STUDY ON RISK MANAGEMENT IN A BUILDING IN TERMS OF THE AIR TREATMENT SYSTEM

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REZUMAT: Astăzi amenintarile complexe de securitate necesită un nou mod de lucru. Combinand tehnologia potrivită cu expertiza de domeniu obtinem cea mai bună solutie de securitate pentru unitatea analizata.Exista programe integrate,de exemplu Honeywell Security Manager,care protejează cladirile oferind accesul în timp real si controlul asupra sistemelor de securitate în întreaga unitate - indiferent cât de complexă este aceasta. Această solutie modulară și scalabilă include o securitate imbunătătită, pentru a asigura un timp de răspuns mai rapid, o raportare îmbunătatită și o performantă optimizată a sistemului. Managerul de securitate permite integrarea într-o singură interfată a operatorului a sistemelor de sigurantă, acces și securitate ale clădirii. Aceasta oferă: răspunsuri mai rapide și mai precise (alarmă centralizată; alarme/evenimente integrate cu digital; vizualizări video live și clipuri înregistrate) si administrarea detinătorilor de card pentru interactiunea cu bazele de date relevante. Managerul de securitate se poate integra, de asemenea, cu Managerul Honeywell LifeSafety pentru a oferi o solutie totala pentru a sustine un mediu sanatos si sigur.

Cuvinte cheie: analiza riscului, manager de securitate, baze de date, filtre, aer conditionat,hazard,

ABSTRACT: Today, complex security threats require a new way of working. By combining the right technology with the domain expertise we obtain the best security solution for the analyzed unit. There are integrated software like Honeywell Security Manager that protects buildings by providing real-time access and control over security systems throughout the unit - no matter how complex it is.This modular and scalable solution requires us to improve the security system, to ensure a faster response time, an improved reporting and optimized performance.The security manager allows the integration of the security, access and security systems of the building into a single interface of the operator. It offers: faster and more accurate responses (centralized alarm; digital integrated alarms/events; live video views and recorded clips) and cardholder management for interacting with relevant databases. The Security Manager can also be integrated with the Honeywell LifeSafety Manager to provide a complete solution to support a healthy and secure environment.

Keywords: risk analysis, security manager, database, filters, air conditioning, hazard

1.INTRODUTION

The design, use and maintenance of buildings and building service systems have become more and more complex, in the sense of management of information and knowledge [1]. The systematical risk management methods and applications are sophisticated ways to evaluate and manage the risks [2]. Systematic risk recognition and assessment is the method for managing risks and pinpointing the responsible party. The stages of risk analysis are defining the target, recognizing hazards, assessing consequences, calculating probabilities, assessing the total risk, and finally, removing, reducing and preventing the risk [3,4].

All the systematically risk management methods and applications evaluate and manage the risks during the life-cycle of the building and the associated technical systems [5,6]. Three presented cases show possibilities to utilize methods in pre-design, design and operation phases. The risk table approach is a checking-list type of method, which is a good tool for assessment of all the possible risks existing in the building project [7,8]. The risk table can be used as part of invitation for bids, as annex of contract documents or as check-list during the negotiations. The risk number approach is a simple tool for pointing the drawbacksor risk components of the complicated systems. The strength of the risk number approach is evaluation of drawbacks based on three sub-factors (severity, probability of detection and probability of occurrence), which all are evaluated separately, based on experts opinion or measured values [9,10]. This is giving more confidence on evaluation. The simulation tools can be used as part of risk assessment, when evaluating the effects of the quality of the building structures and HVAC components on the energy consumption and costs [11,12]. Risk analysis is a systematic way of identifying possible accidents and estimating the severity of the hazards. It is advisable to start by identifying risk sources using qualitative methods.

Risk identification is a detailed compilation of the different risks within an object. It is comparable to risk inventory, but the latter involves an overall compilation of the risks and the collection of data on the risk objects and objects which are subject of protection [13,14].

2. EXPERIMENTAL PART

2.1. Materials and methods

In the process of risk analysis there are two main categories: qualitative risk analysis and quantitative risk analysis. The mathematical method of assessing fire risk and fire safety is a quantitative evaluation method.The mathematical method of assessing the fire risk is used at the following capacities: civil (public) buildings, production and/or storage buildings and fuel depots [15,16].

The method is applied to all or parts of the building constituting a fire compartment or cell. The method is applied both to existing constructions and to constructions in the design phase. The general formula for determining **the risk of fire** is:

$$R_1 = \frac{P \cdot G}{M} \cdot A \qquad (2.1)$$

where: Ri is the existing risk of fire; P-potential fire hazard generated by existing specific risk factors; M-all the fire protection measures provided; A-coefficient that expresses the probability of activating the risk factors, differentiated according to the types of objectives and the nature of the risk factors; G-severity of possible consequences of fire.

For any given situation, the risk of fire is within the range of acceptable risks if this condition is met:

$$R_{fire} \leq R_{faccepted} \qquad (2.2)$$

where: R_f accepted is the accepted fire risk for the type of objective taken in the analysis.

The accepted fire risk is determined by the relationship:

$$R_a = c \cdot R_{fm} \qquad (2.3)$$

where: c is the ranking coefficient; Rfm - small risk of quantified fire;

Fire safety (S_f) is ensured in all situations where one of the conditions is met:

$$S_f = \frac{R_a}{Rf} \geq 1 \qquad (2.4)$$

or

$$S_f = \frac{Rf}{R_a} \leq 1 \qquad (2.5)$$

Factors P, G, M are, in turn, expressed by computational relationships, in which the unknown elements are elements specific to the category of factors. [17,18].

2.2. Results and discussions

The results of the qualitative risk analysis are less accurate, they are more indicative than precise. If these results are not satisfactory, it provides risk management and quantitative analysis showing results in digital form as a result of calculations.

1. The HVAC- system. FILTERS

Considering the type of building-civil building (Fig.2.1), the risk of fire was evaluated in relation to the density of the thermal load and the destinations of the spaces, according to art.2.1.1, from the Fire Safety Regulations of buildings, indicative P118-99 [19].

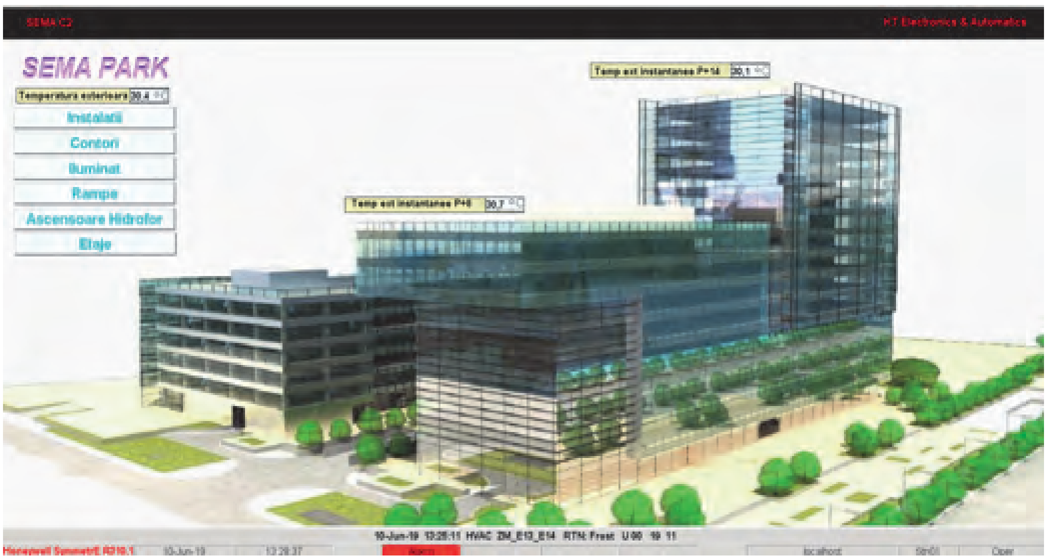

Fig. 2.1. SEMA PARK-business buildings complex..

After the destination, the spaces fall, according to the provisions of art.2.1.3., from *the Fire Safety Regulations of the constructions*, to indicative P118-99, thus, realizing the risk assessment matrix, presented in Fig. 2.2, which allows an entity to have a 360-degree view of the probable risks assessed in terms of the likelihood or likelihood of the occurrence of the risk depending on the severity of the consequences [20].

According to these regulations, the spaces fall into the following levels of fire risk:

- Small risk of fire: pump rooms, power stations ventilation, toilets, rooms of apartments (excluding kitchens);
- Medium risk of fire: central heating, server rooms and electrical panel, offices;
- High risk of fire: underground parking.

As a whole, the spaces within the medium and high risk levels of fire do not exceed 30% of the volume of the building, in accordance with the provisions of art 2.1.3.alin .2, from the Fire Safety Regulations of buildings, indicative P118-99, the entire fire compartment consisting of the very high-rise building above ground is considered as low fire risk.

The application of the method is done by consultingthe technical guide for assessing the fire risk, specific to the destination of the building.

Examples: crowded rooms (GT 030-01), hospitals (GT 049-02), old people's homes and people with disabilities (GT 050-02) etc.

In these guides the method is adapted to the specific of the objectives.

The tables with all the factors and their values are included. Important is the fact that, for each destination, the level of the accepted fire risk is established. The risks can be grouped according to the probability of occurrence and the extent of the damage or the consequences that the risks can generate. Making a risk management matrix is the second step in the risk management process and follows the first stage of completing a form risk assessment to determine potential risks (Fig.2.3).

Risk Likelihood	Risk Severity				
	Catastrophic 5	Hazardous 4	Major 3	Minor 2	Negligible 1
Frequent 5	Unacceptable	Unacceptable	Unacceptable	Tolerable	Tolerable
Occasional 4	Unacceptable	Unacceptable	Tolerable	Tolerable	Tolerable
Remote 3	Unacceptable	Tolerable	Tolerable	Tolerable	Acceptable
Improbable 2	Tolerable	Tolerable	Tolerable	Acceptable	Acceptable
Extremely Improbable 1	Tolerable	Acceptable	Acceptable	Acceptable	Acceptable

Fig. 2.2. Risk Assessment Matrix.

RISK ASSESSMENT MATRIX				
SEVERITY / PROBABILITY	Catastrophic (1)	Critical (2)	Marginal (3)	Negligible (4)
Frequent (A)	High	High	Serious	Medium
Probable (B)	High	High	Serious	Medium
Occasional (C)	High	Serious	Medium	Low
Remote (D)	Serious	Medium	Medium	Low
Improbable (E)	Medium	Medium	Medium	Low
Eliminated (F)	Eliminated			

Fig.2.3. Risk management matrix.

It requires deliberations and involves understanding the business, knowing the risk areas, collecting data and so on. While rating the risk, it is important to understand the consequence if the risk materializes.

In a risk assessment matrix, risks are placed on the matrix on two criteria:

- probability: the probability of a risk;
- consequences: the severity of the impact or the degree of deterioration caused by the risk.

Probability of occurrence: based on probability of occurrence of a risk, risks can be classified into one of five categories:

-Defined: An almost certain risk of occurring during project execution. If you look at the percentages, a risk in excess of 80% could cause problems will fall into this category.

- Probable: the risks that have 60-80% chance of occurrence can be grouped as probable.

-Occasional: Risks that have a probability of occurrence close to 50/50.

-Rar: Risks that have a low probability of occurrence, but can still not be completely excluded.

-It is unlikely: rare and exceptional risks that have a probability of less than 10% occurrence

The intelligent link between the security systems and the network is made by Honeywell Security Manager, from Honeywell, which ensures a faster response time in terms of security and alerting, in real time, of the possible risks. (Fig.2.4).

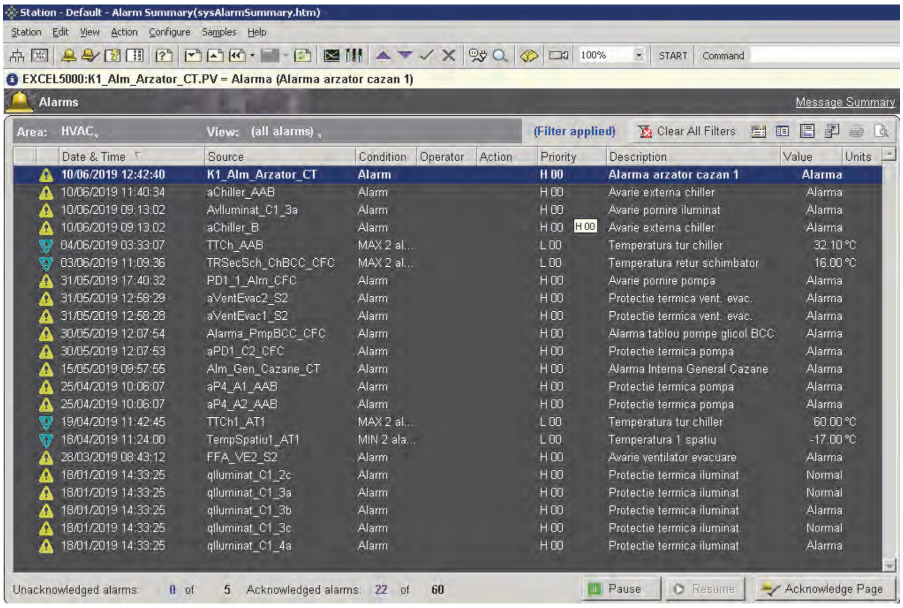

Fig. 2.4.. Scheme of the integrated BMS system .

The Security Manager is one of many applications that integrate with HoneywellEnterprise Buildings Integrator (EBI), a powerful suite of applications that exploits the efficient monitoring and control of the main functions of the facilities, including HVAC, power consumption, lighting, digital video surveillance and security life. The heating, ventilation and air conditioning system (HVAC) will be analyzed, from the point of view of the risks given by the filters encountered at the AHU/CTA and at the fan coils.The AHU (Air Handling Unit) is used to control the following parameters of the space: Temperature, Humidity, Air Movement, Air Cleanliness.The air treatment unit prepares the air that is sent to the building, including recirculating up to 80% of the air in the building. The fan coils are part of the air conditioning system inside the building, they receive the air from AHU/CTA. The fan coils, shown in Fig.2.5, are special installations for the air conditioning of the rooms, which ensure a quiet and sustainable operation, with low energy consumption, both in summer and in winter.The fan coils operate on the principle of air absorption from the room, being drawn by the fan, then filtered and transmitted to the heat exchanger, where the process of cooling or heating of the air takes place, to be emerged in the room.

For the heating and cooling of the spaces, the fan coils use water as a thermal agent. Due to the cooling and heating functions, the fan coils provide a high level of comfort, offering to the rooms both economic and aesthetic advantages.

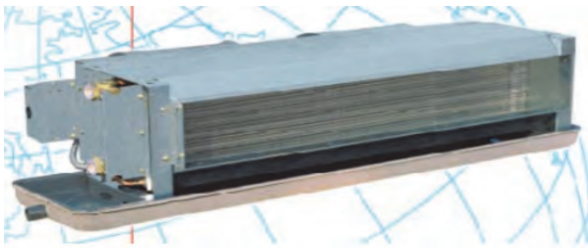

Fig. 2.5. A fan coil.

In case of fire, the fan coils and the air treatment plants are stopped because the fire is prevented from spreading on the air supply pipe in the building.

The heating, ventilation and air conditioning system (HVAC) will be analyzed, from the point of view of the risks given by the filters encountered at the AHU (CTA-air treatment plant/central/unit) and at the fan coils (Fig.2.6).

The fresh air is sent, in the false ceilings, from the technical terrace, next to each mouth of aspiration of the fan coils (VCVs), by the air treatment plants (CTAs). They send the preheated-winter/pre-chilled-summer air and filtered twice. By starting the VCVs, they take the fresh air sent by the CTAs and introduce it into the living space of the office. Depending on the requirements, it is possible to adjust, from the wall thermostats, the temperature of the air introduced by them so as to obtain the desired temperature in the office. The VCVs filter the air once more, passing it through their own filter. At the same time, in space, there is an overpressure that causes the stale air to rise in the ceiling through the extraction grids.

Here is the extraction pipe through which the CTAs extract the foul/stale air and throw it out onto the terrace. The fresh air supply of CTAs is 6 hourly air exchanges throughout the house.

The cloggingc of the filters, related to the CTAs, is automatically signaled by the BMS system and these are changed immediately by the BSS technicians. The VCV filters are changed biannually with their maintenance. In the conditions in which the VCVs are stopped, the fresh and treated air, sent by the CTAs, is extracted from the false ceiling and thrown outside, not reaching the living space.

The office space remains with the same flawed air, its refreshment never occurring.There is discomfort due to the lack of fresh air. On the other hand, the use of properly designed and implemented air filters can help achieve significant cost savings of the maintenance costs.

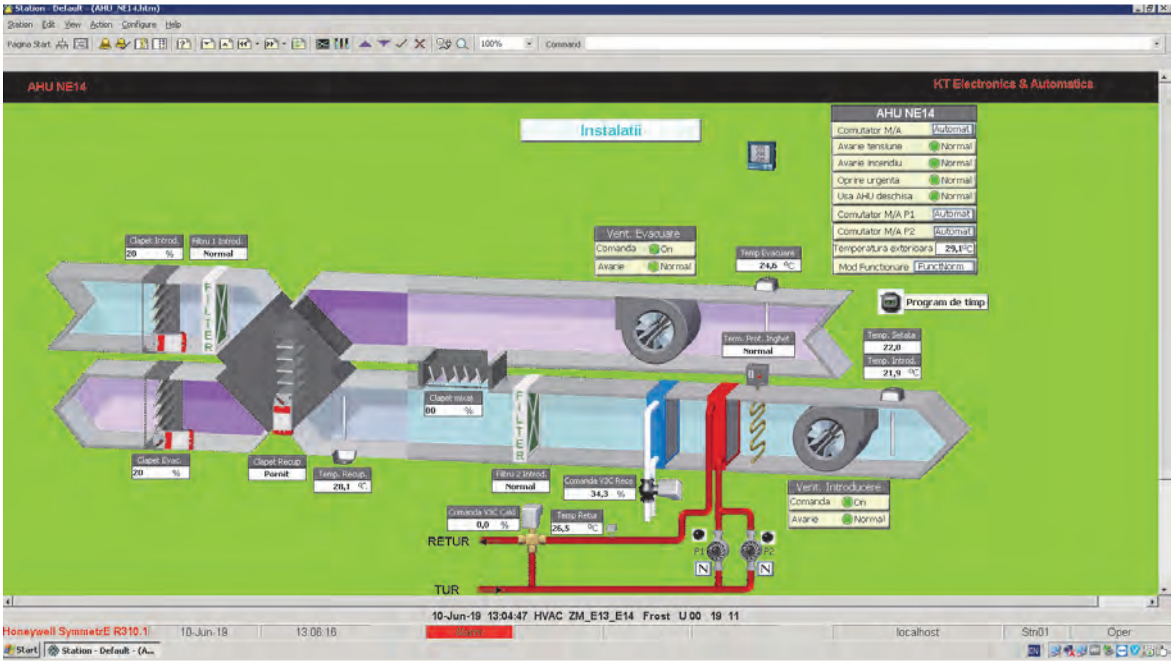

Fig. 2.6. CTA/AHU.

The accumulation of dust in the heat exchangers increases the pressure losses, significantly changing, in a negative sense, the performance and efficiency of the equipment. A 10% decrease in heat transfer efficiency represents 60% of the annual cost of the filters. All the filters available in the wide range of sizes can be made from various types of polyester filter material, synthetic microfiber, synthetic nanofiber, glass microfiber and they are certified with Eurovent energy efficiency risk certificate.

Standard *EN13799 is* applied to air filters in the design of climate and ventilation installations for non-residential buildings, except for industrial applications that define relevant parameters so that the indoor air characteristics (IAQ) reach a certain level of comfort.

The outside air is classified on 3 levels from ODA1 for fresh air, except for temporary pollen moments for example, up to ODA3 for air that has a high concentration of particles and gases. Given the "side effects" of polluted air, the World Health Organization recommends that the following limits, of pollutants (possible to be found in the indoor air!), presented in Fig. 2.7., should not be exceeded.

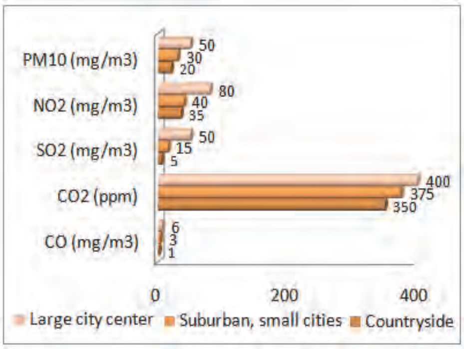

Fig. 2.7. The limits of the following pollutants that can be found in the indoor air.

Also EN 13779 recommends when it is advisable to replace the filters, especially when the pressure drop reaches values that the filter clogging (pressure switch!) or earlier announces, if the filters no longer meet hygiene standards. In this study, it has been expected the number of operating hours of the installation of the climate and ventilation, as shown in Fig. 2.8, after which it is recommended that the air filters should be replaced with new ones:

-pre-filters, coarse filters after 2000 working hours or maximum 1 year;

-fine and medium filters after 4000 hours or maximum at 2 years;

For hygiene reasons, it is recommended to change the filters in autumn and at the end of spring, after the period when the air is full of pollen.

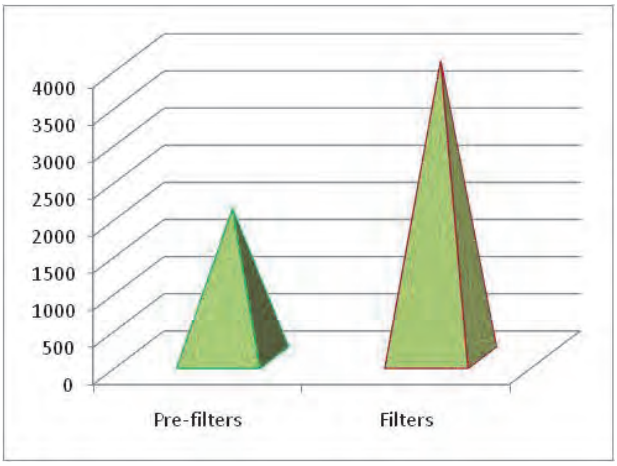

Fig. 2.8. Limits for changing the air filters.

With the introduction of the new ISO16890 standard, the actual operating conditions will be considered more efficiently. Instead of the particle size of 0.4 microns (EN779: 2012), in order to determine the separation efficiency of PM10, PM2.5 and PM1 dust particles (ISO 16890), a wide range of 0.3 and 10 microns will be used. In order for an air filter to be evaluated at PM1 or any other PM size, it will have to demonstrate a minimum efficiency of 50% and this will be incrementally recorded at the nearest 5% - so an air filter that performs 66% PM1 particles will be evaluated at ePM1 65%.

For coarse filters, the new standard will include filters that capture less than 50% of the particles in the PM10 range - these will be known as "ISO Coarse" and will detail PM10 performance, ie "PM Coarse 45%". The integrated BMS system can show alarms to the HVAC system whenever CTA or VCV are in alarm situation.

CTA risk factors: broken belt; clogged filter; the “blinds” do not open; thermal protection of the fan; improper clamping location of the filter;

VCV risk factors: blocked valves; thermal protection of the fan; improper clamping location of the filter; does not ensure the regulation of the ambient temperature; 3-way valve.

After analyzing the number of HVAC events/alarms, for one year, it was found that:

- the number of alarms in spring/autumn is higher than the number of alarms in summer/winter;

- filter clogging represents 70% of all alarm causes, due to solid air suspensions.

Therefore, even though the manufacturer plans to replace the bi-annual filters, 4 shifts/year have been executed. Even if the costs are higher (some of the filters are washed, others are replaced!), we try to replace them with antibacterial filters or wash them with a cleaning agent, with silver ions, to protect the health of the staff.

Cleaning agent with silver ions CLEANEX CLIMATE Silver is for professional cleaning of air conditioning, fan coils and chillers.

The product has high efficiency in cleaning all types of aggressive dirt (dust, nicotine, fat) while eliminating unpleasant odors. The product contains colloidal silver and ensures the elimination of dirt by cleaning the filters, vaporizers and capacitors, leading to an increase in efficiency and a significant decrease in electricity consumption. It ensures the elimination of unpleasant odors by offering a higher quality of the air conditioning provided. The product does not attack the metal components and does not react with the plastic and rubber elements.

The solution is applied by spraying on the elements that require cleaning and sanitation (splitters vaporizers, their filters, lamellar capacitors and including the carcasses of the devices). The solution is allowed to operate for up to 10 minutes, then either rinses with low pressure water, on the filters and condensers of the external splits, or starts the air conditioner in cooling mode, in which case, removing the solution and dirt from the evaporator. it is made through the collector and the condensate drain tube.

It is recommended to clean the air conditioners / filters at the beginning of the hot (spring) or cold (autumn) season.

3. CONCLUSIONS

Risk assessment involves an analysis of "hazards" environmental factors that influence the likelihood of behavior that causes concern. It is expected that any unit/institution to have an individual plan risk management. It will already record many of the preventive and reactive strategies designed to reduce the level of risk.

Purchasing additional security equipment without making a complete risk assessment is a mistake that a facility manager can make when he tries to make a safer building for working in. It is easy to invest in security technology but remember the main mission: risk assessment is the most important thing that managers can do to improve the security of buildings, because it ensures that the security system installed protects against threats.

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