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The Diagnosis of Current Technical Status of Vertical Cylindrical Tanks from the BTX Technology Site

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Abstract

The security status of a system can be defined as the absence of the circumstances which can favor the disruption of system operation. From the application of this concept of the preliminary architecture of the system, it can identify events such failures, combined or not with human errors and external risk factors, which can induce states of insecurity. In this context, to ensure the safe operation supposed to have kept relevant and accurate information about the physical and functional managed system, which it can be translate, in fact, through the proof for monitoring and diagnosis capacity.

Key words: *corrosion, monitoring, diagnosis, mechanical breath valve, flame arrester*

Introduction

For technical systems such as parks of tanks for storage of the products with a high degree of toxicity (BTX), the monitoring of technical status it refers to the insurance of traceability about the functional parameters and the structural integrity instance equipment. These information it find again (or should be find again) accurately recorded in the books of inspection of the tanks. It insists in particular on the accuracy of records, because the next stage, of diagnosis, benefits and it is highly dependent on monitoring stage.
In this paper it tries to make an exercise to support the claims above, by analyzing the technical status of tanks from a storage BTX park located in a refinery area, the interpretation of obtained results by examination in situ (diagnosis) and adoption of decisions accordingly.

The Location of the Examined Equipment

The tanks 572A, 572B, 572C, 572D (in the square 13, parks: 8 / 7, 8 / 8, 8 / 9, 8 / 16, 8 / 5, 8 / 4, 8 / 12) and TK22A, TK22B, TK28A , TK28B (in K43 park) are for storage of benzene meant, 574A, 574B, 574C, 574D, 587, 588, 589, 574E (in the square 13, parks: 8 / 7, 8 / 8, 8 / 9, 8 / 16, 8 / 5, 8 / 4, 8 / 12) are for storage of toluene meant, and 704 (in the square 13, parks: 8 / 7, 8 / 8, 8 / 9, 8 / 16, 8 / 5, 8 / 4, 8 / 12) and TK11B (in K43 park) for storage of xylenes meant (table 1).

Table 1. The location of the tanks

Square 13, parks: 8/7, 8/8, 8/9, 8/16, 8/5, 8/4, 8/12					
No.	**Name of tank**	**The stored product**	**Capacity (m^3)**	**Type of cover**	**Station**
1	572A	Benzene	400	Fixed	RC
2	572B	Benzene	400	Fixed	RC
3	572C	Benzene	400	Fixed	RC
4	572D	Benzene	400	Fixed	RC
5	574A	Toluene	235	Fixed	RC
6	574B	Toluene	235	Fixed	RC
7	574C	Toluene	235	Fixed	RC
8	574D	Toluene	235	Fixed	RC
9	704	Aromatic heavy hydrocarbons (xylenes)	235	Fixed	RC
10	587	Toluene	235	Fixed	RC
11	588	Toluene	235	Fixed	RC
12	589	Toluene	235	Fixed	RC
13	711	Additive Keroflux	650	Fixed	AD
14	574E	Toluene	680	Fixed	RC
15	405	Refined	750	Fixed	RC
16	406	Refined	750	Fixed	RC
17	407	Refined	750	Fixed	RC
18	556A	Fr.C5-C6/ Refined	400	Fixed	RC
19	556B	Fr.C5-C6/ Refined	400	Fixed	RC
20	556C	N – pentane	400	Fixed	RC
K 43PARK					
1	M1	Methanol	800	Fixed	AD
2	M2	Methanol	800	Fixed	AD
3	R27A	Methanol	1000	Fixed	AD
4	R27B	Methanol	1000	Fixed	AD
5	TK22A	Benzene	1000	Fixed	AD
6	TK22B	Benzene	1000	Fixed	AD
7	TK28A	Benzene	2000	Fixed	AD
8	TK28B	Benzene	2000	Fixed	AD

The Estimated Technical Status of Tanks

Based on a rich program of inspection all tanks which are operating in the park above were examined, from point of view the structural integrity (the insulation condition, the protective coatings condition, the dimensional and shape deviations) and the functional one (the characteristics of stored fluid, the operating parameters, the functional status of safety and breathing equipment a.s.o.). Next it will be presented, for example, the results of findings in case of tanks 572 ... 572 D, 574 A ... 574 D, 704.
All the BTX cylindrical storage tanks are with vertical axis and fixed cover, having the constructive-functional characteristics presented in table 2.

Table 2. The constructive and functional characteristics of storage tanks for BTX meant

Tank name	The stored product	Capacity (m^3)	Diameter (m)	High (m)	Tank strapping (l/cm)	Cover type	Station
572A	Benzene	400	7,93	8,26	493	Fixed	Square 3
572B	Benzene	400	7,93	8,27	492	Fixed	Square 3
572C	Benzene	400	7,93	8,26	493	Fixed	Square 3
572D	Benzene	400	7,97	7,38	498	Fixed	Square 3
574A	Toluene	235	6,62	6,87	344	Fixed	Square 3
574B	Toluene	235	6,60	6,88	342	Fixed	Square 3
574C	Toluene	235	6,62	6,88	344	Fixed	Square 3
574D	Toluene	235	6,58	6,87	340	Fixed	Square 3
704	Aromatic heavy hydrocarbons (xylenes)	235	6,62	6,91	344	Fixed	Square 3
587	Toluene	235	6,61	6,87	343	Fixed	Square 3
588	Toluene	235	6,61	6,87	343	Fixed	Square 3
589	Toluene	235	6,65	6,83	347	Fixed	Square 3
574E	Toluene	680	8,99	10,82	635	Fixed	Square 3
TK22A	Benzene	1000	11,94	11,74	1119	Fixed	AD
TK22B	Benzene	1000	11,94	11,74	1119	Fixed	AD
TK28A	Benzene	2000	15,15	11,75	1802	Fixed	AD
TK28A	Benzene	2000	15,15	11,75	1802	Fixed	AD

Findings Related to Technical and Functional Status of the Tanks of Benzene

- 572A ... 572D tanks have both, the visible strains insulation of mantle and the cover.
- It noted the absence of insulation in places.
- The respiratory equipment on the tank cover is completely unworkable.

Fig. 1. The respiratory safety equipment, not working, completely rusty

Fig. 2. The holes for taken samples, opened, in direct contact with the atmosphere

- There is an advanced corrosion in the sheet cover of the insulation which protects the shell of the tanks.
- There are untightnesses by the protection sheet of the insulation in the joints and in the manhole, which it produces the increased wetting of the insulation, leading to an advanced corrosion at the sheet of mantle.
- It is necessary to check the wall thickness of the mantle and to check deviations of circularity by manhole of the tank TK22B.

Fig. 3. TK28A, TK28B tanks location

- There is an advanced state of corrosion of protection sheet for mineral wool.
- The insulation and the protection sheet are partially destroyed by connecting technological pipelines of tanks.
- The respiratory safety equipment is functional, but the hole for samples taken is situated in the open position, in direct contact with the atmospheric environment.
- There are permanent vapor emissions of stored products in the atmosphere.
- There is an imminent danger of self-ignition of the vapors and tank gets fire.

Fig. 4. The TK28A, TK28B tanks physical status

Findings about the Technical and Functional State of Toluene Tanks

- 574A ... 574D tanks, which store toluene, are tanks without heat insulation, each with security respiratory system provided, outdated, unworkable, and the vapor emissions are directly discharged into the atmosphere by keeping the holes for samples taken in the open position.

Fig. 5. The 574A tank, having the respiratory equipment outdated and unworkable, with the discharge of emissions into the atmosphere through the manhole

Fig. 6. The 574B tank, having the respiratory equipment outdated and unworkable, with the discharge of emissions into the atmosphere through the manhole

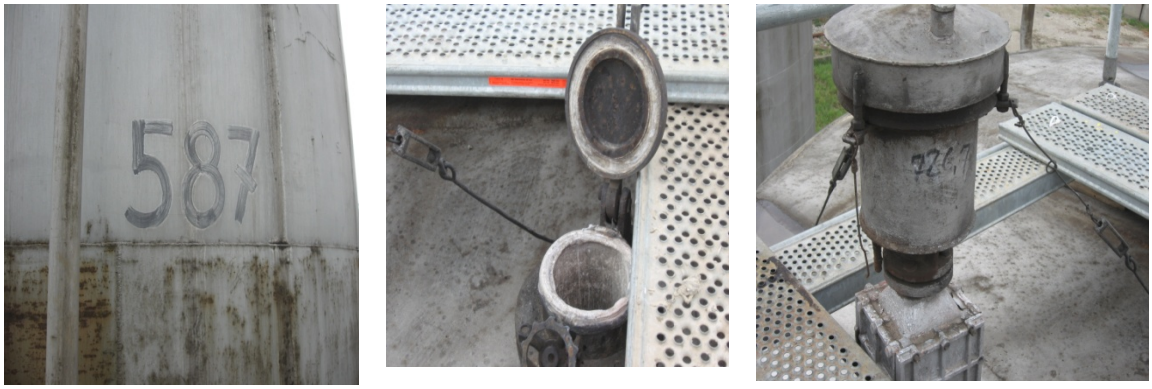

Fig. 7. The 587 tank, provided with a safety respiratory equipment outdated and unworkable, with the holes for samples taken opened

Fig. 8. The 587 tank, provided with a safety respiratory equipment outdated and unworkable, with arrester flame and mechanical breathing valve

- There is a total unfunctionality in terms of the equipment. The respiratory safety equipment is outdated, physically and morally worn;
- Currently, the tank works with the ventilation holes opened, allowing the vapor emissions of stored product, which it leads to security and safety in working almost nonexistent;
- In addition continues pollution of the atmosphere, there is a real danger of the tank get fire;
- It notices an advanced corrosion phenomenon at the bottom-mantle junction;

Fig. 9. The tank 587 presents an advanced corrosion at the bottom-mantle junction

Findings about the Technical-Functional State of Tanks for Xylenes

- There is a total unfunctionality in terms of safety respiratory equipment;
- Currently the tank works with ventilation holes opened, causing vapor emissions of stored product into the atmosphere, leading to very low safe operating and to the imminent possibility of the tank get fire.

Fig. 10. The tank 704, equipped with a safety respiratory system outdated and inoperative, having the holes for samples taken and for light opened

The Diagnosis of Technical Condition by Researched Equipment. Measures which It Imposes for Restoration of Functional Capacity

- It is necessary to determine the flow of breath for tanks which store benzene;
- The respiratory equipment (arrester flame, mechanical breathing valve, hydraulic security valve) must be completely replaced;

- It recommends the examination of assemblage possibilities for safety valves with flap (only in terms of overpressure) on the cover of tanks;
- It requires an appropriate respiratory safety equipment for every each tank (replacing the existing one, which is fully unoperational, physically and morally worn);
- It requires to adopt an adequate breathing equipment for the next period of working;
- For full security and minimize the risk of cracking at basic ring material, and pollution of the soil with the product, should be removing from service the tank 587, until the completion of the tightness and metal wall thickness checks.

Conclusions

- 572A ... 572D tanks have insulation on the outside, both in the mantle and in the cover of tanks. There are visible strains both in the insulation of mantle and in the cover. The insulation is missing in places;
- The 572D tank, presents a major risk of fire, because of favorable factors concerning the risk of some sparks occurrence: lack of sealing materials at the light holes, inoperative respiratory equipment, the hole for samples taken opened, the mineral wool which is the insulation of mantle and of the cover in direct contact with any spark or flame that might appear;
- The tanks 574A ... 574D, which store toluene, are tanks without heat insulation, each with safety respiratory system equipped, outdated, unworkable, and vapor emissions are directly discharged into the atmosphere by keeping the holes of samples taken in the open position.
- The 574E tank presents a good physical status, both the mantle and cover, in the riveted joints, but the access scale up to the tank, the responsible staff for monitoring and maintenance, have a major danger of accident due to damage rested bridge located at half of the scale. It requires the repair and verification the access scale on tank. The status of tank being good, it ascertains the equipping its with modern automatic measurement system, but the hole of samples taken maintaining in the open position, may lead to imminent fire and serious damage both the tank and the measurement system.
- Finally, it considers, we believe that the most efficient solution for avoiding a major accident, is the objective automated monitoring of tank parks and the diminution of vapor emissions by measures in accordance with environmental legislation taking.

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Diagnoza stării tehnice curente a rezervoarelor cilindrice verticale din site-ul tehnologic BTX

Rezumat

Starea de securitate a unui sistem poate fi definită ca reprezentând absența circumstanțelor ce pot favoriza perturbarea funcționării sistemului. Pornind de la aplicarea acestui concept al arhitecturii preliminare a sistemului, se pot identifica evenimente de tipul defectărilor, combinate sau nu cu erori umane şi factori de risc exteriori, ce pot induce stări de insecuritate. În acest context, a asigura funcționarea în condiții de siguranță presupune a avea în permanență informații pertinente şi exacte în legătură cu stările fizice şi funcționale a sistemului manageriat, ceea ce se traduce, de fapt, prin a dovedi capacitate de monitorizare şi diagnoză.