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SPECIAL ISSUE ON "SCIENTIFIC-PRACTICAL INNOVATIVE FOUNDATIONS OF FIRE SAFETY AND PREVENTION OF SERIOUS CONSEQUENCES"

Determination Of The Additional Aspiration Coefficient Formed In The Combustion Zone

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Abstract:

In the article, the need to study the indicators of the movement of dangerous air currents in motion and to limit the spread of these movements in the environment, to determine the parameters of aspiration currents in the environment, is scientifically justified. "Improving the tactics of localization and elimination of emergency situations using the coefficient of aspiration flow" and localization, taking into account the additional air flows absorbed during combustion, in particular, through solutions based on the results of research, which are becoming one of the most urgent issues in the field of fire safety to prove.

Keywords: emergencies, wind flowers and coordinate points, aspiration, fire, wind speed, anemometer, temperature rise, combustion zone, additional convection current

Introduction

Although many scientific researches have been carried out in the world today to find solutions to problems in the field of organizing life and health protection of people in emergency situations, emergency situations and fire prevention, development of various rescue tools and methods and there are still problems waiting to be solved in terms of improving the existing ones. Based on the data of CTIF International Association of Fire and Rescue Services, "When analyzing the fire disasters of the last five years, an average of 7-8 million fires occurred in one year and 80-90 thousand people died(S. T. Ruziev, 2022). Taking into account the fact that, in this direction, it is necessary to develop and put into practice a system for preventing the rapid spread of fire. In this regard, the production of systems

for quick detection and elimination of fire in public and residential buildings using the device for determining the coefficient of aspiration flows in combustion is an important task.

A number of scientific studies aimed at the development of special sensors, fire protection structures, modern fire extinguishing technical equipment and mathematical algorithms aimed at preventing fire disasters are being carried out. In this regard, special attention is paid to determining the coefficient of aspiration flows during the burning of materials in public and residential buildings, and to preventing and reducing the formation of a combustible environment, sources of ignition, and the ways in which fire can spread.

For this reason, conducting research on the prevention and elimination of emergency situations, in particular, the effective provision of fire safety, is becoming one of the most urgent issues of today.

The purpose of the research: to determine the additional convective flow in the pipeline, the rate of fire spread, the coefficient of smoke formation through the device created to determine the additional aspiration coefficient formed in the combustion zone and as a result, to quickly determine the characteristics of the development of man-made emergency situations through this device is to increase the efficiency of distribution of forces and means for decision-making.

The scientific novelty of the research is as follows: Equipment for determining the coefficient of aspiration flows in the combustion of materials was developed;

during the combustion of materials, it was possible to determine the dependence of the aspiration currents formed in the combustion zone on the speed of the additional air flow, as a result, the additional convective flow may occur due to the direct flow of insufficient air into the combustion zone identified;

The optimal options of the level of activity of the "center of additional aspiration flows" are four-sided (the angle between the determined points is 90°,) or (the three-sided determined the angle between the points is 120°,) has been scientifically proven.

When measuring from four sides, all sides of wind flowers and coordinate points are taken into account, but this option is limited to local conditions (water barriers, location of adjacent buildings and structures, mandatory proximity to emergency situations) and emergency situations it was found possible.

In laboratory conditions and during the research process of the experiment, the activity of the "center of the formation of additional aspiration flows" can be carried out simultaneously and/or no more than ±1 minute, and the speed of the surrounding wind is 15 seconds, and the research process of the experiment is after 10 seconds. The process of formation of aspiration flows is determined.(S. Ruziev & Suleymanov, 2020)

2-Methods

Determination of the coefficient of aspiration flows in the combustion of materials.

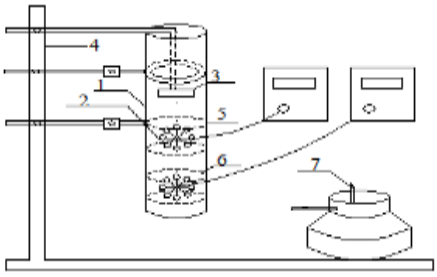
"Improving the tactics of localization and elimination of emergency situations using the coefficient of aspiration flow" and consists of localization, the development of a device for determining the coefficient of aspiration by taking into account the additional flows absorbed during combustion, namely pre-prepared tactical exercises o to reduce the risk of emergency situations as much as possible, and in the event of such situations, to protect people's health, to reduce the amount of damage to nature and the environment, and to reduce the amount of material losses.

The device used in scientific research includes a combustion chamber attached to a tripod, and a mechanism for inserting a sample of the material under test into the center of the combustion chamber

and holding it in a given position is fixed on the tripod, and a burner is installed under the combustion chamber to ignite the sample.

Inside the combustion chamber, there are two anemometers in a row under the sample of the material being tested, and each anemometer has a corresponding potentiometer, which is measured in power sensors, which, as a result of the rotation of the anemometer blades, directly from the potentiometer It determines the movement speed of the wind in the output power sensors. It can be seen that during the combustion of materials, the aspiration currents formed in the combustion zone allow to determine the dependence of the speed of the additional air flow.

As a result, it was shown that the additional aspiration flow occurs due to the absorption of insufficient air directly into the combustion zone. As a result, the schematic view of the device (picture.1) developed for the detection of additional aspiration flows caused by the burning of materials in the combustion zone is presented below.

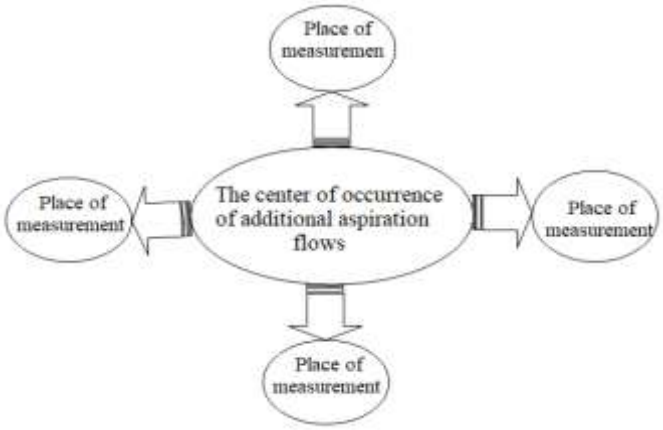


Picture 1. A view of the device for determining the coefficient of aspiration in the open field.

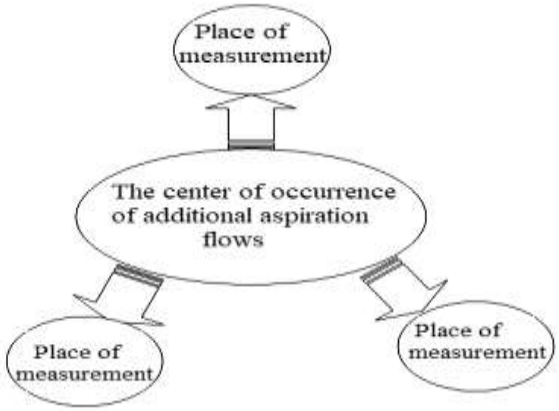
The measurement of additional convection currents in a special ceramic tube allows for a correct assessment of the situation. This, in turn, creates an opportunity to use available forces and tools more efficiently during emergency situations.

According to the conducted experiments, during the test process, it was confirmed that there is a clear connection between the fire hazard that appears during the burning of substances and materials and the appearance of aspiration currents.

The optimal options for the level of activity of the "spot of additional aspiration flows" are four-sided (the angle between the detected points is 90°, pic.2) or (three- suddenly detected "the angle between the points is 120°, pic.3) constitutes.

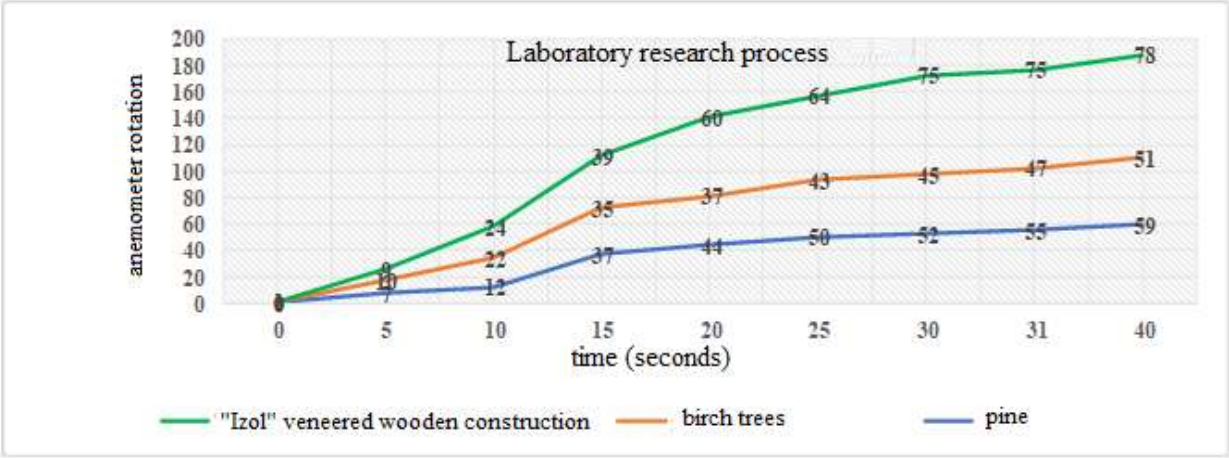


Picture 2. Option to measure from four sides



Picture 3. Option to measure on three sides

When measuring from four sides, all sides of wind flowers and coordinate points are taken into account, but this option is limited to local site conditions (water barriers, location of adjacent buildings and structures, mandatory proximity to emergency situations) and emergency situations. possible The results of the test to determine the additional aspiration flows in the laboratory conditions of the wooden structure (pine, birch trees, as well as the wooden structure covered with "Izol" combustible insulating material) are shown graphically in picture 4.



Picture 4. Additional aspiration flows from the fire source during the burning of structures.

The level of measurement of the activity of the "Center for the formation of additional aspiration currents" can be carried out simultaneously and/or not more than ±1 minute.

The test results of the construction structures showed the formation of aspiration flows in the initial period of the combustion zone according to the linear equation shown in the graph below.

$$У_1 = 19_x - 19 \quad (1)$$

Then, after 10 seconds, refraction occurs and the description of the linear equation changes as follows.

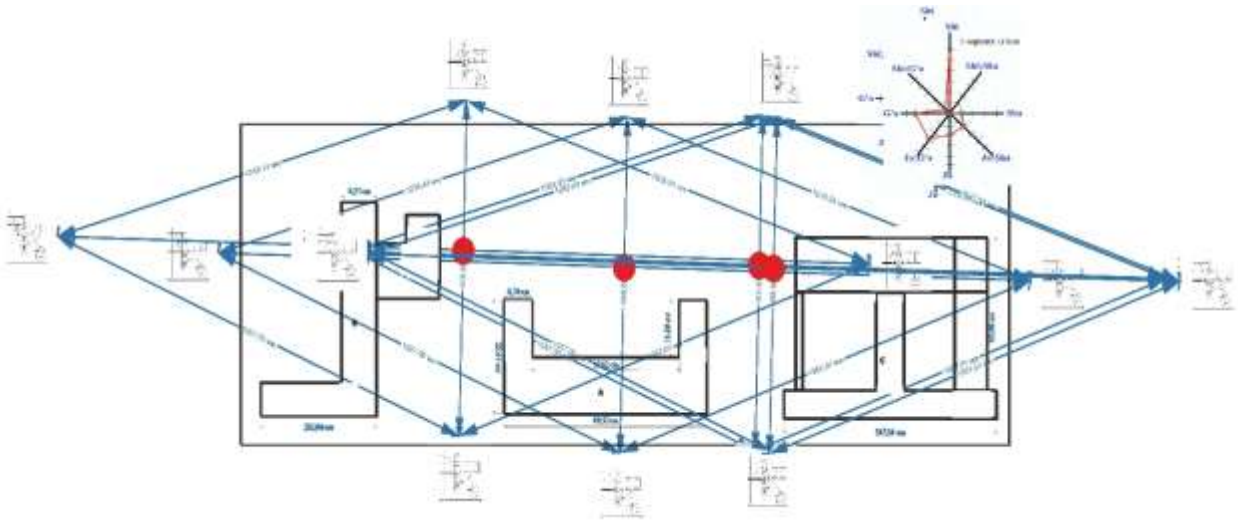
$$У_2 = 2{,}0571_x + 33{,}629 \quad (2)$$

After that, there will be no significant deviations from this equation.

A sharp decrease in the coefficient and an increase in the constant up to “X” is explained not only by the formation of saturation of combustion products in the test zone, but also by the transition of the properties of the combustion process to the operating mode of the material being tested. During our test, the voltage activity of the aspiration current was clearly visible, and from this it is possible to draw conclusions about the source of fire and the combustion process.(‘Option Of The Method Of Successive Approximations In Calculating The Epicenters Of Extreme And Emergency Situations’, 2021)

It allows to pre-calculate forces and means to reduce the risk of emergency situations as a result of exposure to dangerous factors that lead to emergency situations.

As a result, during the detection of the additional convective flow in the pipe, depending on the speed of the additional air flow, it is possible to determine the process occurring in the fire zone. In the four-sided measurement of the point of fire occurrence of the fire center, all sides of wind flowers and coordinate points are taken into account, but this option depends on local conditions (water barriers, neighboring buildings and location of facilities, mandatory proximity to emergency situations) and showed that it can be limited by emergency situations (pic 5).

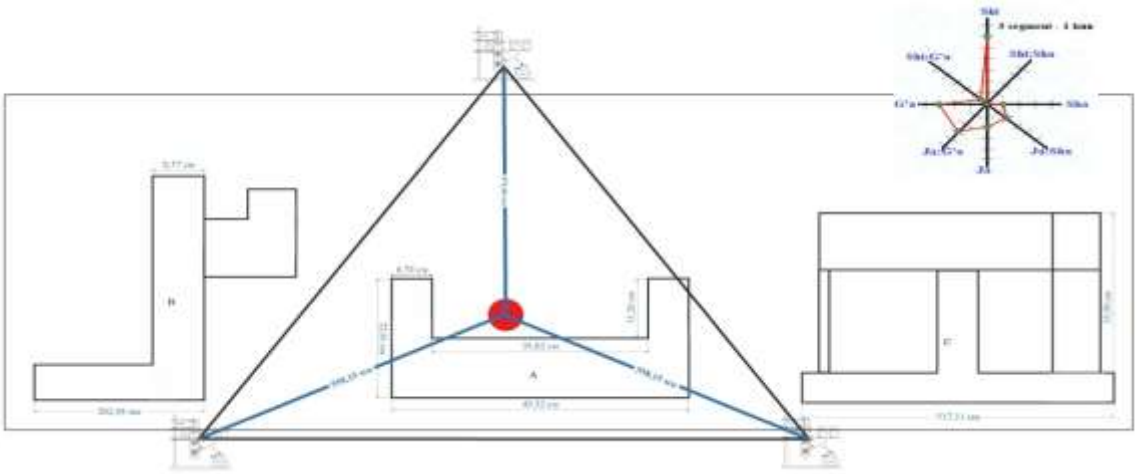


Picture 5. The scheme of the location of unrealistic centers from four directions for determining the point of fire occurrence of the fire center.

It was observed that the distance between the center measuring equipment determined by the result obtained by the aspiration coefficient determination device is located at a distance of 63 meters.

When determining the fire source, it is possible to get accurate results by moving its center to the north, east, south, and west sides of the fire object. For this purpose, in the process of determining the center of the fire, we install measuring equipment 45 meters to the northeast, 45 meters to the west, 45 meters to the north and south of the predetermined central point, and repeat the measurements.

In order to determine the center of the fire, special measurements were made using a device for determining the coefficient of aspiration. Based on the data obtained from the measurement results, the results of the wooden structure (pine, birch trees, as well as the wooden structure covered with "Izol" combustible insulating material) are shown graphically in **picture 6**.



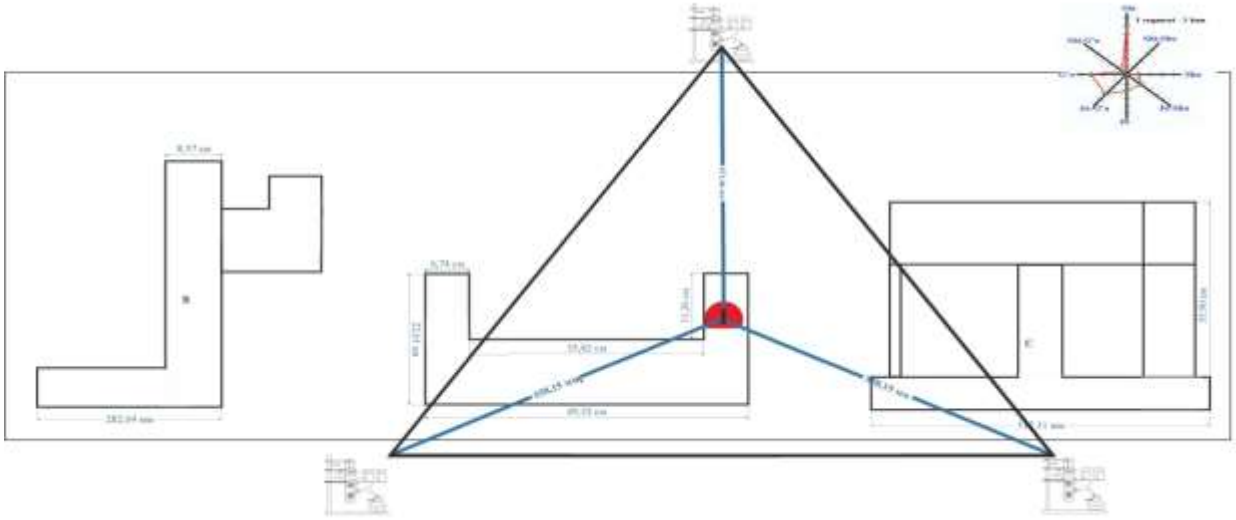
Picture 6. Location diagram of the center of the fire relative to the point of fire occurrence (the center of the fire coincides with its detection point).

3- Samarkand State University of Architecture and Construction 2nd stage student dormitory building.

V- Samarkand State University of Architecture and Construction 1st stage student dormitory building.

S- Building of the Faculty of Architecture of Samarkand State University of Architecture and Construction.

The detected center is marked in red on the diagram. When the distance between the measuring equipment is 90 meters, it was shown that the center cannot be located at this point in real conditions. Therefore, in order to get closer to determining the real center, we repeatedly moved the measuring equipment 45 meters to the west, north, south and east of the first measurement in the re-experiment. The obtained results are shown in the following pictures (picture 7).

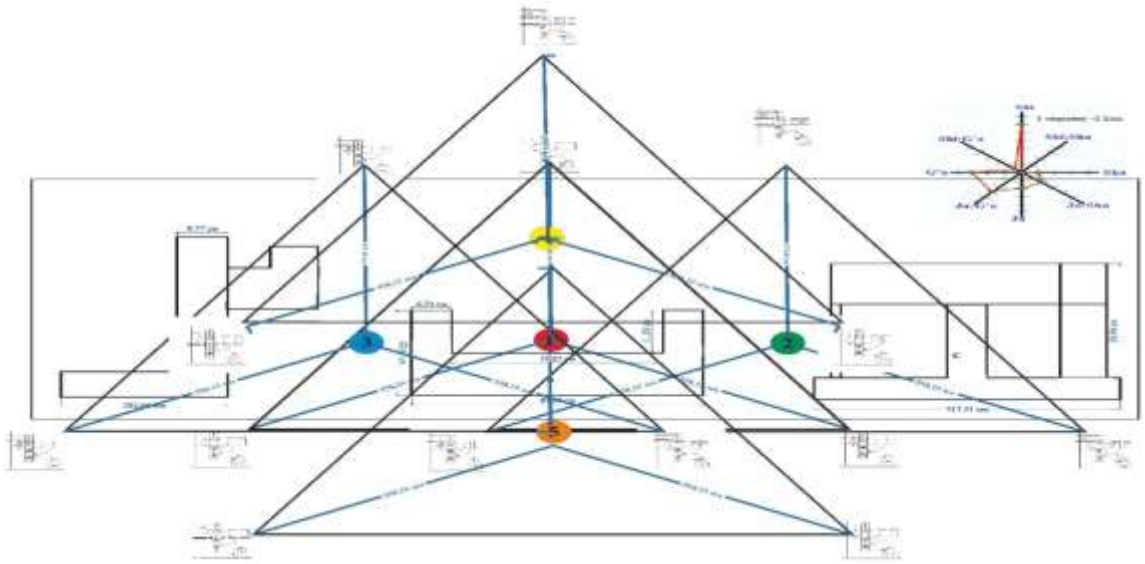


Picture 7. The scheme of the fire center moving to the east in relation to the point of fire.

As a result of the generalization of the data obtained from the conducted experiments, this method can be the main reason for preventing fires through widespread use. It was shown that the level of measurement of the activity of the center of the formation of additional aspiration currents can be carried out simultaneously and / or not more than ±1 minute.

After conducting additional repeated experiments, we compared the 5 unrealistic centers to each other. As a result, we determined the point of maximum convergence in the real center. We determined that this point was located 18 meters from the wall of the second student dormitory building and designated this point as the determined real center (ARM -1).

Under the influence of the speed of movement of air currents in the atmosphere, and in laboratory conditions, the processes of formation of aspiration currents slow down, and in the field conditions of experimental research, cases of the formation of aspiration currents are observed.



Picture 8. Measurements in the process of determining the center of fire sex

A-. Student residence No. 2 of Samarkand State University of Architecture and Construction.

V-. Student residence No. 1 of Samarkand State University of Architecture and Construction.

S – the building of the Faculty of Architecture of the Samarkand State University of Architecture and Construction.

3 Results

An experiment in field conditions is an indicator of research.

According to the arphemetric formula, the sum of experiments conducted on pine, birch, "izol" wooden constructions was determined.

Using the Simplex method, we have shown that it is possible to find the smallest time difference from the average of the experiments conducted on pine, birch, wooden constructions with "isolation" coating.

$$S_{common} = (S_1 + S_2 + S_3 + S_n/n) - S_{min} \quad (3)$$

where S1, S2, S3 and Sn are the results of conducted experiments;

Sminn is the smallest number in the experiment.

n- is the number of conducted experiments.

Using four-way measurement on the example of a pine structure, the uncertainty of the processes of formation of aspiration flows in the center of the fire was determined as follows.

$$S_{pine} = (S_1+S_2+S_3+S_4+S_5+S_6/6) - S_{min} = (3+4+5+12+6+11/6) - 3 = 41/6) - 3 = 3{,}8 \quad (4)$$

In the example of the birch construction, using 4-way measurement, the uncertainty of the processes of formation of aspiration flows in the center of the fire was determined as follows.

$$S_{birch\ tree} = (S_1 + S_2 + S_3 + S_4 + S_5 + S_6/6) S_{min} = (4+5+3+14+7+12/3 = 45/6) - 3 = 4{,}5 \quad (5)$$

In the example of a wooden structure with "izol" coating, using 4-way measurement, the uncertainty of the processes of formation of aspiration flows in the center of the fire was determined as follows.

$$S_{izol} = (S_1 + S_2 + S_3 + S_4 + S_5 + S_6/6) S_{min} = (3+5+6+16+3+9/3 = 41/6) - 3 = 3{,}8 \quad (6)$$

We present the determined results in the form of a table.

Table-1

Uncertainty level indicator from 4-way measurements of conducted experiments

№	4-way type of measurement	Number of conducted experiments						Level of uncertainty	Explanation
		1	2	3	4	5	6		
1	pine construction	3	4	5	12	6	11	3,8	
2	birch construction	4	5	3	14	7	12	4,5	
3	"izol" covered wooden structure	3	5	6	16	3	9	3,8	

In the example of a pine structure, using 3-dimensional measurement, the uncertainty of the processes of formation of aspiration flows in the center of the fire was determined as follows.

$$S_{birch} = (S_1 + S_2 + S_3 + S_4 + S_5 + S_6/n) - S_{min} = (6+6+8+9+7+7/6=43/6) - 6 = 1{,}166 \quad (7)$$

In the example of the birch structure, using 3-dimensional measurement, the uncertainty of the processes of formation of aspiration flows in the center of the fire was determined as follows.

$$S_{pine} = (S_1 + S_2 + S_3 + S_4 + S_5 + S_6/n) - S_{min} = (7+6+7+8+6+8/6=42/6) - 6 = 1 \quad (8)$$

In the example of a wooden construction with "izol" coating, using 3-dimensional measurement, the uncertainty of the processes of formation of aspiration flows in the center of the fire was determined as follows.

$$S_{izol} = (S_1 + S_2 + S_3 + S_4 + S_5 + S_6/n) - S_{min} = (6+7+8+6+6+7/6=40/6) - 6 = 0{,}66 \quad (9)$$

We present the determined results in the form of a table Table 3.

Table -2

Level of Uncertainty from 3-way measurements of conducted experiments.

№	3-way type of measurement	Number of conducted experiments						Level of uncertainty	Explanation
		1	2	3	4	5	6		
1	pine construction	6	6	8	9	7	7	1,166	
2	birch construction	7	6	7	8	6	8	1	
3	"izol" covered wooden structure	6	7	8	6	6	7	0,66	

Table -3

The results of the research presented in the research paper are the results of quantitative comparative analysis.

№	Difference between 4-way and 3-way measurements of true center accuracy.				
	types of sample	4 lateral measurement		3 lateral measurement	
		mean of arithmetic	Level of uncertainty	mean of arithmetic	Level of uncertainty
1	**pine construction**	**41**	**3,8**	43	1,166
2	**birch construction**	45	4,5	42	1
3	**“izol” covered wooden structure**	42	3,8	40	0,66
	Explanation			The 3-way measurement type is closer to the actual fire center	

This methodology makes it possible to improve the effectiveness of the correct distribution of forces and tools for quick response measures during a fire, based on the analysis of the data obtained by the aspiration coefficient determination device and the probable assessment of the fire risk.

During the combustion of materials, the aspiration flows formed in the combustion zone allowed to determine the dependence of the speed of the additional air flow.

Conclusions

1. It was scientifically proven that the available time period for studying the mechanics of the formation process of aspiration flow in the localization of the consequences of emergency situations can be divided into three parts.

($\sum t1$) time to determine operational state;

($\sum t2$) time to accept control solution;

($\sum t3$) operational intervention time

2. Differences were observed between the results of testing different samples in the center of the fire under the same conditions for the formation of aspiration flows. In this case, the 3-way measurement type showed a higher level of accuracy than the 4-way measurement type. Wind velocity 3-way measurement type 4-way measurement type showed that the formation of aspiration currents has a serious effect on the center of the fire.

3. The mathematical description of safety, which covers the process of ensuring the safety of the technical system, has been improved in order to implement quick measures taking into account the level of danger in emergency situations at construction sites.

4. Based on the comparison, it was concluded that the processes of formation of aspiration currents in the fire center of wooden construction samples are not close to each other.

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