Dear Reader,

Time is running again so fast and already half of 2015 has nearly past, an important year for large pipe diameter systems in Europe. The raw material situation is very difficult, no material is available and only at very high prices– with thanks to the nice and funny explanations of „force major“ given by the main raw material suppliers.

Another news is that the German company „Bauku“ got a new main owner, the company „Hawle“ . The other large pipe producer in Germany „HENZE GmbH“ also got a new main shareholder „KHB GmbH“, and beside the general manager Wolfgang Fester, I am now also appointed as a general manager of HENZE GmbH.
KHB GmbH is also a main shareholder of Krah GmbH. So the consolidation of the large plastic pipe market is going on quickly.

The Krah Community will join its forces with the large diameter pipe producers to have a sustainable and successful future.

Also, our long term project, will be finished super soon: „The Handbook on large plastic pipes“ – we will go into print by the end of July 2015. The distribution can start in August.So do not lose time and order your copy online.

Best wishes from Westerwald,

Alexander Krah

Testing of HDPE-Manholes for fire hazard

Ministry of works-Bahrain

Introduction:

Manholes made of Polyethylene have been used successfully for more than 40 years Worldwide. It is a growing market and the advantages of manholes made of thermoplastic materials are well known:

- No leakages
- Easy handling
- Low weight
- Durability > 50 years
- Impact resistance
- Flexibility
- High Strength
- Tailor-made design for any load case
- Easily Fabricated – important for future connections

In this case, the Ministry of Works – Bahrain had reservations concerning the possible flammability of the HDPE manholes during and after installation. These reservations had to be answered clearly and without any remaining doubt!

- **“Would the manhole burn if an ignited material was accidentally dropped into it?”**
- **“Could the manhole be deliberately set on fire using common place equipment“?**

Of course everyone is aware that Polyethylene is a plastic material and is flammable. It can be classified e.g. according DIN 4102-Part 1 into class B2, what is representative for “normal flammable materials”. That is not really surprising because it is a plastic material. Having said this, the manufacturers are using the temperature-behaviour of Polyethylene very successfully for their production processes.

- **“How would you rate the risk of ignition under defined conditions?“**
- **“How could you demonstrate the varsity of the material under these conditions?“**

The following described type-test, made in Bahrain 2014 for a local approval, show clearly that Polyethylene manholes have also under irregular usage no problems and fulfil all requirements!

Type testing for fire hazard and resistance

The test-procedure is developed for testing HDPE Manholes for fire hazard and resistance. The test should determine if HDPE manholes will catch fire and continue to burn under two different scenarios. These scenarios should emulate the possibility of either an accidental incident or intentionally attempting to set the manhole on fire.

Specimen: 1400mm ID HDPE Manhole @ 1.8m DTI, including benching to MOW (Ministry of Work) specifications.
Inlet and outlet are closed off via HDPE welding at the entry and exit points.

Apparatus: Match Stick
Ignited Cigarette Lighter
Burning Cigarette
Burning Kerosene Block
Petrol

Scenario 1:

Manhole stored at site in a securely bounded area, standing vertically.

Testing of HDPE-Manholes for fire hazard

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Acceptable storage conditions necessitate these manholes to be kept in vertical position, with safe distance from each other, stored in a locked yard near site office guarded by security (As is standard on all MOW sites).
Other assumptions: Ambient temperature between 35˚C and 45˚C, with wind speed less than 15 km/h.

Following nuances are assumed to occur:

a.
Fire test using match stick:
Throwing of ignited match stick into the manhole.
Fire duration was under 5 seconds and extinguished itself out, leaving no damage to the manhole.

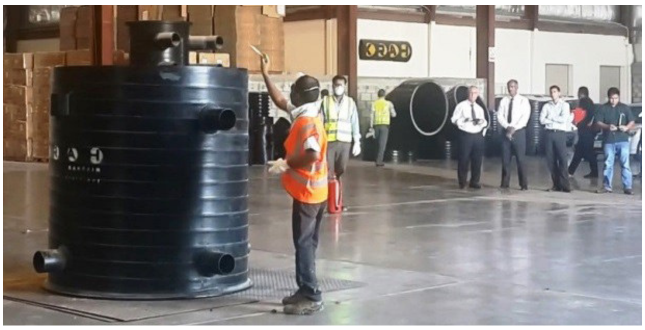
b.
Fire test using ignited cigarette lighter:
Fire duration was under 5 seconds and extinguished itself out, leaving no damage to the manhole.

c.
Fire test using burning cigarette:
Throwing of ignited cigarette into the manhole.
Fire duration was under 5 seconds and extinguished itself out, leaving no damage to the manhole.

d.
Fire test using a burning kerosene block:
Placing of ignited Kerosene soaked block onto HDPE sheet.
Fire duration was under approximately 6 minutes and extinguished itself out, leaving no discernible damage to the HDPE sheet.


a.)


b.)


c.)

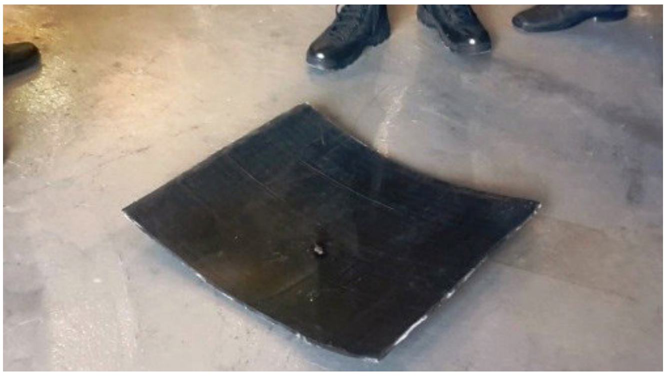
d.)

Testing of HDPE-Manholes for fire hazard

Ministry of works-Bahrain

Conclusion of testing according scenario 1:

The HDPE Manhole was proved to be fire resistant under these conditions and it was observed that the fire failed to burn or sustain for long, thus causing little to no damage on the HDPE Manhole and sheet.



Scenario 2:

Simulation of Manhole installed with top and unlocked lid

Other assumptions:

Ambient temperature between 35˚C and 45˚C.
Manhole in full operating mode including some fluid in the flow channel.

Following nuances are assumed to occur in the case of the unlocked CI lid:

- Close and seal all upstream and downstream connections
- Open lid.
- Put petrol (3-4 liters) inside manhole.
- Close lid in order to accommodate buildup of fumes for approx. 5 mins.
- Open lid.
- Throw in petrol soaked rag and ignite petrol.
- Close lid.
- Allow the petrol to burn out.

Setting up MS Requirements

Fire Test using Burning Petrol;

Fire duration was approx. 30 seconds and extinguished itself out, leaving no damage to the HDPE Manhole.

Igniting the petrol

Testing of HDPE-Manholes for fire hazard

Ministry of works-Bahrain

Fire Burns Out

Inside Manhole after Fire - No Damage

Conclusion of test according scenario 2:

The HDPE Manhole proved to be fire resistant under the conditions as set up in the Method statement. It was observed that the fire burned out and did not ignite the HDPE material, thus causing little to no damage on the HDPE Manhole.

All tests are witnessed by:

- Staff and QC, Krah Bahrain
- Representatives from MOW, MED, SEPPD, SEOMD,RPMD and other departments, Kingdom of Bahrain
- Representatives from Civil Defense, Kingdom of Bahrain

Author:

Claude Hendy
KRAH BAHRAIN CO.WLL.

HENZE Double-Wall-Tanks
with integrated tank heating

HENZE is one of the market-leading manufacturer of large diameter plastic pipes. The pipes, made out of Polyethylene or Polypropylene are used for applications in water- and sewage systems and as industrial application as well. The spiral wound pipes can be produced either with a solid or profiled wall as structured pipes.

Especially the double wall structures enables HENZE to provide a high quality and security standard for industrial applications and interesting solutions for process-engineering (double wall tanks, heat- exchanger etc.)

The following brief-report shows the special application of storage- and treatment tanks, made of Polypropylene, for a bitumen-emulsion in road constructing.

Pic.1: HENZE Double Walled Tanks for the suspension of Bitumen emulsion

The storing and maintained suspension of a bitumen-emulsion for further production steps depends largely on whether the temperature of approximately 70 degree Celsius can be constantly held inside the storage tanks. Additionally to the fine distribution of bitumen in the watery liquid, emulsifiers stabilize the temperature inside the mixture.

In case the temperature drops below a certain degree, the emulsion is broken and the bitumen will fall out and become sticky. Therefore, the constant
temperature is of major importance.
Since thermal discharge arises in terms of hot water during the production, it stands to reason to use this for the intended purpose. Thanks to the know-how in process engineering and design of plastic pipes a constant temperature, proper storage as such as an adequate treatment could be achieved.

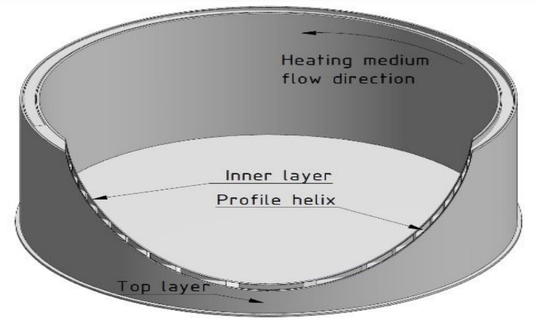
The double-walled construction allows beside its usual purpose (the storage of media) also a leakage test. The test can be carried out via electric resistance measurement using probes to detect over- or under pressure.
The spirally wound profiles inside the pipe wall can additionally be used for cooling of process media. However, in this specific case the storage medium (bitumen-emulsion) was heated up by passing a heat-medium through the profiles. Thus, the heating-water (thermal discharge from production) was pumped into the spiral profile of the double-walled wounded pipes of the vertically tanks.

HENZE Double-walled tanks, unique in material and construction

The Double-Wall-Tanks for this application are produced out of Polypropylene Homopolymer PP-H, “Daplen BE 60” by Borealis. This material is known for its outstanding thermal and mechanical characteristics.
According to graduate engineer Michael Florin, who is HENZE’s responsible project manager, it is:”… the first choice for the present case”.

HENZE Double-Wall-Tanks

with integrated tank heating



Pic. 2: HENZE Double wall Structure, designed for perfect flow of heating medium

The pipe was produced according to DIN 16961 with an inner diameter of 2000 x 5900 mm cylindrical height. The general approval Z-40.21-209 by DIBT served as the base for the structural dimensioning. Additionally, the following
important parameters were calculated by the manufacturer in order to guarantee the maintenance of warmth in the inside: energy yield, isolation and heat loss.

The effective volume amounts to 15 m³ per tank during unpressurized storage and treatment of media.
A design temperature of 70 degrees based on a lifetime of 25 years was chosen. Standardly, a safety factor of 2 was taken.
Lateral connection pieces are included in the structural view. The tanks consist of a flat bottom and a cover each. Agitators run on top of the covers fixed by traverses.

Performance guidelines perfectly fulfilled

If there are nozzles installed in the cylinder wall of the tank, a bridging piece / bypass has to be used to avoid any disturbance for the flow of the heating media. The pinpointed redirection of heating media into the bypass was realized through special connection pieces.

The connection pieces seal hermetically the complete wall cross-section by welding.
The bridging pieces were connected respectively before and after each “water-stop-nozzle” (see Pic. 3).

Pic. 3: Tank Design with Special Bridging Piece / Bypass

To achieve the greatest heat transfer, the wall thickness base (Inliner) was chosen to be small. Correspondingly, the wall thickness of the top layer was constructed greater to achieve a better isolation and meet the structurally required overall-wall-thickness.

To know exactly what is needed

The storage- and treatment tanks for bitumen-emulsion called for a particular specification of the wall. Moreover, an exclusive design was demanded which could flexibly adapt itself according to its use. “This was the only way to save all heating costs for the tanks operation. Precisely this individuality, the responding to problems and its solutions such as the choice of wall thickness according to its required design, are strengths which we can retrieve at any time for any case” says Florin after the successfully completed case.

Author:

Dipl.-Ing. Michael Florin
HENZE GmbH, Germany
lorin@henze-gmbh.de
www.henze-gmbh.de

A new and innovative solution

House connections for large spiral-wound pipes

HE-HAS-160/225
The Krah Community Member Henze GmbH offers his patented House Connection Solution **HAS-160/225** to all Krah Community Members (Patent No. DE 102005051560B4) and to all large plastic pipe users (PE and PP pipe systems).
Finally, a quick, secure and cost effective solution for house connections of large plastics pipes is available. The complete installation of the **HE-HAS** will be done from outside, so the installation can be done under operating conditions. No manual „hand-extrusion welding“ is anymore required, but a special heating element fusion system is used, according to DVS2207.

The **HE-HAS** house connection is available in two connection sizes: **DN160-SDR17,6** and **DA 225-SDR17,6.** So other pipe materials, like PVC, PP can be jointed easy. The **HE-HAS** house connection can be done on solid wall pipes, according to DIN8074/75, DN/EN 12666, DIN16961, EN13476, ASTM F894, NBR7373 and PAS...

Collector sizes are:
>= DN/ID300 – maximum profile height/solid wall thickness = 85 mm
>=DN/ID600 – maximum profile height/solid wall thickness = 145 mm
Approved for HENZE and KRAH pipes !

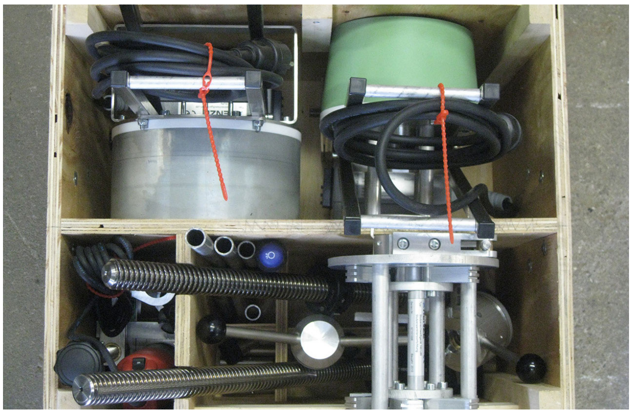
A new and innovative solution
House connections for large spiral-wound pipes

Installation procedure:
•A hole will be drilled in the pipe
•The tensile equipment will be inserted through this hole into the main pipe
•The existing hole will be made conically
•A heating element will be inserted
•After the fusion temperature is reached, the heating element will be removed
•The HE-HAS house-connection will be inserted and the fusion pressure will be built up.
•After cooling, the inner parts of the house connection will be scalped off, so that the main pipes has a smooth surface again.

The average installation time is only 15-20 min. The new house connection HE-HAS has the following advantages:

•Very cost effective
•Quick and easy installation
•Long life time
•Welded technology
•100% water tight
•No leakage during soil movements, thanks to welding
•The connection can be done during an operating line

Prices for the welding equipment (HE-HAS-WE) can be obtained on request (on purchase or renting basis).



Beside the HE-HAS-WE welding equipment you need only the HE-HAS house connection parts.

List prices are between 60,00 EURO-100,00 EURO/pcs.

Any further technical or commercial information on request.

Henze GmbH
Dipl.-Ing. A. Wittner
Joesef-Kitz-Str. 9
53840 Troisdorf
www.henze-gmbh.de

Sewage Pressure Pipes
for Northern Argentinean provinces

Project Description

Under the program for the *Development of Northern Argentinean Provinces*: Infrastructure Water and Sanitation, financed by the Interamerican Development Bank, the Program Execution Unit conducted the bidding process and award of the International Public Tender No. 01/13 for project:
Streamlining of Pumping Plant Drive and Effluent Treatment Station - Santiago del Estero whose bid is on 27 November 2013. On held January 13, 2014, the InterAmerican Development Bank (BID) reported no objection to the recommendation for award of contract.

This integrated urban sanitation project involves the expansion of sewage lying over the construction of a sewage liquids treatment plant. It provides for expanding the number of new connections in 14,493 units, which would add to the existing 30,560 units. The length of the extension needed to achieve network is estimated at 425.9 km.

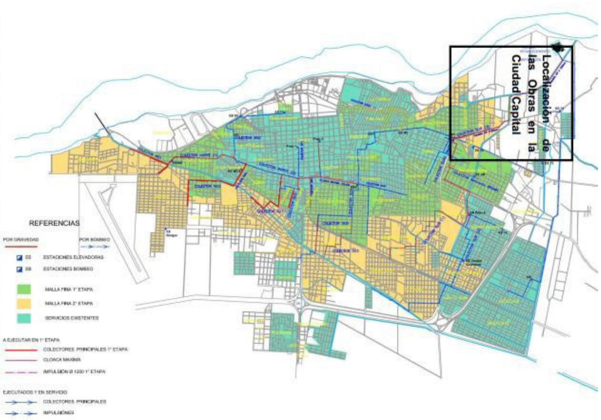


Figura 2.2.- *Localización de las Obras dentro de la ciudad de Santiago del Estero*

The new pipeline will run from the station EB1 by Dr. Degano, Independencia, Av. Dr. Victor Alcorta heading south to the main drainage canal south street that runs through Los Lapachos.
From there change direction by 90°, to take on the left side to its in the Viano channel mouth to cross it and continue along the left side of channel until turn at 90° to go to inlet of future treatment plant.

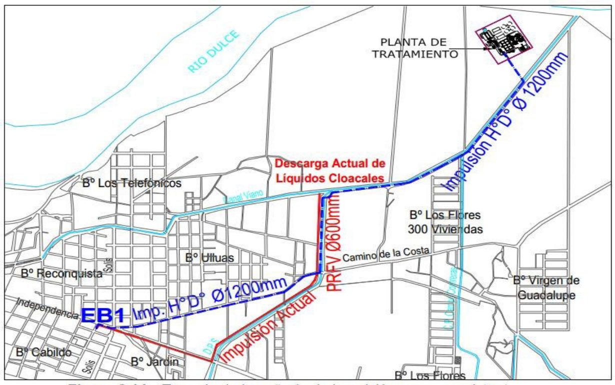


Figura 2.14.- *Trazado de la cañería de impulsión nueva y existente.*

This is a line 4250 meters of pipes that will be subjected to a maximum pressure of 3 kg/cm², for which the use of a hydraulic line of 1100 mm inner diameter and 6 kg/cm² nominal design pressure was determined.

Technical Offer

The constructor consortium called Krah America Latina to develop an alternative to the original offer, which was conceived in ductile iron or HDPE ISO4427, with butt fusion joint.

Sewage Pressure Pipes
for Northern Argentinean provinces

But both alternatives were not adapted to the limitations of the work, in the first case because they were imported goods, expensive and very long delivery times and secondly, of hard work in the trench, to be carried by urban areas and collapsible soils and high water tables.

For this, Krah America Latina made two offers, one using the PE/GF technology and the other with PE100 using the DIN/PAS 1065: 2007 standard. For this he made a comparison shown in the table below.

Mechanical and static calculations
While main pipeline will work at a maximum pressure of 3 kg/cm², the conditions of employment demanded that the pipes had 6 kg/cm² maximum allowable design pressure. So we proceeded to perform mechanical calculations according to the table in the previous text field.

All calculations were based on ISO 161 standard. At the same time, structural calculation was performed. For this Marston-Spangler theory stated in recommendations of AWWA M55 standard is used; then the calculation is added box.After hard negotiations, the use of the first alternative was decided and went on to perform the mechanical and structural design of the pipe.

Pipe characterisitcs	PE 100 Krah pipe		PE-GF200 Krah Pipe		Standard PEHD Pipe
	Electrofusion	Butt Fusion	Electrofusion	Butt Fusion	
Nominal diameter (mm)	1100	1100	1100	1100	1300
Inside diameter(flow capacity(mm)	1100	1100	1100	1100	1200
Wall thickness (mm)	48	48	28	28	50
External diameter (mm)	1185	1186	1156	1156	1300
Delivery times	8 month	8 month	6 month	6 month	not determined
Start up delivery date	45 days after OC	45 days after OC	90 days after OC	90 days after OC	
Jointing technologies	Electrofusion	Electrofusion	Electrofusion	Electrofusion	Butt-Fusion
	Butt-Fusion	Butt-Fusion	Butt-Fusion	Butt-Fusion	Rubber Sealing
	Rubber sealing	Rubber Sealing			
Standard length	6 m modules of 6 m		6 m modules of 6 m		
Special lengths					12 m
Joint procedure speed (estimated)	1 h	4 h	1 h	4 h	18 m
EF machines on rent (qty)	2 devices	no	2 devices	No	4 h
Joint speed performance	96 m/day	18 m/day	96 m/day	18 m/day	not determined
Time to change failed EF machines	3 days	-	8 days	-	
Possibility to make joint inside trench	Excellent	Difficult	Excellent	Difficult	Difficult
Longitudinal crack propagation resist.	Excellent		Excellent		Regular
Product made in	Argentina		Chile		Chile
Standards	DIN PAS 1065:2007		DIN 19674		ISO 4427
Quality certificate issued by	Bureau Veritas		not determined		not determined
Specific weight	165 kg/m	163 kg/m			
Ring stiffness	14,55 kN/mm²		10.02 kN/mm²		
Raw material	PE 100		PE100/GF (PE-GF)		PE 100
Work pressure class	6,02 kg/cm²		7,9 kg/cm²		not determined
Test pressure class	8,42 kg/cm²		11,12 kg/cm²		

Sewage Pressure Pipes

for Northern Argentinean provinces

DATA			
Raw material:	**PE100**	Safety factor C:	
ıg pressure (kg/cm²):	6,00	Test pressure (kg/cm²):	
meter measurement:	ID	Nominal diameter (mm):	
wall thickness (mm):	**43,00**		

INTERMEDIATE CALCULATIONS		
Long term stress cracking (σu_{50}):	100,00	kg/cm²
Short term stress cracking (σu_1):	140,00	kg/cm²
Admissible stress σ_{adm50}:	80,00	kg/cm²
Admissible stress σ_{adm1}:	112,00	kg/cm²
Internal diameter:	1100,00	mm
External diameter:	1186,00	mm
SDR:	27,58	
SN:	3,77	kN/m²

VERIFICATION		
admissible working pressure (kg/cm²):	**6,019**	VERIFIED
max admissible test pressure (kg/cm²):	**8,427**	VERIFIED

DATA			
MATERIAL PROPERTIES	Flexural Modulus, Short Term (E_S):	850000,00	kPa
	Flexural Modulus, Long Term (E_L):	200000,00	kPa
	Poisson Modulus (n):	0,40	
	Last Circumferential Shrinkage Stress, Short Term (σ_{Tadm}):	22500,00	kPa
	Last Circumferential Shrinkage Stress, Long Term (σ_{Tadm}):	14000,00	kPa
PIPE	Nominal Diameter (DN):	**1100**	mm
	Profile:	**VW-43**	(VERIFICA)
TRENCH AND INSTALATION CARACHTERISTICS		**SCENARIO 1**	**SCENARIO 2**
	Cover (T), in m:	1,50	3,00
	Trench Width (B), en m:	2,05	2,05
	Water Table Depth (H), in m:	2,00	2,00
	Water Table Unit Weight (gw), in kg/m³:	1000	1000
	Support angle (a) in degrees:	120°	120°
	NATURAL SOIL → Soil Type:	D	D
	FILLING CONTAINMENT → Soil Type:	2	2
	Proctor:	90%	90%
	Unit Dry Weight (γs), in kN/m³:	20,00	20,00
TRAFIC LOADS		**SCENARIO 1**	**SCENARIO 2**
	Vehicle Type:	AASHTO H20	AASHTO H20
	Floor Type:	RIGID	RIGID
	Wheel Load (P), in kg:	N/A	N/A
	Contact Area (A), in m2:	N/A	N/A
	Impact Factor (If):	N/A	N/A
STATIC LOADS		**SCENARIO 1**	**SCENARIO 2**
	Static Ground Pressure (Pe), in kPa:	0,00	0,00
	Load Area length on each side of the pipe (M), in m:	1,00	1,00
	Load Area length on each side of the pipe (N), in m:	1,00	1,00
SAFETY FACTORS		**SCENARIO 1**	**SCENARIO 2**
	Relative Maximum allowable deflection:	5,00%	5,00%
	Buckling Safety Factor (FSp):	2,00	2,00
	Safety factor of Circumferential Compressive (FSc):	2,00	2,00

Sewage Pressure Pipes
for Northern Argentinean provinces

Finally, the pipes were designed under these concepts and specifications and conditions are as follows:

KRAH PROFILE PIPE, DN 1100, PROFILE VW43	
Manufacturer:	KRAH AMERICA LATINA S.A.
Manufacture Standard:	DIN PAS 1065
Description:	Thermoplastic pipes with smooth internal and external wall thickness PN 6 PE100 - Electrofusion joint without internal protruding
Material:	High density polyethylene
Application:	Sewer pumping main PN6 PE100
Geometric properties:	
Internal diameter (mm):	1100
Length (m):	6,00
Wall profile:	VW-43
Wall dimensions:	s1
s1 (mm):	43,00
	Note: Dimensions can be change without previous notice always keeping at least minimum ring stiffness
Joint system:	Socket - spigot with integrated EF
Mechanical properties	
Inertia moment (mm4/mm):	6625,58
Inertia distance (mm):	21,50
Ring stiffness (DIN 16961) (kN/m²):	14,55

INTERMEDIATE CALCULATIONS			
PIPE	Designation:	1100VW-43	
	Profile Height (h):	43,00 mm	
	Moment of Inertia (Ix):	6625,58 mm4/mm	
	Distance of Inertia (e):	21,50 mm	
	Profile area (A):	43,00 mm2/mm	
	Outside Dia (OD):	1186 mm	
	Average Dia (Dm):	1143 mm	
	Ring Stiffness (RS):	30,17 kPa	
	Nominal Ring Stiffness (SN):	**3,77 kPa**	
TRENCH AND INSTALATION	Water Table Height (Hw), in m:	0,00	1,00
	Delayed Deflection factor (D_L):	1,25	1,25
	Support Coefficient (Kx):	0,090	0,090
	Natural Ground Reaction module (E_N'), in kPa:	10300,00	10300,00
	Filling Ground Reaction module (E_E'), in kPa:	7027,81	9921,62
LOAD CALCULATIONS	**Filling Groung Tensile Strenght (P_E), in kPa:**	**30**	**60**
	Actual load Ratio per wheel/AASHTO H20, in m:	N/A	N/A
	Equivalent Radio (R), in m:	N/A	N/A
	Live Loads Tensile Streght (p_v), in kPa:	**16,68**	**6,00**
	Ratio M/T:	0,67	0,33
	Ratio N/T:	0,67	0,33
	Influence coefficient (Ic):	0,124	0,052
	Static Loads Tensile Streght (p_E), in kPa:	**0,00**	**0,00**

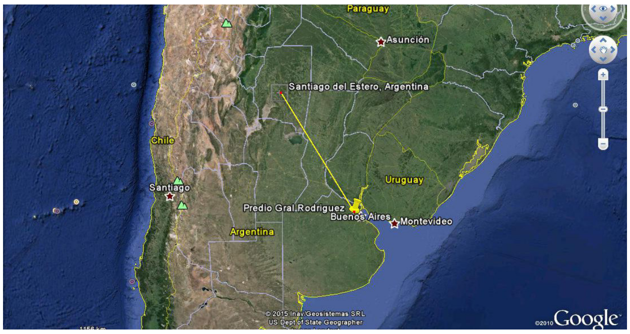
VERIFICATIONS					
RING DEFLECTION	Ratio E_N'/E_E':	1,47		1,04	
	Ratio B/D:	1,73		1,73	
	Combination Soil Support Factor (Sc):	1,28		1,03	
	Combined Soil Reaction Module (E'), in kPa:	9026,63		10206,18	
	Stiffness Soil Factor (0,061*E'), in kPa:	550,62		622,18	
	Deflection (Δy), in mm:	9,60		12,76	
	Relative Deflection (Δy/D):	0,84%	OK	1,12%	OK
BUCKLING	Water Buoyancy Factor (Rw):	1,00		0,89	
	Elastic Support coefficient (B'):	0,26		0,32	
	Total Outside Pressure (q), Short Term, in kPa:	46,68		75,80	
	Total Outside Pressure (q), Long Term, in kPa:	30,00		69,80	
	Allowable Buckling Pressure (q_a), short term, in kPa:	528,16		593,71	
	Buckling Safety Factor, short term:	11,31	OK	7,83	OK
	Allowable Buckling Pressure (q_a), long term, in kPa:	256,20		287,99	
	Buckling Safety Factor, long term:	8,54	OK	4,13	OK
CIRCUMFERENCIAL COMPRESSION	Circumferential compressive stress (s_b), short term in kPa:	620,46		1007,40	
	Circumferential Compression safety factor, short term:	36,26	OK	22,33	OK
	Circumferential compressive stress (s_b), long term in kPa:	398,72		927,69	
	Circumferential Compression safety factor, long term:	35,11	OK	15,09	OK

DATA			
Raw material:	**PE100**	Safety factor C:	1,25
Working pressure (kg/cm³):	6,00	Test pressure (kg/cm²)	7.500
Diameter measurement:	ID	Nominal diameter(mm):	**1100**
Inner wall thickness (mm):	**43,00**		
INTERMEDIATE CALCULATIONS			
Long term stress crackling (σU_{50})	100,00	kg/cm²	
Short term stress crackling (σU_1)	140,00	kg/cm²	
Admissible stress$_{adm50}$:	80,00	kg/cm²	
Admissible stress$_{adm1}$:	112,00	kg/cm²	
Internal Diameter:	1100,00	mm	
External Diameter:	1180,00	mm	
SDR:	27,58		
SN:	3,77	kN/m²	
VERIFICATION			
Pipe max. admissible working pressure(kg/cm²):	6,019	VERIFIED	
Pipe max. admissible test pressure (kg/cm²):	8,427	VERIFIED	

Sewage Pressure Pipes
for Northern Argentinean provinces

Work site

The work began in October 2014 and is scheduled for completion by September 2015. Shipments are made from Krah America Latina factory located in Buenos Aires and travel more than 1000 km to reach the work site in northern Argentina.



All joints were made using the unique system of electrofusion by Krah. Training courses were held and operators of construction consortium were prepared; regular visits to monitor the process are also performed.

At the date of issuance of this report, the work is in full swing, following the planned schedules.

Polyethylene Pipes and Manholes
for Landfill-Applications

General:

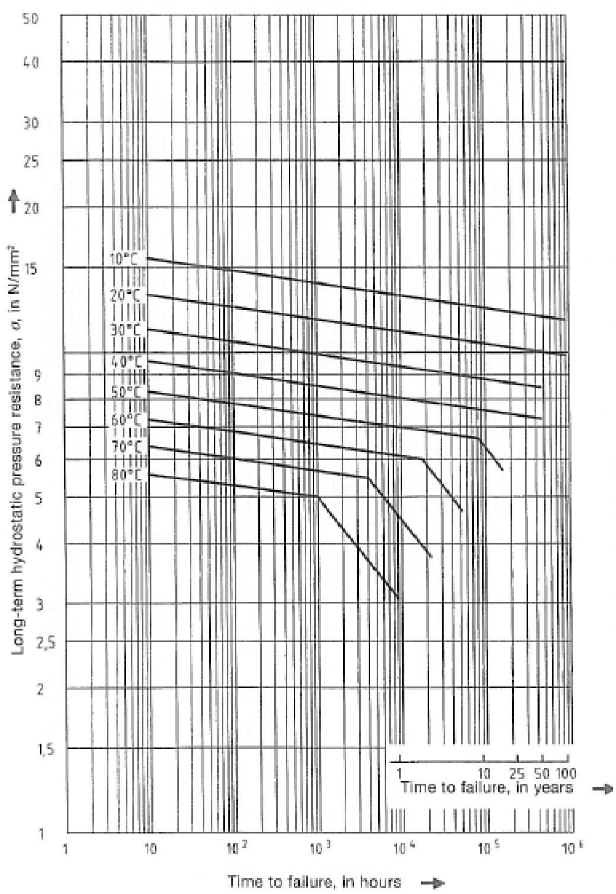
The control of gas and fluids in landfill application requires safe and applicable pipe-systems.
Due to environmental risks, the requirements for the raw-material and all finish and semi-finish products are much higher than for standard sewer applications. Also for welding and fabrication the quality-requirements are significantly higher. Special local approvals for raw-material, product, producer, welders and fabricators are often needed to simply enter the market.

For more than 30 years High Density Polyethylene (PEHD) has been successfully used in landfill-applications. Especially the modern bimodal types of PEHD are the perfect material for the challenges we face in landfills and in contact with hazardous fluids and gases.

The excellent chemical resistance of polyethylene against a multitude of acids, lyes and organic hydrocarbons is a strong argument for using Polyethylene in landfills.

Also very important are the mechanical characteristics and the durability. Today we have been using Polyethylene successfully in the pipe-industry for more than 55 years and tests have shown clearly, that we can consider a life service time of more than 100 years. The long-term-hydrostatic pressure curves (pic. 1) provide the basis for the stress-related design.

The reliable strength depends on the temperature and the stress-loaded time. In terms of strain and stiffness the creep-modulus, the flexibility and the behavior against Slow-Crack-Growth (SCG) has to be considered.
Landfills are planned for generations of human life. To guaranty a maximum of safety for our environment and thus our all health, Polyethylene serves as the most convenient solution and should be used.



Polyethylene Pipes and Manholes
for Landfill-Applications

Typical technical characteristics of a modern High Density Polyethylene, used for pipes, fittings, semi-finished products and of course for fabrication of manholes, tanks and apparatus etc. in landfill-application:

Properties	Value	Standard
Density	≥ 940 kg/m³	DIN EN ISO 1183
Colour	Black	
Carbon-Content of PE100(not validPE-el)	2-2,5%	DIN EN ISO 11358
Thermal stability	≥ 20 min (210 °C)	ISO 11357-6
Strain at yield	≥ 8%	ISO 6259-3
Strength at yield	> 23 MPa	ISO 6259-3
Strain at break	> 350 %	ISO 6259-3
Flexural-Modus 1 min.(ISO178)	1100 MPa	ISO 9080 ISO 12162
Long term strength(20°C,50years,H2O) Min. required Strength/ MRS)	10 MPa (MRS 10)	
Hydrostatic strength	≥ 5 MPa	DIN EN ISO 1167-1,2
Slow crack propagation (not valid for PE-el)	≥ 1600 h (80 °C, 4MPa, 2% Arkopal)	EN 12814-3
Full-Notch-Creep-Test (FNCT)		

For other applications like manholes, shaft-systems, leachate-reservoirs, pumping stations and other large diameter constructions, the structured profiled wall is indispensable.

The static design is following ATV M127 standard and has to consider the special load situation in landfills. The waste-filling of the landfills cannot be considered as a fix and stable system, because of undefined rotting, higher temperatures and accruing gas. The waste-filling is settling down which affects the induced down-drag-forces to the shaft. Also the load-distribution is completely different to applications where defined soil-conditions are existing.

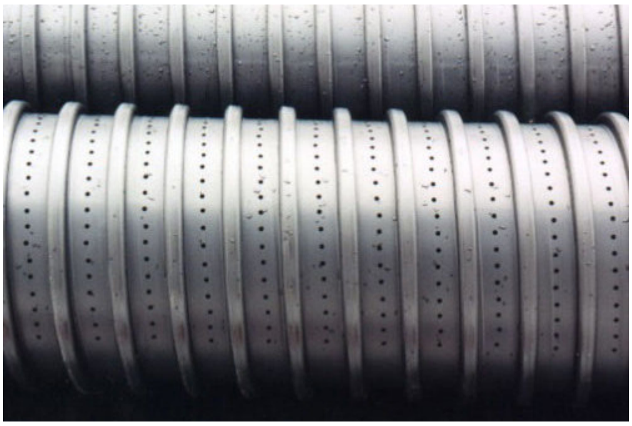
Pic.3: Manholes in Landfill application (Henze GmbH, RBV Pöthe, Germany)

Polyethylene Pipes and Manholes
for Landfill-Applications

Typical application for Polyethylene Pipes in landfills are:

- •Drainage pipes for leachate
- •Leachate manholes
- •Penetration-Constructions
- •Leachate collector Pipes
- •Gas Collectors
- •Leachate reservoirs and pumping stations
- •Condensate separators

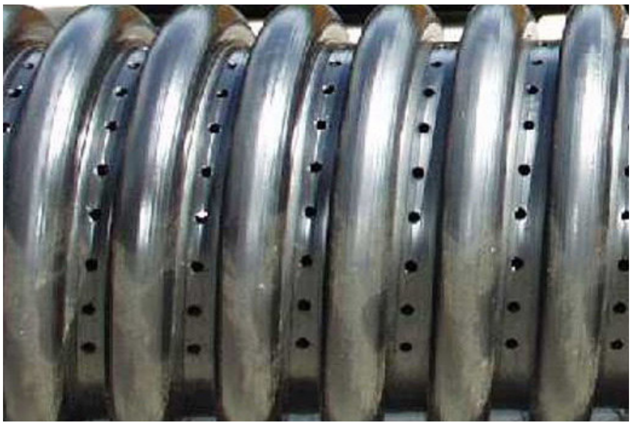
Pic.1: Long Term hydrostatic pressure resistance of pipes made from PE 100, acc DIN 8075 (99)



Helical extruded polyethylene pipes and manholes

For all large diameters ≥ DN/ID 300 helical extruded pipes (Krah-pipes) are well-proven.

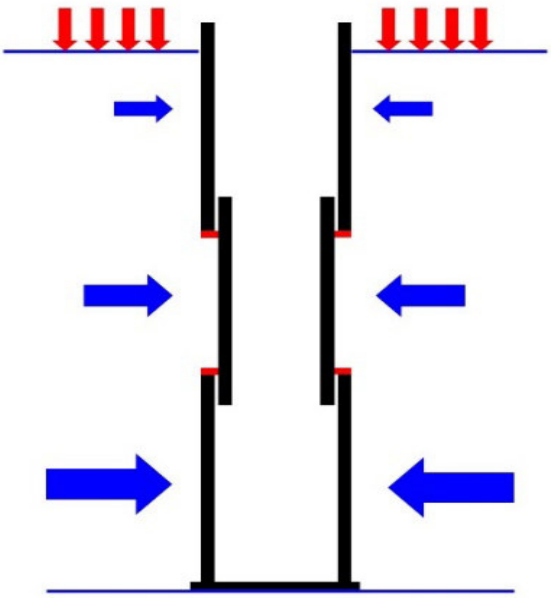
The possibility of tailor-made wall structure provides many advantages in design of the components. Profiled-wall is usually used when stability/stiffness is needed and solid-wall when strength is wanted. For leachate-drainage-pipes often a combination of solid-wall and profiled-wall is used. The holes or slots are made between the profiles, so that the entrance-resistance for the liquid can be reduced and the stiffness of the complete pipe is guaranteed:



Telescopic manholes

For manholes with high depth a telescopic system is well-proven and can be a good alternative. The settlement in landfills can be up to 40%. During settlement, the telescopic shaft is reducing the height automatically and is avoiding any static overload.
Due to the telescopic-system the induced forces can be minimized. Each segment of the system is flexible and is adjusting to the height of waste around.
Mostly the segments are jointed with predetermined breaking points either by welding or by using special pins. In the case of settlement the breaking-point will clear the way for reduction of manhole-length.

Polyethylene Pipes and Manholes
for Landfill-Applications



Pic. 4: scheme telescopic shaft

Manholes for landfill-gas

Another specialty of landfill-application is the landfill-gas. Wherever components come into contact with landfill-gas, they have to be protected against electrostatic charging. Because plastic materials are by nature not electrically conductive, a special recipe for the Polyethylene has to be used.

Raw-material suppliers provide Polyethylene-material with a higher content of black carbon to achieve the necessary electrical conductivity. The required value for the electrical conductivity depends on national regulations (e.g. GUV R127), but typically the requirements are as follows: Surface-Resistance ≤ 106 Ω. In each case the surface has to be grounded!

The helical extrusion technology provides the possibility to produce only the inner layer of the pipe with PE-el and the remaining wall structure with typical PEHD (PE100).

This saves costs and additionally it has technical advantages. PE-el is optimized for electrical properties, but not for the mechanical loads we face in this application. It is recommended to use for the stress-loaded parts and components of modern PE 100 only.

Polyethylene Pipes and Manholes
for Landfill-Applications

Leachate reservoirs / Double wall constructions
Having regard of environmental protection means to transfer highly loaded leachates into the sewer without any leakage loss. This task begins at the dam's side of the landfill. The total route in the dam's side from the penetration-building up to the leachate reservoir should be designed with a double walled profile. All following pipelines and shaft structures must be manufactured in a way that leakage tests can be carried out.

Because of thermic induced expansions, the inner and outer pipe walls are firmly connected. The monitoring area can be tested for leakproofness via vacuum or excess pressure. A permanent monitoring display or humidity sensor can be additionally installed at the drainage point. Thus, a central monitoring in the control station is possible.

What needs to be considered:

„Landfill leachates are harming the environment as they contain hazardous liquids. Their exact composition is mostly unknown and can change over the years.“

Constructions for the storage of leachates are thought to transfer heavily loaded leachates in reduced amounts into the treatment plant and/or to create stowage space as temporary storage until the leachates are collected by a suction vehicle.

The manufacturing of these storage tanks f
rom spiral wound profiles enables the leakage controle of the whole system.

The storage pipes have an inner and an outer homogenous pipe wall. As spacers between both pipe walls, either a square or round profile is integrated. Additonal drilling inside the profile create a cavity, which is used as a monitoring space for excess pressure and vacuum.

Pic. 7: Double wall Leachate-reservoir
(Henze GmbH, RBV Pöthe, Germany)


Pic. 8: Penetration construction
(Henze GmbH, Germany)

Author:

Stephan Füllgrabe,
Plaspitec GmbH, Germany

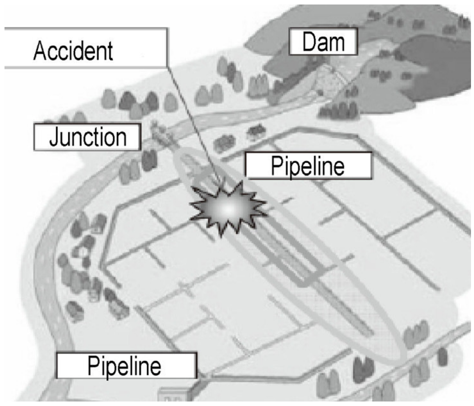
Stock management of agricultural pipeline in Japan

1. Background

All over Japan we have huge agricultural fields to cultivate rice, vegetables, fruits and other crops. Major parts of the pipeline project were developed between 1968 and 1985 by the National development project. Since then over a century passed and the infrastructure became too old. Major problems of our pipelines are leakages, cracks, collapses and corrosion. This is not only harmful to the agricultural facilities but also to the farmer’s property. For the stock management of agricultural pipelines, both human capacity and financial capacity is used.

2. Current situation

Next to the agricultural pipelines for farmers, tunnels, pipeline siphon systems by Fiber reinforced plastics mortal, steel pipes, ductile irons and concrete pipes exist in Japan.
Furthermore, in 1994, 2001 and 2009 leakages even led to an outage of water supply for a longer time and thus affected human activity tremendously. According to an investigation report by Mie prefecture, there were 51 accident-cases on pipelines until 2012. In particular within 5 years, they had a total of 25 accidents; a further accumulation of similar incidents can be expected. Leakage problems occurred in PC pipes, steel pipes and fiber reinforced plastics mortal pipes. The map shows at which part of the pipe the accident exactly happened.



From 2003 to 2011 a governmental research team investigated the given conditions of the main pipelines intensively by evaluating the concrete, neutralization tests, measurement of joint defection, EMF measurement, non-distractive inspection and drilling investigations. The result showed corrosion, abrasion and crack propagation due to degradation over time.

Stock management of agricultural pipeline in Japan

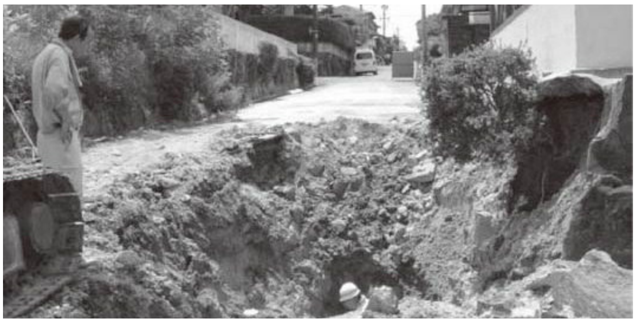
3. Problem

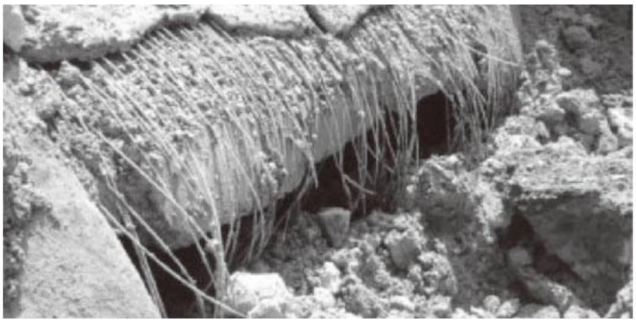
3.1. Fiber reinforced plastics mortal pipes

We found leakage problems especially in the joint section at fiber rein forced plastic mortal pipes (600DN) underneath the road. They were not able to transport 100% of the liquids for agricultural purposes any longer. Moreover, a car accident happened due to leakage underneath the road.

3.2. PC pipe

We also faced troubles with PC pipes (1350DN) when the ground collapsed due to its leakages and formed a sinkhole. When agricultural, but especially sewer pipes, burst like this, most likely a secondary disaster follows due to contaminated soil or groundwater.

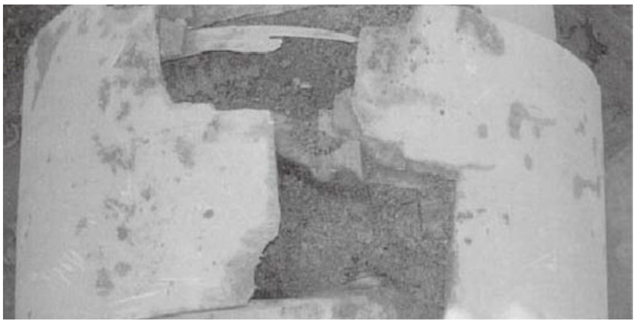




4. Investigation

4.1. Cause of trouble (Fiber reinforced plastic mortal)

It was confirmed by these investigations that the soil conditions were significantly softened, uneven settled and also showed stress concentration on the fitting and smaller collapses (see picture below) after such a collapse.



4.2. Cause of trouble (PC pipe)

Additionally it was confirmed by the surveys that the water quality was contaminated by erosive free carbon dioxide. The carbonation of the cover coat mortal is reducing the pipe wall thickness. As a cause of degraded PC steel wire, the pipes cracked and collapsed.

5. Conclusion

Especially for agricultural uses, it is very important to utilize pipes with a significant longer life time. It is striking that we need a complete modification to replace our oldest facilities with modern ones in order to provide safe water for agricultural uses. The new ones need to have a sufficient lifetime. Back in the days, we used fiber reinforced plastic mortal pipes, PC pipes, ductile iron and steel pipes.

However those are not durable enough for our needs.

Exclusively with polyethylene pipes we can ensure (or guarantee) the required lifetime and quality for our pipe systems.

Polyethylene pipes retain their characteristics for up to 100 years and longer. PE-pipe was already used for gas applications and as water pipelines around the globe. This is the time to use PE-pipes for agricultural uses.

Now proven: 100 Years life expectancy for Polyolefin sewer pipes

Teppfa- The European Plastic Pipes and Fitings Association

Polyolefin sewer pipe systems have a service lifetime expectancy of at least 100 years.‘ This is the conclusion of a recent two-year project commissioned by TEPPFA and independently scrutinised by Professor Heinz Dragaun from the Technical School for higher education (TGM) in Vienna. The project involved the excavation of many samples from in-service pipe networks that were tested and assessed under meticulous laboratory conditions. The results of the analysis and findings of this work are expected to favourably influence those sewer operators faced with major capital investment in new or replacement networks.

Most European countries have their fair share of antiquated sewer networks.They not only leak and lack performance, they also need to be modernized or just replaced. But life expectancy is a critical factor in any investment decision. Polyolefin (polypropylene and polyethylene) systems have been used widely for over 40 years and compared to non-plastic pipe materials, they have consistently offered a longer term solution. However, whereas the life expectancy of polyolefin pipes has been discussed for many years, a definitive conclusion has never been determined. Until now, that is.

Increased confidence

Tony Calton, TEPPFA’s general manager is delighted with the project‘s outcome: „Designers, owners and operators of sewer networks can now be confident that these sewer systems will have an in-service life of at least one hundred years when materials, products and installation practices meet the appropriate requirements.“
„The outcome is also vitally important for material suppliers, pipe manufacturers and contractors working closely with the sewer market. Clearly it will lend further appeal and allow polyolefin sewer pipes to be specified with increased confidence as they perform consistently throughout their very long asset life.“

Conditions set out by the project team were rigorous and relied on ‘long-term real-time data. For instance, tests included the excavation of pipes that had already been in use for up to 40 per cent of the proposed in-service lifetime.

These tests demonstrated that no excessive deterioration or degradation has occurred over this time. Tony Calton notes that „although the oldest excavated pipes were manufactured using ‘first generation’ material formulations, a residual lifetime of more than 50 years was calculated. And we should also bear in mind that current formulations offer even greater lifetime performance than those earlier materials.“

Now proven: 100 Years life expectancy for Polyolefin sewer pipes

Other key factors were investigated throughout the duration of this project but these were found not to adversely affect life expectancy.

These included the chemical composition of the sewer water, the temperature profile of sewer flows and variations in the kind of i nstallation practices used. The influence of higher concentrations of sewer effluent that are typically associated with structured wall pipe systems was also examined.

The full technical report and a summary technical report are available on the TEPPFA website.. A four-page leaflet outlining the project scope is also available through TEPPFA's company members and/or National association members. It is also important to note that this project was co-ordinated by TEPPFA in conjunction with LyondellBasell, Borealis and TGM (Austria).

Further information: Tony Calton: Tony.calton@teppfa.eu , Tel.: +32-2-736 24 06

Avenue de Cortenbergh,
711000 Brussels
Belgium