF coupled with integrity management.**
- **OPS incident data shows low design factors do not assure decreased incidents**
- **Application to new lines is appropriate**
- **Careful application to existing pipelines is necessary**

Conclusions (cont'd)

- **It is time to take advantage of the material, construction and inspection improvements by basing the operating pressure on a 0.80 DF for Class 1 locations with appropriate safegards.**