# Update to HSE Pipeline Risk Assessment
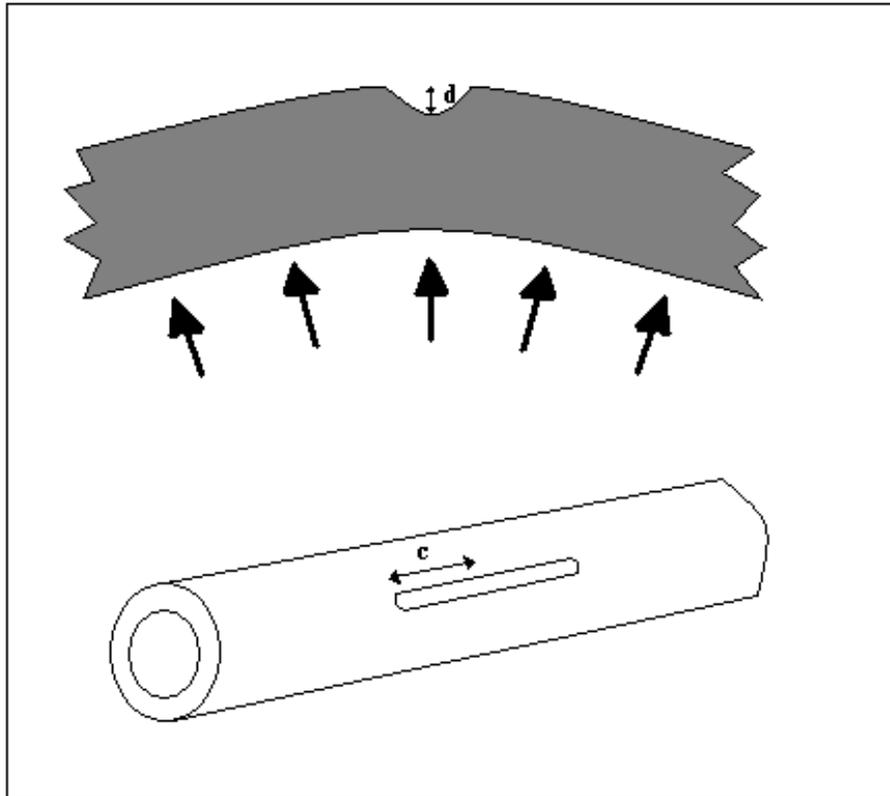
Dr. Peter J Harper
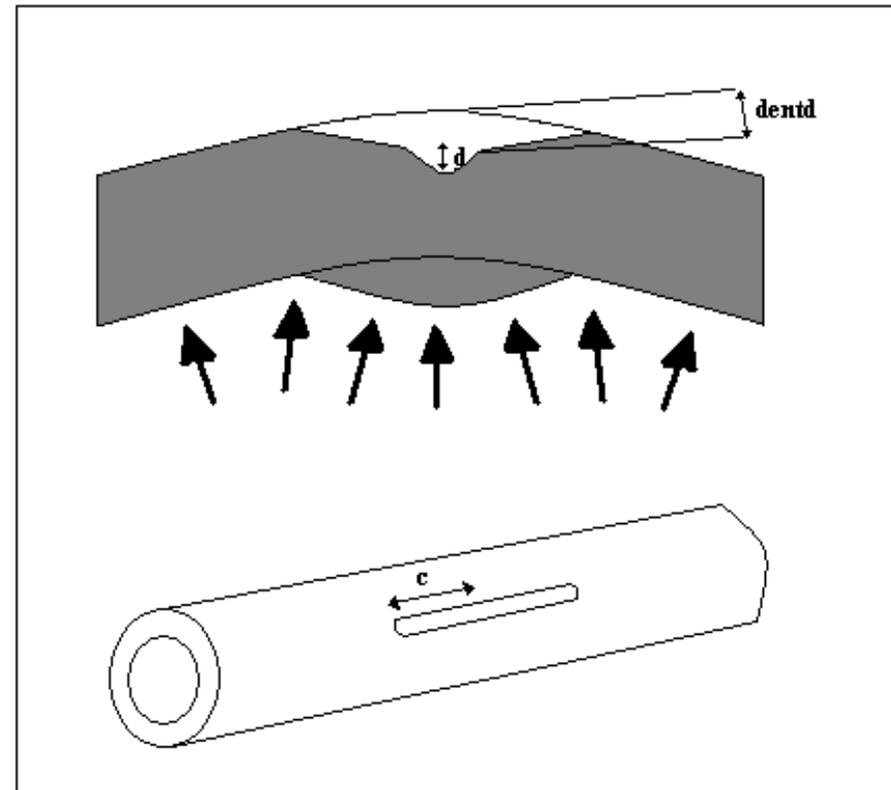
HSE HID CEMHD5

# Failure Rates

- PIPIN is HSE's model for predicting failure frequencies of pipelines

- Uses fracture mechanics to predict third party activity (TPA) failure rates

- Operational data for mechanical, corrosion and ground movement/other failure rates

- Developed in the late 90s by WS Atkins

- Current version is PIPIN V3.0

# PIPIN



Gouge

**Dent and gouge**

# Aspects Considered

- Rewriting the model to improve model resilience (reproduce existing results)

- Reviewing the science

- Updating the model based on the review

- Operational data

- Strike rates and damage data

- Depth of cover

- Slabbing

# Science Review

- Model externally reviewed
- A number of suggestions made, including some of the correlations used for the fracture mechanics
- Each suggestion has been considered in turn and 584 test cases have been run each time
- Industry, external consultants and experts at HSL have been involved
- One area has been rejected on further investigation
- The rest have been approved by HSE
- Overall effect is to increase failure rates

# Science Review

- Updates incorporated are:
  - Removal of modelling uncertainties
  - Removing simplification to an equation for dent-gouges (made it the same as for gouges)
  - Correcting the rupture calculation (removing double-counting – requires calculation of critical crack length which involves solving a cubic for every iteration of the model)
  - Revising the micro-crack correlation (removing the dependence on the industry model and using full dataset)
- The rejected modification was to the Charpy energy – fracture toughness correlation

# Operational Data

- Operational data is used to provide historical information on mechanical, corrosion and ground movement/other failure rates.

- Previous analysis based on data up to ~2000

- Some European wide data was used as not enough UK specific data

- More recent data (up to 2010) has been analysed

- Problems arise when no incidents have occurred.  How do you derive a rate?

# Strike rates and damage data

- The damage data refers to the Weibull distributions used to determine the length and depth of the dent or gouge and the force with which the pipe is struck

- Analysed updated UKOPA data and tested several distributions to see which provided the best fit to the data

- Lognormal has been used for dent-gouge length and impact force, Weibull for gouge length and depth, and dent-gouge depth

- Updated data reduces failure rates

# Risk Assessment

- MISHAP01 code rewritten in Excel for ease of updating (now MISHAP12)

- Individual models not changed

- Distances now rounded to ±5m

- Links to PIPIN V3.0

- Now links to mapping tool

- Individual models will be reviewed over next 2 years

# NGG1454A: 9,52mm w.t.

o Const Bdy

Meon View

Issues

0    0.2206

kilometres

NGG1454B: 9.52 mm w.t., Slabbing adjacent to dev

Co Const Bdy

Drain

Issues

Meon
View

Camping
Site

White Gables

Cherry
Lodge

0

0.2743

kilometres