



don't crack under pressure

Advantages of high quality PE pipe materials

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by Robin Bresser / PE100+ Association



Creating value in Pipe - basic human needs

- Water supply
- Energy supply (gas, oil, hot water)
- Sewage disposal
- Telecom



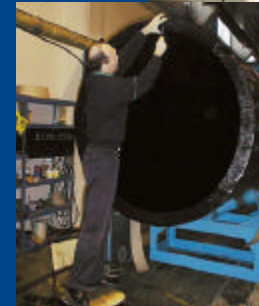
Roman times . . .



. . . and today

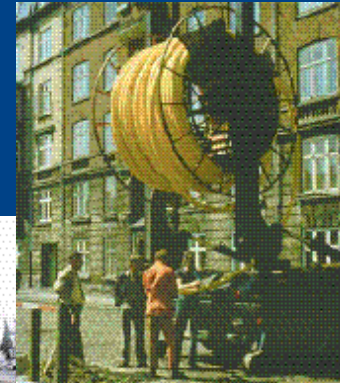
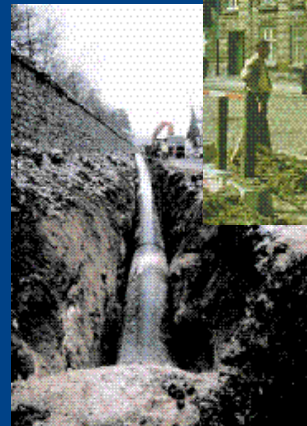
In Europe, PE&PP pipes have an impressive track record

- 1950's - first PE pressure pipe installed
- 1970's - second generation PE for water and gas
 - crosslinked PE (PEX) for hot water
- 1980's - PP pipe systems for new applications
- 1990's - bimodal PE100 introduced
 - higher pressures and larger pipes
 - PO pipe markets grow at 6%
- 2000 - high momentum into the new millennium



Key success factor for PE pipes: Flexibility

- Long lengths in coils
- Curving trenches
- Modern installation techniques
 - relining
 - horizontal drilling
 - plowing in



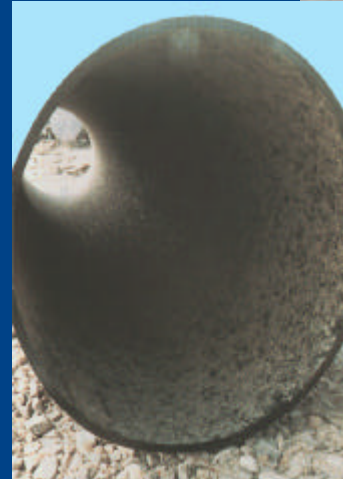
Key success factor for PE pipes: Weldability

- Cost effective butt welding
- Safe and practical electrofusion
- Leak tight pipeline
 - earthquakes
 - ground movement
 - tree roots



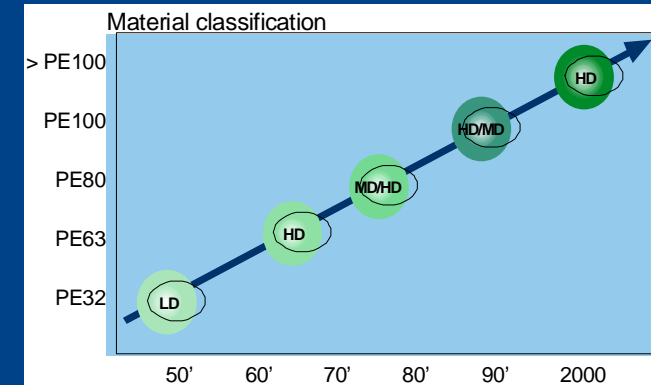
Key success factor for PE pipes: Water neutrality

- No corrosion
- Neutral towards drinking water
- No encrustation
- Low coefficient of friction

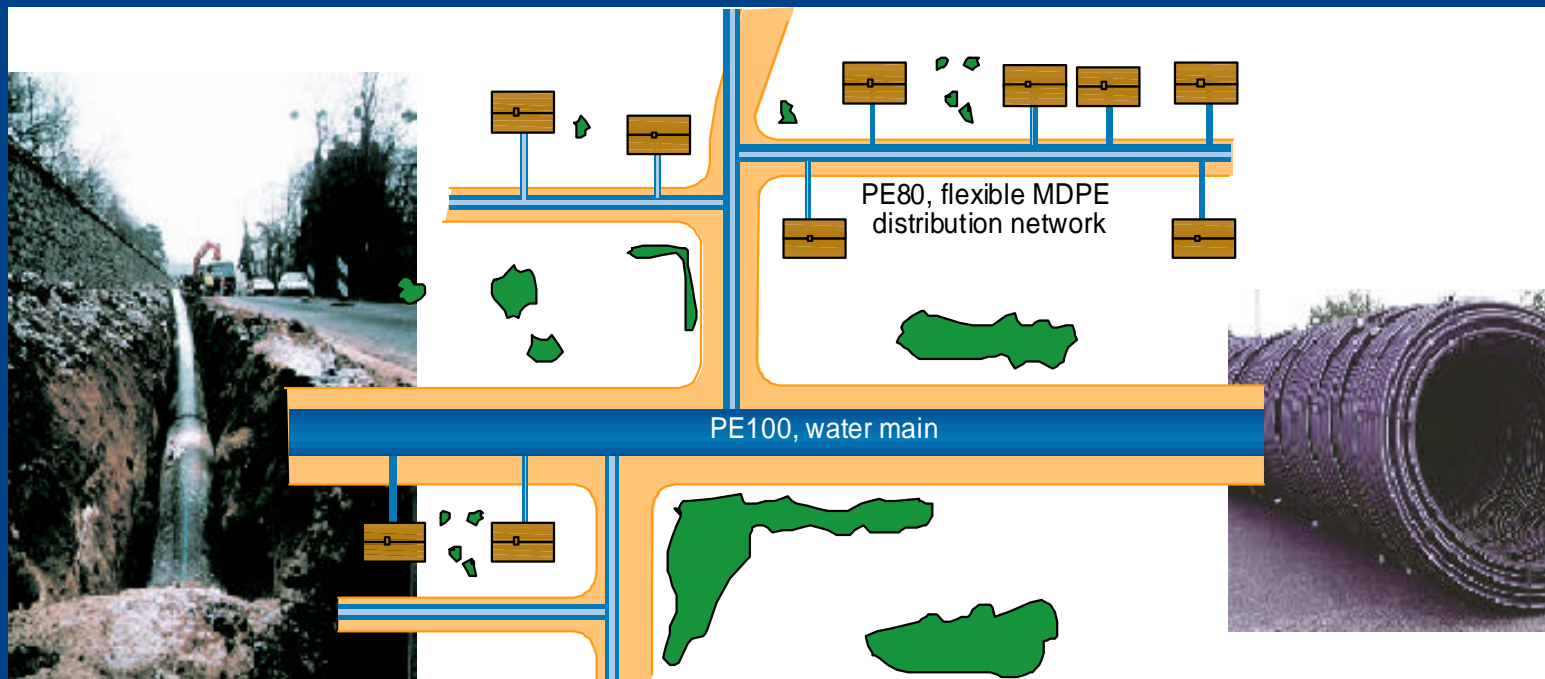


Key success factor for PE pipes: Positive image

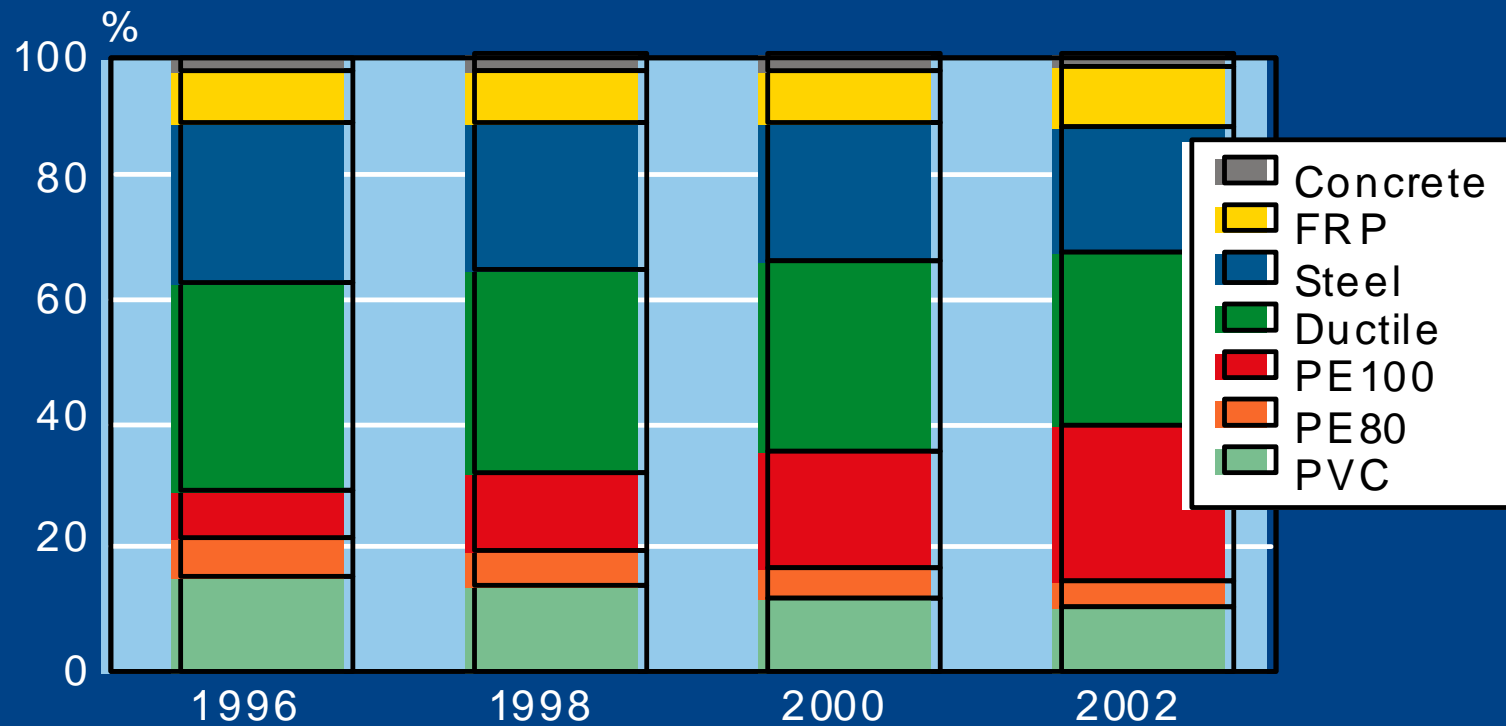
- Innovation / new generations
- High level of standards
- Safe for gas transportation
- Environmentally friendly
- 100 years reference design time



Water distribution mains and service pipes



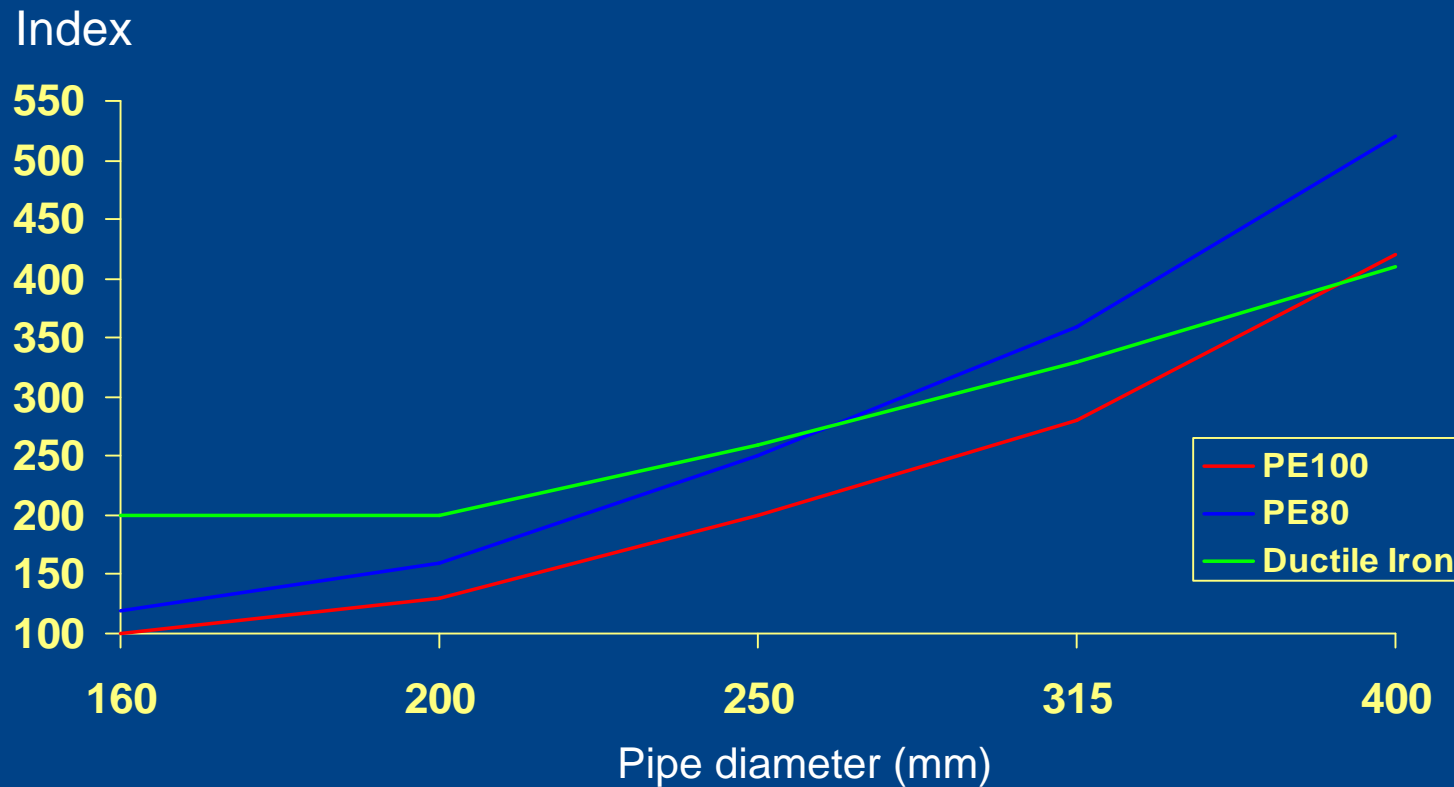
Water pipe mains >180mm - material trends Germany



Strong PE penetration is foreseen in the diameters above 180 mm

Sources: CDC 1999

Typical estimated installation cost for water pipe



Earthquake pipe failure statistics: Armenia, Colombia

Material	Installation Length (km)	Failures per km
PVC (water)	99,95	0,80
Ductile iron (water)	5,69	0,00
Asbestos cement (water)	221,9	0.95
Steel reinforced concrete (water)	1,14	0.00
Galvanised steel (water)	3,81	0,52
Cast iron (water)	1,03	0,97
Polyethylene (gas)	115,13	0.00

Sources: EPA Colombia, March 1999 and Gases del Quindio E.S.P. Colombia, 1999

Balance of mechanical properties

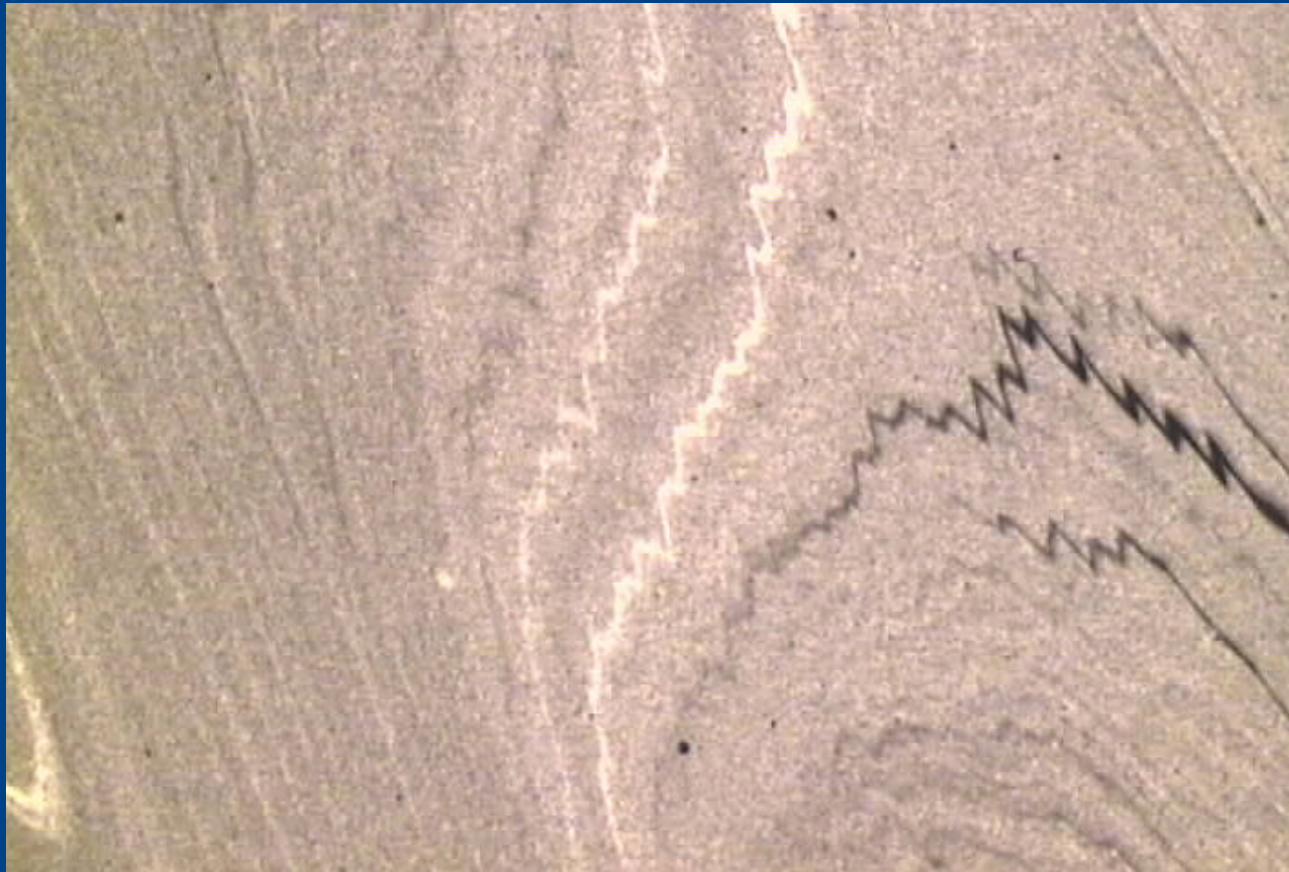
Long Term Hydrostatic Strength (MRS)

Slow Crack
Growth (SCG)

Rapid Crack
Propagation (RCP)



Dispersion of additives



Microscope photo
of pipe made of
natural resin and
master batch
(100X magnification)

Drinking water quality



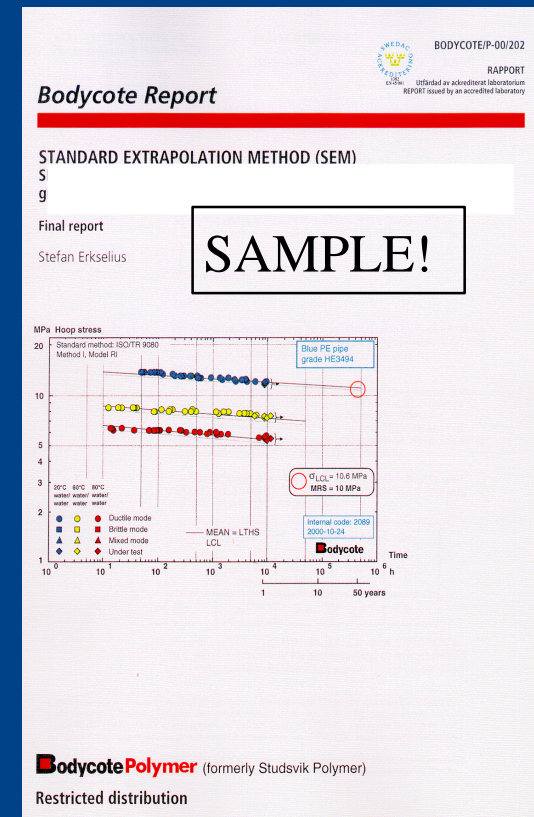
Rigorous organoleptic testing of pipes and granules

Test on real pipe systems to confirm quality



Minimum safety factor of 1,25 for water allowed because:

- Experience with extrapolation methods
- Documented, ready made compounds
- Combination of tests done on pipe and compounds
- System standards (Type test, PVT, BRT)
- Positive track record



Australia case: quality pipes for long lifetimes



Hammersley water transportation project, Australia: project requirements

- Supply of water to a large, remote iron borefield
- Water requirements of 200 l/s
- 60 km of 500 mm pipeline (3000 tons of PE100 material)
- Very stony, uneven and hot terrain
- Corrosive soil and alkaline water
- 20 years service life with low maintenance

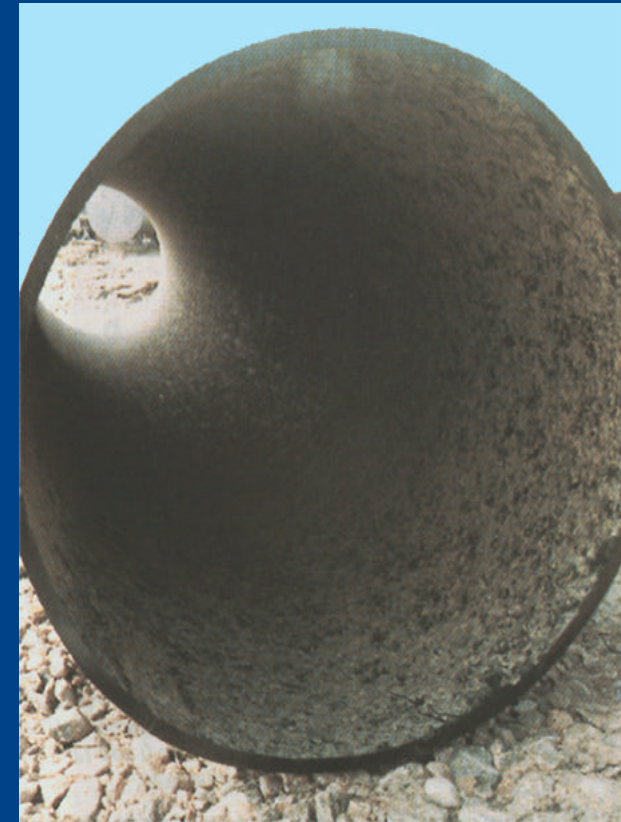


Hammersley water transportation project, Australia: cost effective installation



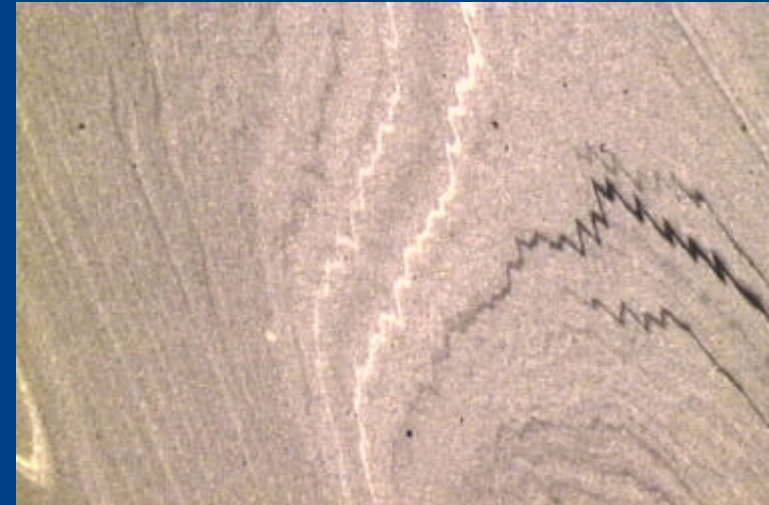
Hammersley water transportation project, Australia: trouble free operation

- Pipeline has been in operation since 1995
- Very few maintenance stops
repair minor welding problems
- No problems with the pipe material
steel pipeline estimated lifetime: 6 months
- Hammersley is generally happy with
their choice of pipe material



Case Story: Indian PE pipe history and relaunch

- HDPE pipes introduced in 1969 followed by decade of steady growth to 35 ktons
- Poor quality pipes in market
 - poor uv stabilisation
 - unsuitable master batch
 - no technical support
- Brittle failures resulted in loss of confidence, AP province ban in 1982 and stagnation
- Two high profile PO pipe seminars in November 2000
 - Mumbai
 - Hyderabad (AP province)
- Establishment of Indian Polyolefin Pipe Association in progress



Weak or poorly enforced raw material standards: everybody loses



Conclusion and outlook for the future

- PE water pipe systems have had very strong growth and an impressive track record
- High level of standards and approvals are critical to sustain this growth
- PE pipe industry will remain strongly committed to the water segment