

ANALYSIS OF THE SITUATIONS REGARDING THE FAILURES IN THE NATIONAL TRANSPORT SYSTEM OF PETROLEUM PRODUCTS ADMINISTERED BY CONPET S.A.

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Abstract: This article will analyze the type, the frequency of occurrence, as well as the costs associated with the fixing of the failures occurring in the national system of transport of petroleum products administered by the company CONPET S.A.

Key words: failure, costs, pipes, transport of petroleum products

1. Introduction

CONPET S.A, with a tradition of over 100 years, is the national operator of pipeline petroleum and derivatives transportation system in Romania and provides transport services for the Romanian refineries. [1] The company operates a 3,800 km pipeline network, which crosses 24 counties, based on the Oil Agreement for the Concession of the National Transport System for Oil, Gasoline and Ethane by Pipelines concluded with the National Agency for Mineral Resources (ANRM), in 2002.[2]

The pipeline system administered by the company CONPET S.A includes, besides the main

pipelines and pumping stations, loading-unloading ramps and reservoir parks.

2. Analysis of the types of failures

The study covers a period of 40 months, from January 2016 to April 2019.

The identified types of failures are:

- Technical failures;
- Inflicted failures.

The technical failures recorded are caused mostly by corrosion. (Table 1). The graphical evolution of failures recorded in the national transportation system is shown in Figure 1.

Table 1. Recorded technical failures

Reference year	Technical failures		Inflicted failures	The percentage of failures caused by corrosion out of total failures
	Corrosion	Other causes		
2016	30	0	15	66,66%
2017	49	0	11	81,66%
2018	21	3	12	58,33%
2019 January - April	9	1	4	64,28%

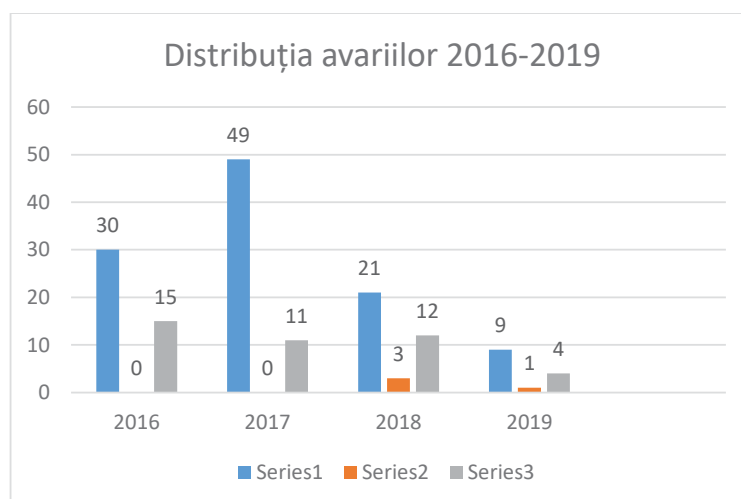


Fig.1 The distribution of inflicted and technical failures between January 2016 and April 2019 – in the national transportation system operated by CONPET S.A.

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The percentage of failures caused by corrosion out of the total failures was, in 2018, the smallest, representing 58.33%, while in 2017 it was 81.66%.

The evolution of failures caused by corrosion between January 2016 and April 2019, for different pipe sizes is shown in Table 2.

In the case of the Ø 24 pipeline, one may notice that, in 2017, 19 technical failures caused by corrosion were determined, which are distributed as shown in Table 3.

Table 2 *The evolution of technical failures between January 2016 and April 2019*

Pipeline dimension	Year 2016	Year 2017	Year 2018	Year 2019
Number of technical failures caused by corrosion				
4 in	0	0	1	0
4in + 5in	3	1	1	0
5 in	0	1	0	0
5 9/16 in	1	0	3	0
6 in	1	0	0	5
6in + 5in	0	0	1	0
6 5/8 in	6	13	4	0
8 in	1	1	1	0
8 5/8 in	1	0	1	0
8in + 6in	0	0	0	0
10 in	2	2	0	0
10 ¾ in	3	0	4	0
12 in	0	0	1	1
12 ¾ in	0	2	0	0
14 in	1	0	0	2
14 ¾ in	0	0	0	0
20 in	1	7	4	0
24 in	5	19	0	1
28 in	2	3	0	0

Table 3 *The records of failures in the case of the Ø 24 in pipeline*

Constanța -Petromidia	2 failures – Lumina (Constanța county)
Bărăganu-Călăreți	4 failures – Dragalina (Călărași county)
	6 failures – Ivănești (Călărași county)
Călăreți-Ploiești	2 failures – Livedea (Ialomița county)
	3 failures – Nuci (Ilfov county)
	1 failure – Lacu Turcului (Prahova county)
	1 failure – Pietroșani (Prahova county)

The identified failures together with the corrosion phenomena may be as well:

- Accidental breakdown of the pipeline outlet;
- Crack in the pipeline protector;
- Breaking the defrost pipeline;
- Hole in the pipeline;
- Transverse crack
- Attempts to cut the pipeline;
- Craft installations.

Part of these inflicted failure - therefore, they are not technical failures - are craft installations. The

distribution of these failures is represented in Table 4.

In the case of the Ø 10 ¾ pipeline, let's notice that, in 2018, 8 technical (not caused by corrosion) and inflicted failures were registered, which are distributed as shown in Table 5.

By comparison, monthly, the evolution of failure fixing is presented in Table 6. In this table Av.C represents technical failures caused by corrosion and Av.A, other types of failures. Figures 2, 3, 4 and 5 show the graphical annual evolution of failure repair.

Table 4. Calendar distribution of failures

Pipeline size	Year 2016	Year 2017	Year 2018	Year 2019
	Number of failures, except corrosion			
4 in	0	0	0	0
4in + 5in	0	0	0	0
5in	0	0	0	0
5 9/16 in	0	0	0	0
6 in	0	0	0	1
6in + 5in	0	0	0	0
6 5/8 in	1	1	1	0
8 in	0	0	0	0
8 5/8 in	0	0	0	0
8in + 6in	0	0	1	0
10 in	0	0	1	2
10 ¾ in	3	3	8	0
12 in	0	0	1	1
12 ¾ in	1	0	0	0
14 in	1	2	1	1
14 ¾ in	2	1	0	0
20 in	4	2	1	0
24 in	3	0	0	0
28 in	0	0	0	0

Table 5. The records of the failures in the case of the Ø 10 ¾ in pipeline

Siliște-Ploiești	2 failures – Adîncea (Dâmbovița county)
	1 failure – Bucșani (Dâmbovița county)
Orlești-Poiana Lacului	2 failures – Făgetelu (Argeș county)
	1 failure – Aurești (Vâlcea county)
Bărbătești-Orlești	1 failure – Leordeni (Argeș county)
	1 failure – Totea (Gorj county)

Table 6. Calendar evolution of failure repair

Month	Failure/ Year							
	2016		2017		2018		2019	
	Av.C	Av.A	Av.C	Av.A	Av.C	Av.A	Av.C	Av.A
Jan.	3	0	3	0	1	0	3	2
Feb.	2	5	4	2	3	1	3	0
March	3	1	5	1	4	3	1	1
April	2	1	9	0	2	4	2	2
May	1	1	10	1	0	2	-*	-*
June	1	0	2	1	1	1	-	-
July	3	2	3	0	1	2	-	-
Aug.	1	1	3	0	1	1	-	-
Sept.	4	3	0	2	0	0	-	-
Oct.	5	1	4	3	1	1	-	-
Nov.	2	0	2	0	4	0	-	-
Dec.	3	0	4	1	3	0	-	-

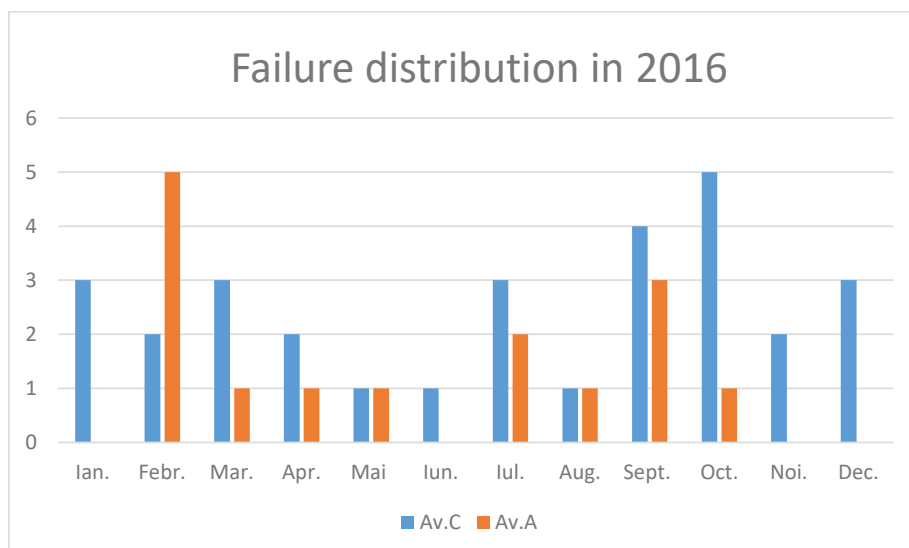


Fig. 2. *Distribution of failures in 2016*

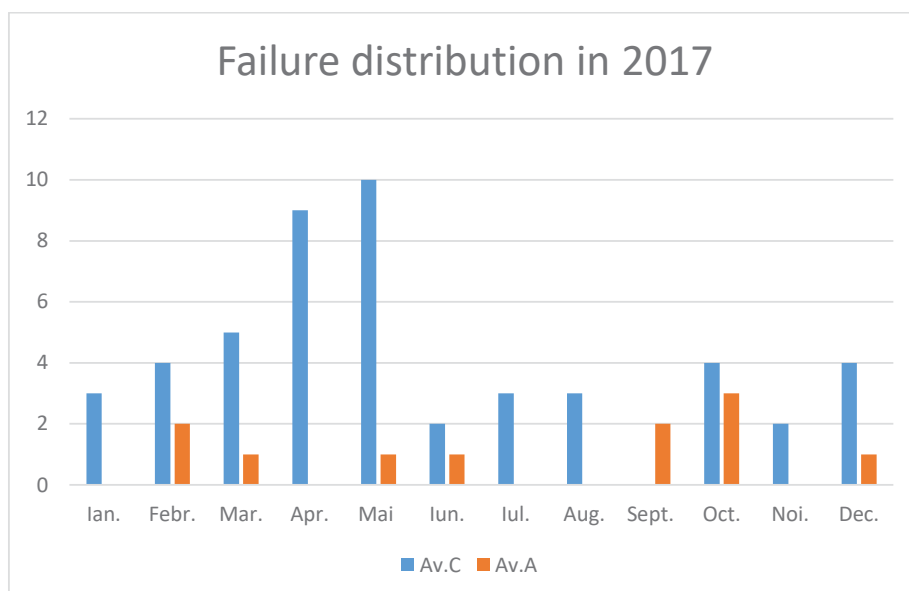


Fig. 3. *Distribution of failures in 2017*

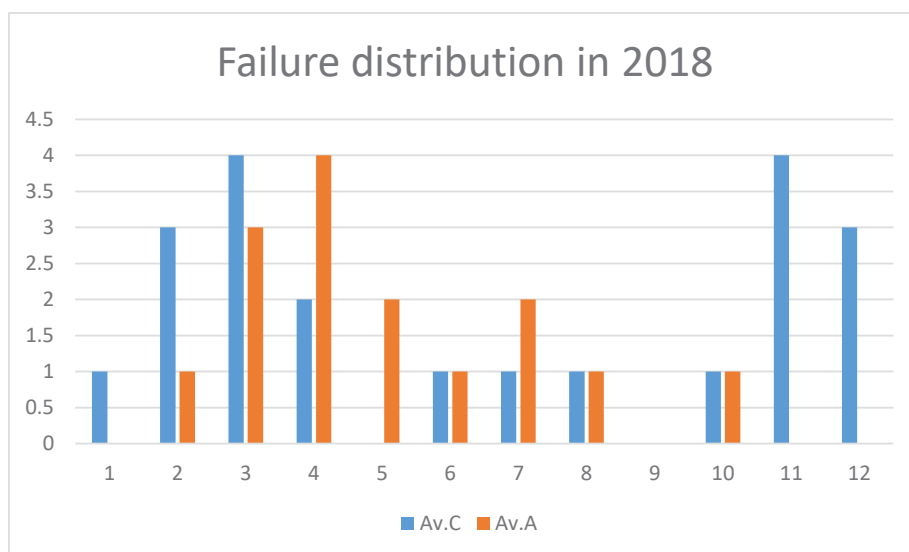


Fig. 4. *Distribution of failures in 2018*

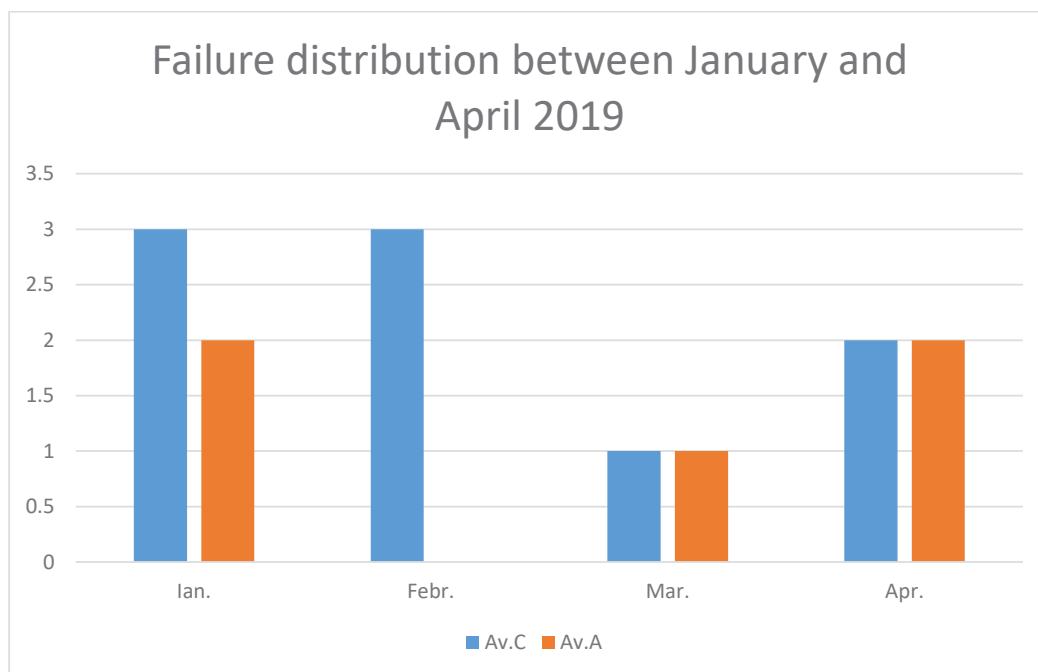


Fig. 5. *Distribution of failures between January and April 2019*

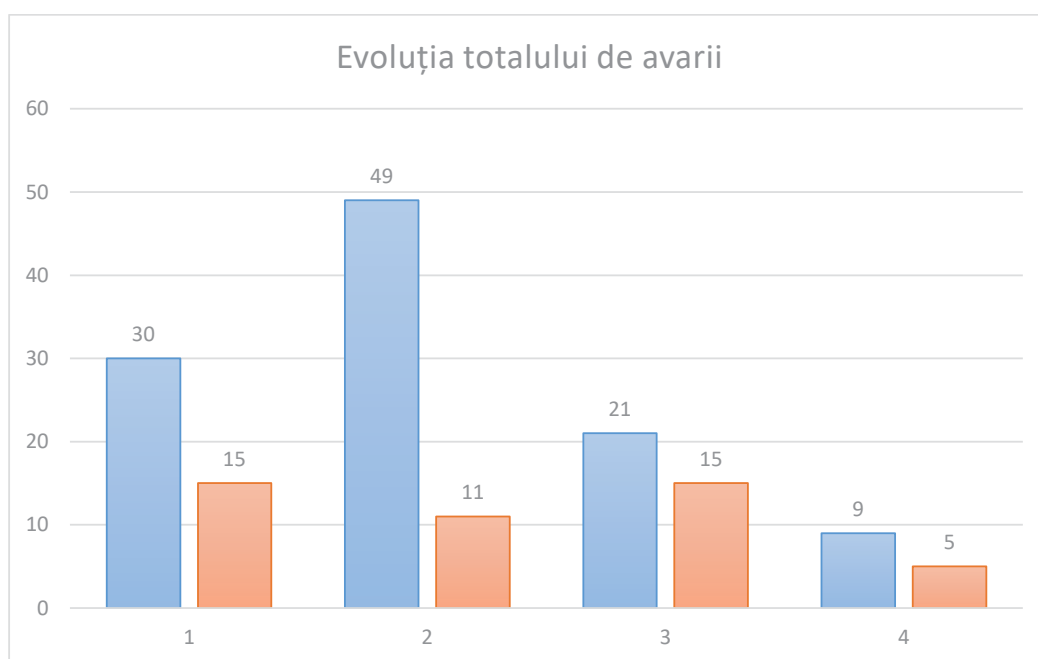


Fig. 6. *Evoluția comparativă a avariilor pe cei patru ani de studiu*

Evoluția costurilor este centralizată în tabelele 7 și 8. Aceste costuri reprezintă doar valorile cheltuite cu remedierea propriu-zisă a avariilor (fără a fi menționat costul cu pierderile de produse petroliere), dar sunt incluse costurile de ecologizare a suprafeței poluate cu țiței, în urma avariilor provocate.

Din figura 8 se constată că, deși a fost un maxim de 286488,50 U.M. atins în anul 2017, în anul 2018 numărul avariilor generate de coroziune a scăzut și în continuare sunt în scădere.

Evoluția costurilor asociate remedierii coroziunii, pe dimensiune conductă este prezentată în figura 7.

În tabelul 8 sunt prezentate costurile asociate remedierii celorlalte tipuri de avarii, pondere mare având avariile provocate (furturi).

Evoluția costurilor asociate remedierii celorlalte tipuri de avarii, pe dimensiune conductă este prezentată în figura 9.

Table 7 Evolution of the costs of repairing corrosion damage for different pipeline sizes

Pipeline Size	Year 2016	Year 2017	Year 2018	Year 2019*
	Corrosion damage repair costs, M.U.**			
4 in	0	0	9681,92	0
4in + 5in	7215,31	14788,16	2213,76	0
5in	0	2059,09	0	0
5 9/16 in	4393,69	0	7297	0
6 in	5163,90	0	0	24751,30
6in + 5in	0	0	1709,85	0
6 5/8 in	64039,75	64541,75	11932,81	0
8 in	4607,33	7398,53	1502,33	0
8 5/8 in	1567,55	0	6868,58	0
8in +6in	0	0	0	0
10 in	37911,25	7949,17	0	0
10 ¾ in	56547,83	0	16621,19	0
12 in	0	0	7685,42	7335,55
12 ¾ in	0	36503,68	0	0
14 in	3145,89	0	0	75218,38
14 ¾ in	0	0	0	0
20 in	3117,34	29344,37	107162,32	0
24 in	28961,75	101289,88	0	10917,93
28 in	5881,55	22613,86	0	0

** U.M. – monetary units

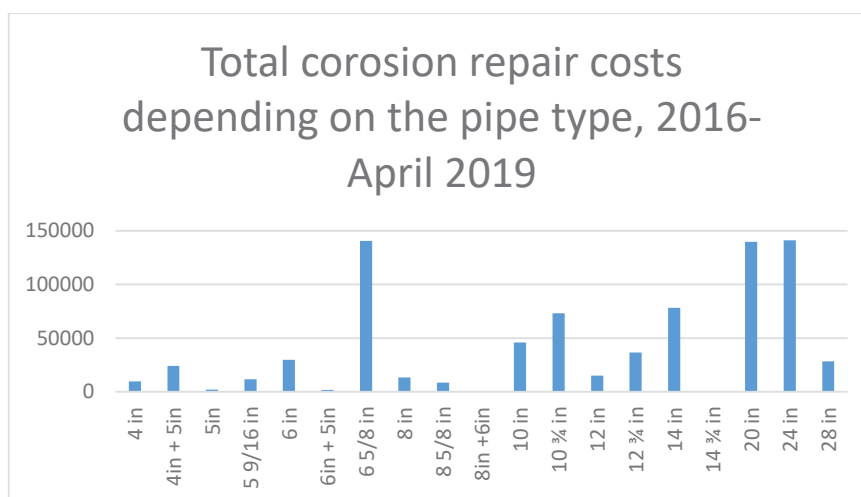
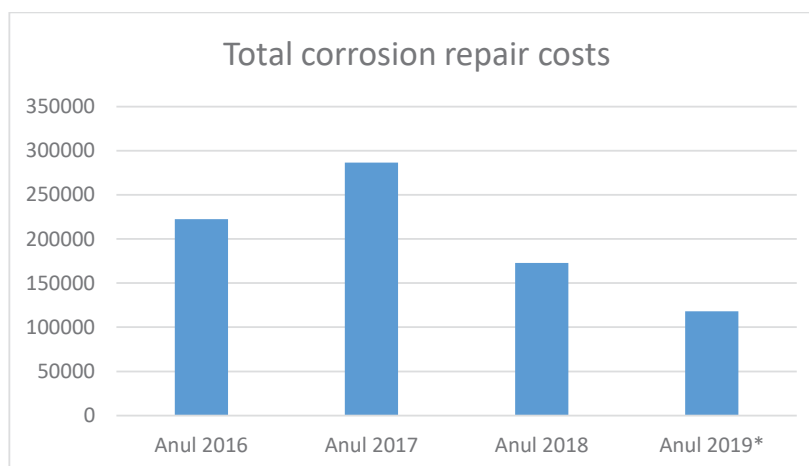
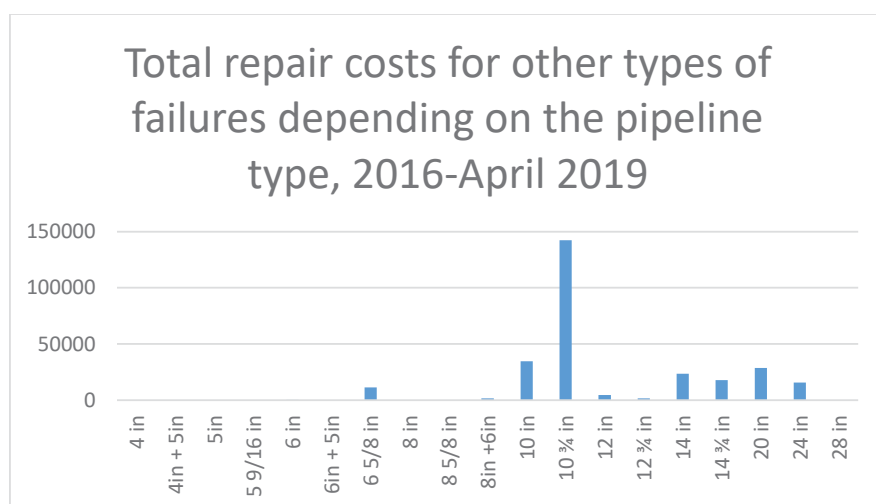
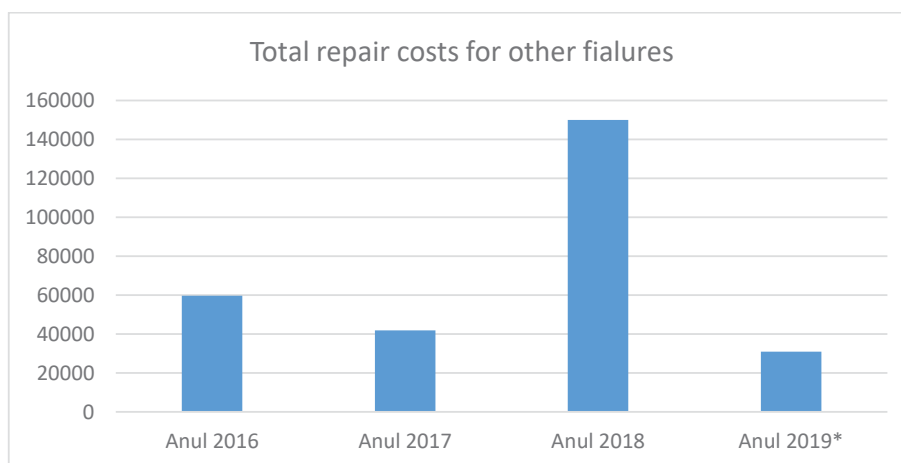
**Fig. 7** The costs associated with the fixing of corrosion, depending on the size of the pipeline**Fig. 8** Costs recorded for the repair of pipelines corrosion failures

Table 8 The costs associated with the fixing of the other types of failures

Pipeline size	Year 2016	Year 2017	Year 2018	Year 2019*
The costs associated with the fixing of the other types of failures				
4 in	0	0	0	0
4in + 5in	0	0	0	0
5in	0	0	0	0
5 9/16 in	0	0	0	0
6 in	0	0	0	336,31
6in + 5in	0	0	0	0
6 5/8 in	2327,28	2412,84	6710,60	0
8 in	0	0	0	0
8 5/8 in	0	0	0	0
8in + 6in	0	0	1743,28	0
10 in	0	7624,47	4580,62	22432,82
10 ¾ in	10309,43	9428,42	122637,59	0
12 in	0	0	2476,36	2180,84
12 ¾ in	1651,62	0	0	0
14 in	5617,93	6599,57	5383,80	6013,55
14 ¾ in	8350,75	9619,08	0	0
20 in	15834,76	6165,57	6555,78	0
24 in	15664,13	0	0	0
28 in	0	0	0	0

**Fig. 9** The costs associated with the fixing of the other types of failures for different sizes of the pipeline**Fig. 10** The annual costs associated with the fixing of the other types of failures

3. Conclusions

The highest values of corrosion fixing costs, as noted in Figure 7, are recorded for the 6 5/8 in, 20 in and 24 in pipeline. As a result, it is necessary to adopt measures to monitor corrosion and to apply preventive maintenance methods in the case of the sections displaying such sizes.

In 2018, as one can see in Figure 10 and Table 8, a maximum of 150088.00 M.U. was reached. Distributing this cost over the 12 months of the year, it results that the cost level is 12507.33 M.U./month. Doing the same analysis for the other calendar years, we found that, in 2016, the fixing of other defects represented 4979.65 M.U./month, while in 2017 this value decreased to the level of 3487.50 M.U./month. Although, in 2018, there was a 358% increase in costs compared to 2017, in 2019 - the cost was compared to the 4 calendar months - there was a decrease in costs to 7740.88 M.U./month.

References

1. <https://www.conpet.ro/>, accesat la data de 5 august 2019.
2. <https://www.wall-street.ro/articol/Companii/68296/Conpet-Este-posibil-sa-fim-nevoiti-sa-facem-disponibilizari.html>, accesat la data de 5 august 2019.

3. CONPET documentation

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