Abstract. The problems of the state fire supervision inspectors’ work were observed. A detailed analysis of the instructions elaborated by fire supervision inspectors on eliminating violations in the area of fire safety at the production plants "Atmospheric and vacuum pipe heater" located on the premises of Oil Refinery Joint Stock Company "Uфанефтехим" and "Electric desalting plant" on the territory of Refinery Joint Stock Company "Ufa Refinery". The causes of the fires during ten years at the production facilities were identified and analyzed.

The analysis of the violations at the "Atmospheric vacuum distillation unit - 2" of Oil Refinery Joint Stock Company "Uфанефтехим" was conducted by the fire control inspectors on causal connection with the ongoing fires.

The acts of commission investigating the causes of fires were analyzed. These acts were created after extinguishing the fires that occurred at the "Electric desalting plant of Atmospheric vacuum pipe heater-6" at JSC "Ufa Refinery". The proposed measures to enhance fire safety facilities developed by members of Incident Investigation Commissions were studied.

A conclusion was made that there is a need to study the acts compiled by the
Accident Board after the fires and incidents; in these acts they design measures to prevent fire situations on the premises of oil refineries, and there is a necessity to improve regulations in the field of fire safety.

After considering the requirements made by the fire supervision and acts issued by the accident board it has been suggested that the work of the state fire supervision inspectors should be linked with work of the accident board created following the fires. It was proposed that in the process of the regulations development the incident investigation acts should be studied; these acts should concern the incidents in the territory of oil refineries if the Republic of Bashkortostan. It was suggested that regulatory documents in the field of fire safety were enhanced with due account for the measures proposed in the acts of incident investigation at oil and gas enterprises.

Аннотация. Рассмотрены проблемы работы инспекторов государственного пожарного надзора, произведен детальный анализ разработанных инспекторами пожарного надзора предписаний об устранении нарушений в области пожарной безопасности на производственные установки «Атмосферно-вакуумная трубчатка» (АВТ), расположенные на территории нефтеперерабатывающего завода открытого акционерного общества «Уфанефтехим» и «Электрообессоливающая установка» (ЭЛОУ) на территории нефтеперерабатывающего завода открытого акционерного общества «Уфимский нефтеперерабатывающий завод». Выявлены и проанализированы причины возникновения пожаров за десять лет на производственных установках «Атмосферно-вакуумная трубчатка» и «Электрообессоливающая установка» на территории нефтеперерабатывающих заводов открытого акционерного общества «Уфанефтехим» и открытого акционерного общества «Уфимский нефтеперерабатывающий завод».

Проведен анализ нарушений на установке «Атмосферно-вакуумная трубчатка-2» нефтеперерабатывающего завода открытого акционерного общества «Уфанефтехим», выявленных инспекторами пожарного надзора
по причинно-следственной связи с происходящими пожарами.

Проанализированы акты комиссий, расследовавших причины возникновения пожаров, созданных после ликвидации пожаров, произошедших на установке «Электрообессоливающая установка атмосферно-вакуумной трубчатки-6» открытого акционерного общества «Уфимский нефтеперерабатывающий завод». Рассмотрены меры, предложенные по усилению пожарной безопасности объектов, выработанные членами комиссий по расследованию инцидентов.

Сделан вывод о необходимости изучения актов аварийных комиссий, созданных после пожаров и инцидентов, в которых разрабатываются меры по предупреждению пожаров, возникающих на территории нефтеперерабатывающих предприятий и необходимости совершенствования нормативных документов в области пожарной безопасности.

После рассмотрения предписаний пожарного надзора и актов аварийных комиссий, предложено связать работу инспекторов государственного пожарного надзора с работой аварийных комиссий, создаваемых после возникновения пожаров. Предложено при разработке предписаний пожарного надзора об устранении нарушений в области пожарной безопасности изучать акты расследования инцидентов на территории нефтеперерабатывающих заводов нефтегазовой отрасли Республики Башкортостан. Предложено совершенствование нормативных документов в области пожарной безопасности с учетом мероприятий, предлагаемых в актах расследования инцидентов предприятий нефтегазовой отрасли.

**Key words:** fire safety, oil and gas industry, atmospheric vacuum pipe heaters, CDU AVT, labor protection, JSC "Ufaneftekhim", JSC "UNPZ".

**Ключевые слова:** пожарная безопасность, нефтегазовая отрасль, атмосферно-вакуумная трубчатка, ЭЛОУ АВТ, охрана труда, ОАО «Уфанефтехим», ОАО «УНПЗ». 

Nowadays, we more often hear about fire safety issues at hazard locations on the television and other mass media. Society develops and increase of fire safety is becoming of vital importance.

According to the reviews of facility protection representatives in the Russian Federation, which are subject to fire supervision check, the inspectors often put forward requirements which are difficult to meet [1]. There are wrongfully justified requirements made by fire supervision inspectors. Moreover, the problem of the effectiveness of fire supervision inspectors is becoming more and more important. This poses the question, “What would happen if the fire control inspector did not come to the site and not "disturb" with constantly detected violations of fire safety? It is believed that the number of fires would not increase due to this. This is especially important for the large facilities where the violations are detected in large numbers, approximately 300-400 violations per inspection. These are oil and gas industry refineries. Therefore, the relevance of the chosen theme can be considered valid.

In this work to scientific novelty we can refer the proposal to link the work of the state fire supervision with that of hazard locations representatives working as part of fire investigation commissions, it’s also possible to draw conclusions and develop suggestions to improve the effectiveness of fire supervision inspectors’ work.

Let’s analyze the effectiveness of the violations identified by fire supervision inspectors and the effectiveness of emergency commissions at oil and gas facilities in the Republic of Bashkortostan (further in the text - RB).

Let’s perform an analysis of the causes of fires at production plants “Atmospheric and vacuum distillation units” of “Ufaneftekhim” (further in the text - JSC “UNH”) for the period from 1998 to 2009. According to the statistics, during these 12 years the fires at the production plant “Atmospheric vacuum distillation unit” (further in the text - AVT) in the territory of “UNH” occurred due to the following reasons: self-ignition of pyrophoric compounds of immersed refrigerator bundle; depressurization of pump drain valve, wearing out
of the pipeline with sludge pump, a rupture occurred as a result of design errors; autoignition of soaked insulation from the tracer, a fire occurred due to gasoline condensate falling onto hot pipelines between the column K-5 and heated pumping station, spontaneous combustion; passing of flanged connection on the line of inhibitor supply to the “shlen” followed by ignition of the steam- heated pipe line; corrosive wearing off and tearing of the pipeline; getting of oil in tars and pipe insulation and auto ignition; poor organization of flammable and fire hazardous work; lack of sensors of signaling and blocking bearings temperature, poor service, late implementation of the project; violation of technological regulations of the production process; passing of tube pump - a violation of technological regime; smoldering debris in the pit under the transformer capacity 0.4 kV, during hot work a “candle end” was left on flammable materials in the danger zone of the welding [2,3].

Thus, eleven fires resulted from violation of process safety rules. Two fires occurred due to the violation of fire safety during hot work.

The fires due to process security breach could have been avoided if measures had been taken timely to improve the process equipment and (or) the maintenance or total overhaul.

The fires due to violation of fire safety rules during hot work could have been avoided if measures had been taken timely to conduct briefings and a strict control of the personnel performance by supervisory authorities (health and safety, fire safety).

Now let’s perform an analysis of the violations revealed by fire supervision inspectors for a causal relationship with the ongoing fires. At the production plant AVT-2 of “UNH” the state fire supervision revealed the following violations: the shield by the open cold pump and AUG wasn’t mounted (elimination of this violation does not prevent the cause of the fires, but only saves from the danger of escape routes in case of fire); the fixed fire extinguishing installation wasn’t converted to automatic start mode (elimination of this violation does not prevent the cause of the fires, but only protects the
structure from fire spreading and destruction of supporting structures in case of fire); the flange (near gate) of open cold pumping is violated (elimination of this violation does not prevent the causes of fire, but only protects the structure from fire spreading); the alkali room is not equipped with an automatic fire alarm installation (causes of fire are not associated with the need of fire alarm in the alkali room); there are no emergency buttons of ventilation cut-off on CDU AVT-3 near the emergency exits outside the cold pump (absence or presence of emergency buttons can affect the safety during evacuation, the rate of fire spread, but not the cause of the fire) [4].

Let’s perform an analysis of the fires at CDU AVT-6 of JSC “Ufa Refinery” in connection with the acts of commissions established after the fires.

On January 22, 2006 a fire occurred at CDU AVT-6 of JSC “Ufa Refinery” (further in the text - UNPZ). The cause of the fire was: technical – destruction of the pipeline due to the internal pressure at low temperatures; organizational - lack of control by production specialists, the absence of operating procedure manual for periodically functional oil pipeline.

The planned activities to enhance fire safety proposed by the commission investigating the causes of the fire were as follows:

- to conduct a survey of technical devices, metal structures, electric wiring, cables, control and measuring instruments in high temperature zone;
- to reconstruct the damaged technical devices, metal structures, maintenance floor, cable tray system, power utilities, measuring instruments, thermal insulation etc;
- to replace the emergency section of pipeline, to inspect the technical state and define the appropriateness of the examination of industrial safety of technical devices in the zone of the heat exchangers;
- to complement the technological installation instructions by making requirements for the safe operation of a batch (deadlock) pipes in heating mode;
- to develop and implement measures to improve the level of safety in the case of exploitation of CDU AVT-6 at low temperatures;
- to hold an extraordinary briefing on labor protection;
- to convene an extraordinary test of industrial safety knowledge;
- to supplement timely the lists of current deadlock and periodically functional pipelines;
- to give an assignment to design and perform the installation of thermocouples on pipelines;
- to install heat tracing pipeline.

On June 9, 2006 a fire occurred at CDU AVT-6 of JSC “UNPZ”. The cause of the fire was: technical - depressurization of the pipeline due to fatigue failure of the metal in the heat affected zone of the weld; organizational - operation of the pipeline with expired standard operation life in the absence of positive industrial safety expert report with the residual life stated. The planned activities to enhance fire safety were as follows:

- to perform a survey of technical devices, metal structures, electric wiring, measuring instruments communications in the high temperature zone;
- to replace the packing material of valves and flanged connections in the high temperature zone;
- to replace pipelines with due account for the calculation of the self-compensation possibility from temperature deformation;
- to produce pipeline test on leak in the zone of high temperatures.

On June 29, 2005 a fire occurred at CDU AVT-8 of “Novoufimsk Refinery” (further in the text - NUNPZ ). The cause of the fire was: technical - uneven local erosive wear of the eighth shell portion of K-2 made of metal 15K in the intermediate irrigation zone between the plates 17 and 18. The planned activities to enhance fire safety were as follows: to make pipes revision, valves in the zone of fire, to develop the project and replace the worn-out column K-2 with a new column, to conduct a briefing.

On October 22, 2002 a fire took place at AVT-6 of JSC “UNPZ”. The cause of the fire was: technical - sharp temperature deformation of the pipeline as a result of being hit by hot product (1000°C) without gradual pre-heating;
organizational - temperature pumping from the unit G-43-M 107/1 is not regulated. The planned activities to enhance fire safety were as follows: to make additions to the regulations on the pumping of oil from the plant G-43-107-M/1 to the line substandard AVT-6 by temperature parameter, to consider the removal of the pipeline to the surface.

On July 2, 2001 there was a fire at AVT-6 of JSC “UNPZ”. The cause of the fire was: technical - deposits of insoluble silicon oxides, aluminum, calcium, iron in the furnace coil; work of the furnace P-3 for 30 days without filing the pipe coil with steam (dry distillation, as recommended by the company “Koch – Glitsch”). Officially, there are no organizational causes of the fire. The planned activities to enhance fire safety were as follows: to perform steam burn-off of the coke of the furnace coil P-3; to revise furnace P-3 and replace the defective pipe, to disable swapping imported petroleum residues in the raw of AVT-2, to mount a controlled system of steam-cleaning of the coils of furnace P-3 by the repair in 2002.

On March 15, 2000 a fire occurred at AVT -6 of JSC “UNPZ”. The cause of the fire was technical – valve DN 500, PN 40 (Gemany-manufactured) was installed in the pipeline of transfer line of furnace P-1/3. As a result of long-term operation metal fatigue occurred that led to the breakage of thee wedge gate. There are no official organizational causes and fire damage. The planned activities to enhance fire safety were as follows: to repair the valve DN 500, PN 40 on the transfer line furnace of P-1/3, to replace valves DN 500 - 3pc. on transfer lines furnaces P-1/ 1, P-1/2, P-1/3 as obsolescent.

On May 5, 1998 a fire occurred at AVT-6 of JSC “UNPZ”. The cause of the fire was: technical – valve DN 200, PN 40 (Germany-manufactured) was installed in the pipeline exit 1 of flow furnace P -1/2 in the transfer line of K- 2 with a defect in the housing wall, where the skipping was discovered (Conclusion of Engineering Supervision Department of JSC “UNPZ” as of 08.05.1998), organizational – in the event of process shutdown of unit No.4 temperature fluctuations were admitted, which led to partial depressurization of
the flange connection of the transfer line directly from the column K-2 with spontaneous oil ignition. Officially there is no fire damage. The following measures were taken: to replace the valve, to measure the residual wall thicknesses of all the valves on the flow furnaces lines, to check the hardness of the conducted flange steel located in the area of fire, to consider installing a transfer valve on the line directly by the column K-2, to instruct.

On January 5, 1997 a fire occurred at AVT-2 of JSC “UNPZ”. The cause was that the discharge welding of carbon steel tapping was installed instead of the steel tapping 08Cr18Ni10Ti. Officially there is no fire damage. The planned activities to enhance fire safety were as follows: to replace the removal of carbon steel with steel 08Cr18Ni10Ti; to issue a decision on the state of the pipeline and the possibility of safe operation of the pipeline; to introduce branding pipeline elements indicating the serial number in the log based on the results of steeloscope.

On December 14, 1996 a fire broke at AVT-2 of JSC “UNPZ”. The cause of the fire was that the electric dehydrator ED-1 was under repair, a plug was installed on the incoming condensate pipeline proceeds by ED-1, water trapped with raw materials accumulated in the formed dead-end area; and defrostization and laying squeezing-out took place in the closed water supply line, the dead-end section of the pipeline had not been heated and the monitoring of the state by the operating staff was not installed. The planned activities to enhance fire safety were as follows: before launching the electric dehydrator ED-1 to warm the dead-end pipe section of incoming condensate.

On April 30, 1996 a fire occurred at AVT-6 of Order of Lenin Ufa Oil Refinery. The cause was auto ignition of gummed oil soaked in insulation as a result of a slight transmission rate of diesel fuel vapor in the flange connection of the vapor outlet line K-9. The skipping is the result of vapor shut off in the column. The planned activities to enhance fire safety were: to replace the gasket flange connection of exit vapor pipe from K-9, to open vapor receipt into columns in series and at steady pace.
On October 14, 1994 a fire happened at AVT-2 of JSC “UNPZ”. The cause was the fault of the gauge of gas-liquid separator E-2, because of which the E-2 was filled with a liquid product followed by a liquid phase entering the oven injectors. Officially there is no damage. The planned activities to enhance fire safety: to retrofit the reservoir with a liquid level alarm [5].

Naturally, the elimination of a violation identified by fire supervision inspector, such as mounting the shield will not prevent the cause of the fire, for example, because of the gauge malfunction that caused the one of the fires. At the same time, equipment of reservoir with a liquid level alarm proposed in the act of an emergency commission could prevent the cause of a fire due to a fault gauge.

Conclusions

Thus, after comparing all the causes of fires and violations observed by inspectors a conclusion was made that none of the causes of fires was related to the violations found by fire supervision inspectors. The causes of fires at AVT of JSC “UNH” and JSC “UNPZ” are identical in nature. The activities proposed after the occurrence of fires and acts specified in emergency commissions do not coincide with the violations revealed by State Fire Supervision. At the same time the activities proposed by the Commission organized after the fires are directly related to the elimination of the causes of fires [6]. Inspections by State Fire Supervision do not prevent the occurrence of fires and emergency commissions generated after fires are effective in efforts to prevent future fires.

State Fire Supervision identified five violations at AVT of JSC “UNH”. After their elimination none of them could prevent the fire during the twelve years since the detected violations of fire safety requirements do not eliminate causes of fires. Fire Inspection operates inefficiently, if it did not exist, fires would still occur in the same amount and with the same consequences. The question is, do we need the fire inspection?

The inefficiency of Fire Inspectors takes place for several reasons:
- before drawing up regulations by bodies of Fire Inspection the causes of previous fires are not examined and not linked with the proposed activities;
- there is no connection between the causes of fires and the requirements in the regulations;
- there is no link between emergency commissions, working after the fire and State Fire Inspections examining the hazard locations before fire;
- a low level of state fire inspection and detection of violations is maintained;
- a low level of regulatory literature is maintained [7].

In connection with the previous proposal it is suggested that:
- Fire State Inspector should analyze acts of emergency commissions created after the fires and incidents, and take it into account when elaborating regulations,
- regulatory documents should be improved in the field of fire safety, and the requirements directly connected with causes of fire should be highlighted as priority requirements in fire safety.

**References**

1  In anticipation of the fire inspection. 
http://www.comcom.ru/baza_znanij/detail/11433/


4  Orders to eliminate violations of fire safety requirements of the State Fire Supervision "Ufaneftekhim", Ufa, 2005. 10 p. [in Russian].


7 Bakirov I.K. What should be done to effectively scan objects in the field of fire safety// Fire safety in construction. 2011. Number 11. pp. 43-46. [in Russian].

Список используемых источников


2 5 отряд Федеральной противопожарной службы по Республике Башкортостан //Журнал учета пожаров Государственного учреждения. Уфа, 2009. 135 с.

3 Хафизов Ф.Ш. Нормативные документы и проблемы в области пожарной безопасности на производственных объектах в Республике Башкортостан//Промбезопасность – Приуралье: ежемес. информ.-аналит. журн. 2012. № 10(41).С.14-17

4 Предписание по устранению нарушений требований пожарной безопасности Государственного пожарного надзора «Уфанефтехим», Уфа, 2005. 10 с.


6 Бакиров И.К. Отношение к пожарной безопасности в России. Государственный пожарный надзор и пожарные риски // Пожарная безопасность в строительстве. 2010. № 5. С. 26-27

7 Бакиров И.К. Что надо сделать, чтобы эффективно проверять объекты в области пожарной безопасности //Пожарная безопасность в строительстве. 2011. № 11. С. 43-46
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