HADMÉRNÖK

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FUTURE RESPONSIBILITY OF RISK MANAGEMENT IN FUEL TRANSPORT PROCESS MECHANISM AT POWER PLANTS

Abstract

Risk analysis and monitoring are getting more and more significant in the role of nowadays' management processes. Unlike the everyday risks, risks at operating plants have an impact on the economical and sustainable operation which is why it is getting frequently noticed at more and more operating plants. I examine the professional literature of risk management first, and present practical power plant cases afterwards.

Napjaink menedzsment folyamatainak egyre fontosabb szereplője a kockázatok elemzése, monitorozása. A hétköznapi életben megélt kockázatokkal ellentétben az üzemi kockázatok a gazdaságos és fenntartható működést is befolyásolják, így egyre több helyen ismerik fel ennek súlyát. Alább a kockázatmenedzsment szakirodalmi vonásait vizsgálom meg, majd áttérek a terület gyakorlati kérdéseire erőműves példákkal szemléltetve.

Keywords: *risk, risk management, risk analysis, security techniques, fuel transport in power plants ~ kockázat, kockázatmenedzsment, kockázatelemzés, biztonságtechnika, erőműves tüzelőanyag transzport*

INTRODUCTION

Reviewing and monitoring different risks is getting a more and more important issue in today's management systems. Compared to the ordinary risks, risks at different plants and factories have an impact on the economical and sustainable maintenance, thus its importance is getting recognized. First I examine the literature of risk management first below, then I go through the practical issues of the topic with power plant examples.

RISK-REDUCING METHODS IN PRACTICE

We face different risks, unstable circumstances during our everyday life, and we cannot always see the consequences in advance. Sometimes we try to phrase these situations with ordinary words and expressions like "I hope", "I am not sure…", "Maybe", "What if", etc. However as soon as possible we try to clarify these expressions, when the possible consequences become clearer for us.

After the little introduction, it is worth going through the basic risk definitions, methods included in risk management. How can we explain risk management?

Nowadays there are plenty well-known definitions of risk management, which can be explained regardless of their place in line. These definitions are the following: risk, risk management and risk management process. When we talk about risks, we usually describe different actions, where the consequence of uncertainty has an impact on the target. The consequence of uncertainty can be positive or negative as well. The target can also be various: environmental, health, financial or security. Here is an example from the everyday life: someone sits in the front seat without fastening his seatbelt in the car. Not only he risks paying a fine, but also puts his life in danger. Furthermore, risk can be a happening, which is really difficult or in some cases is impossible to be prepared for. Also an everyday example for here: think of an unexpected natural disaster. There is no need to make it big like tsunamis, but it is enough to think about extreme weather conditions (hail, drought, etc.).

Risk management is the coordination of different actions where the actions are directed towards the management and regulation of an organization.

During risk management the different management theories and practices come together and apply for all different organizational activities (e.g.: communication, determining and examining risks). There are several examples from the past in power plant environment for these processes which helped with the safe production and prevented unwanted negative consequences. Just to look through national power plant examples, there are several cases when unwanted happenings were prevented by applying risk-reducing methods. If we look at an example at Mátra Power Plant – one of the most significant power plants in Hungary with the largest power performance – with the fuel transport processes, it is an ordinary action to reduce risks and to maintain processes safe. However, looking through the different riports of the plant, there were some failure cases caused by human error.

On the following figure I explain a happening, when human error caused the failure. The examination is based on the time period of 2000-2005 and my research in Mátra Power Plant. Here I also present the consequences of these kind of failures caused by human error.

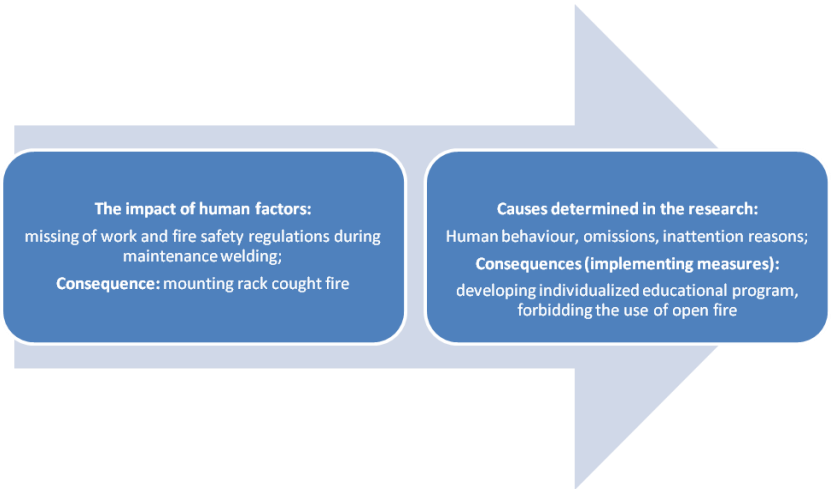

Figure 1: Major fire cases and their consequences [1]

In case of more dangerous fire cases afterwards, there was no disruptions in the operation or any kind of breakdown thank to the fire safety equipment and the professional personnel. An expressive example for this is that a new fire-fighting professional staff has been set up by the conveyor belt, and also there is a regulation of standby, and last but not least more fire safety and security equipment have been set up.

During the examination of the causes of fire cases, it has been determined, that in most cases the main cause were human error and spontaneous combustion of carbon dust during normal operation. Obviously, the probability of the occurrence of these happenings can be reduced significantly by continuous surveillance and maintenance works. Furthermore, human error and behavior interactions have to be examined after precise identification, thus it can be monitored and measured later, and also can be built into the safety regulations. [2]

If we take a look at the examples we mentioned, it is noticeable that examination of risks is really important, and it is also necessary to work out and use practical methods in power plant area, as well.

There is a standard about the basics, methods and processes of risk management (ISO 31000/1) with the following points:

- risk management has to create value and has to protect the existing ones,
- it is a part of the decision process,
- it has to handle uncertain processes,
- it has to be a basic component of the organizational process,
- it has to be a well-structured, methodical and a well-scheduled activity,
- it has to be customized, and has to use the best available information during the process,
- it has to include human, and in case it is necessary, cultural factors,
- it has to be clear, dynamic and has to react to the changes in time,
- it has to help the development and the growth of the organization.

If we always try to focus on these points and also give feedback on the right schedule during the process, risk management can achieve its goal: can handle and examine the system operation.[3]

In “Safety critical systems” curricula by Dr. János Abonyi and Dr. Tímea Fülep when defining the basics of risk management, risk and reducing risks are defined as basic definitions. Based on this a risk cannot be fully eliminated, since there is a middle ground here, and also there is a proportionality between the risks and the measures against them. However, it is the duty of plant director and the architect of technical structure to keep the risk

level as low as reasonably possible (ALARP: as low as reasonably possible). The structure is on Figure 2.

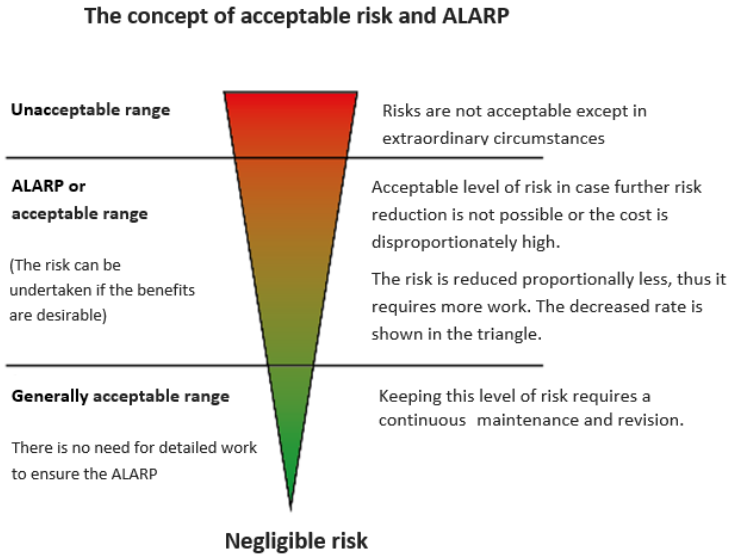

Figure 2: ALARP method [4]

It can be seen on Figure 2 that engineers planning the technical system can face with 3 possible situations. First, is when the risks are not acceptable, only in case of extraordinary circumstances in the background. The risk is acceptable in the acceptable range, in case the further risk-reducing is not possible or the advantages are acceptable. The third level is the generally acceptable range where keeping the risk level requires a continuous maintenance and revision.

Moreover, there are some other risk examination methods, mentioned below (risk matrix, risk map, etc.).

When we talk about a risk matrix, we use a risk examining method based on the determination of the risk, which leads us to create a risk map. This can be seen on Figure 3. Lines on the figure help us differentiating different levels of risks, and also give chance to the movement between the levels.

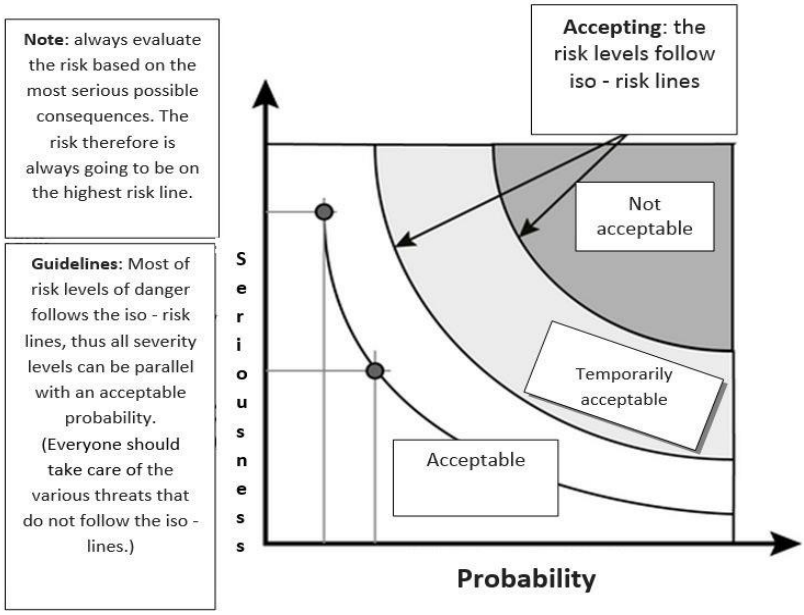

Figure 3: Illustration of a risk map [4]

This method helps with a pre-risk-examination, giving a review about the unwanted emergency event and its consequences with its likelihood to happen. Afterwards, we can also use a risk matrix, which not only supports and completes engineering tasks well, but also gives an opportunity to illustrate risk decreasing methods. Its drawback however is that it is only capable of examining pre-recorded breakdowns, and also that in most of the cases it is only possible to give subjective examinations. [4]

Operating range of risk management

Handling and examination of risks is a part of risk management system. *"Handling risks, risk management, risk examination, principles of tasks according to risk management rules, different methods and procedures are all parts of methodical risk management usage in practice."*

In Balázs Zele's publication about logistical industry security in power plants we can read about coal transport processes and their risks and security issues. "Examining logistic processes we can tell, that lignite-fuel transport process includes more points from the mining period until electric energy is generated towards the consumers. Analyzing such power plant we can mention various industrial circumstances and environmental effects which have impact on the operation: investment, normal operation or extending the operational time which for instance can happen in case of renovating or at decommissioning or closure phases. In case of a power plant operating normally, as we mentioned before, it is essential to provide the fuel in the appropriate quantity, in parallel with fire safety and plant safety issues taking into consideration." It is a complex process we examine here, since the aim is to generate and distribute electric energy besides providing lignite fuel support. The risk management process description also contributes to this complex system, which includes the different levels of risk handling and risk management. Process can be seen on Figure 5.

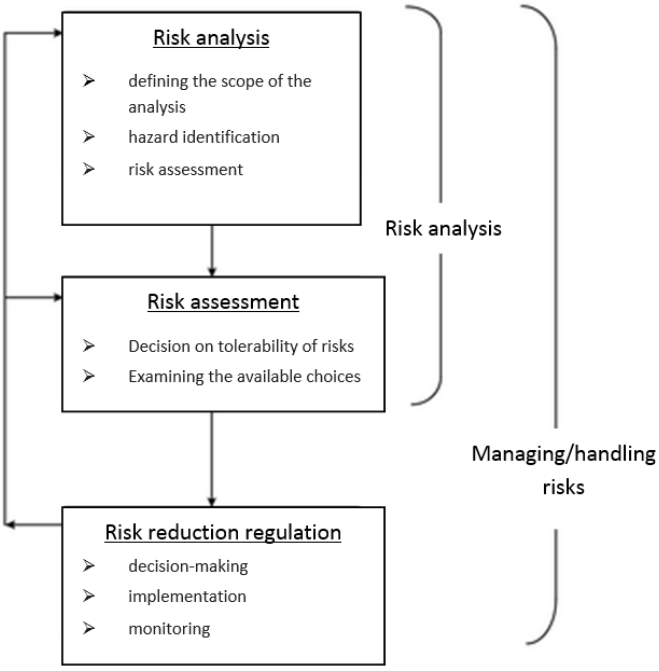

Figure 4: Process of risk management [4]

Process of risk management

As you can see on Figure 4, risk management activity consists of 3 basic functions: mapping of risk management, analyzing and evaluating risks, and reducing risks. According to the description of Rassmussen-Svedlung (2000) we can divide two directions in corporate sector when we discuss risk management. The strategy can be proactive when the target is to handle risks, and also can be reactive when we put crisis management into focus. In case of reactive strategy when we discuss different crisis situations, the process works out a business continuity plan.

Consequences of failures of fuel support systems in the logistical process

To sum up the consequences of failures of fuel support systems in the logistical process we can say – as I already mentioned it in one my previous publication – that the system is really complex, there are several fields and parameters which have to be taken care of. Management has also a complex role here, as system monitoring is its responsibility which is a complex task to deal with. Failures which may come up are influenced by the quantity of fuel, the inappropriate environmental parameters and the amount used quantity. The responsibility of the management is to handle operational failures (damage of the conveyor belts, restoration of different failures after security interference, human errors) and maintain the continuous, uninterrupted operation. That is why management always has to be prepared, and all the above mentioned tasks have to be dealt with immediately.

Mátra Power Plant – the second largest energy generator plant in Hungary – has experienced more failure happenings during its operation, which were handled well by the human personnel of the plant, and they prevented the plant from a loss of production on the long term. Furthermore, looking at the traditional logistic systems, we can also see similar examples at the railway, air or car transportation. Péter Bajor highlighted in his dissertation: the growth of transit will lead to the critical breakthrough of different network parts. Prevention of the different operational failures is essential by building a regulation system which is able to provide necessary reserve.

If we further think about this method, we see that a management-focused logistic system can be created in order to control the fuel transport systems, too. This can be a sub-system of logistics, which would be a special part of control structure in the logistics of energy generating units. Thus the controlling, monitoring and regulation of this process would be the management function in the plant.

Usage and exploitation of alternative, renewable energy resources also requires management regulation, as well as the system which uses biomass mixed with other fuels to the firing. This system could be also beneficial with the solar power investment, which is actually can be the largest solar system in the country mixed with lignite firing in the second largest power plant of Hungary. This contributes to the significant role of management in accordance with the security and energy safety as well. [9]

Management is responsible for organizing and controlling the process, keeping the balance, and controlling the different fuel transport processes within and outside the power plant. In the future the system would be monitoring the two plant mechanism besides the technical support and controlling processes. Risk management – besides the prevention activities and electronic-mechanic protection – plans and controls the different fuel transport processes. This could be lignite (coal) firing or – as it is working by Mátra Power Plant – biomass-mixed firing energy generation, too. Planning and monitoring the system requires engagement and attention, which may require a new working group in the management as a risk management monitoring unit. Some questions and problems might come up during the process, and the personnel has to be prepared for these situations with a previously

determined strategy. In my opinion the following points should be involved in the planning process:

- How many and what kind of suppliers transport the biomass to the plant;
- processing, planning the homogenization process, marking the optimal place for fulfilling the process;
- quantities, length of transport ways have to be involved in the planning, also the inspection and security systems have to be taken into consideration (cameras, fire alarms, alarm system);
- impact of the personnel involved in the process, risk of this impact;
- cost (organizing the system structure) of the process (transport, processing, homogenization, conveyance) [7]

To sum up management is responsible for the above mentioned points, and to plan an appropriate structure to control and monitor the system and provide all the mentioned points. It is not only about the monitoring of the safety techniques and the different security systems, but also the cost side of the logistical aspect. Transport costs, the safety structure of the logistic system are involved in this logistical aspect. It is also have to be provided that all partners who are in connection with the plant are fulfilling the previously agreed points and requirements. Furthermore, it is also has to be monitored, that what kind of product is supplied by which supplier, and it is also important here, that biomass also arrives to the plant area, so considering the different materials, the required quantity must be homogenized. They also have to deal with cancelled transports or suppliers who cannot provide the service in spite of the agreement, thus risk aspects which might come up here also have to be included in the risk issues by the management. Moreover maintaining and providing the transport ways within the plant and the cost issue regarding this topic also can be a risk point here.

Based on the previously mentioned, here is a summarizing figure (Figure 5):

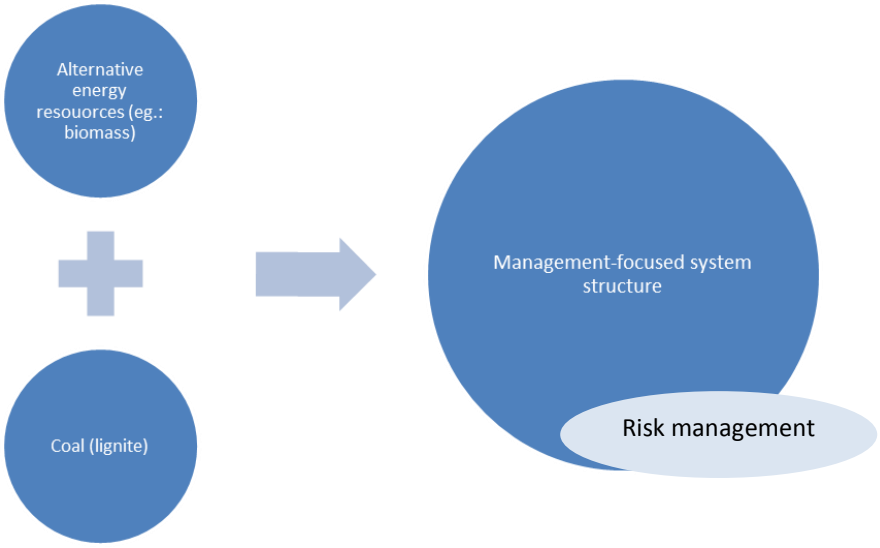

Figure 5: Management-focused system structure (self-edited figure)

In order to continue my previous research I would like to extend my research to not only the technical fields, but also the commercial fields of power plant security. That is why I came up with examining the logistic support system and its property protection system structure, and also covering the management and risk management aspects, basic processes and roles of the issue. In case of plants using coal-firing or renewable energy resources, the transportation way of the fuel (coal) is really long and goes through a difficult route until it arrives to the furnace. That is why monitoring is necessary from the beginning, whether we take the mechanical or security monitoring system as a basis.

Human personnel, as a basic important element in the system, is able to monitor, regulate and control the process. In this system, maintaining the logistic system-focused structure is really important, where risk management is always in charge, but only takes a step, when it is absolutely necessary. Risk management can be handled only by one dedicated organization, which has to have a stable structure and work parallel with the other parts of the organization.

The integrated gasification combined cycle (IGCC) [1] seems beneficial from technological side, and coal storage, transport and conveyance until the furnaces defined here should be used in practice.

The above determined controlling and monitoring system can also be used during renewable energy utilization in plants. In the future, no matter how energy politics is shaping, transport and safe storage of primer energy resources probably will be a key task too. Technologic development is on the rise that is why human personnel need to be developed too at surveillance field, since that is a critical element of the energetic logistics issue.

We are on the same page with Anikó Schubert, who examined and described risks in connection with supply chains in her publication "Risk management in supply chains". I would also like to mention Mentzer (2001) here, who stated how members of the supply chain share the risks between each other, in spite of the fact that the amount of the risks are different by each individual member of the chain. This is exactly the same process by a power plant, too, since it is really important that what kind of consequences or danger factors or the interaction of these follow a failure happening or a breakdown.

There are several publications and studies in connection with the topic, but regarding the substantial definition the following summary gives a great review (Zoltayné, 2002). *Risk* includes the probability of a negative event or happening. It has 3 significant dimensions: *probability*, *complexity* and *consequence*. The issue of complexity gives the chance to choose between the different scenarios, however in almost every case environment or our own limits stop the process. Probability can be measured, however we can never say a concrete, precise information about it, since when we talk about risks, we can never think of certain events. In case of consequences – as it was mentioned before – we can meet negative and positive consequences as well.

Risks may come up in case of outsourcing different activities, or involving external services in different processes, when external coworkers step into the power plant area. We can also take the beginning of the transport process as a basis point, when different suppliers transport fuels into the area of the power plant, no matter it happened on highways or railways, etc. We can also mention situations when the normal operation process is interrupted, which might lead to technological breakdowns or even to breach of contract. [8]

Loss of control is also an important issue here, which even in case of legal contract, has to be counted in by the operational organization. The operational plant has to consider previously the different long-term situations, when they might lose control of the surveillance, influence or the capability of interference by the operation. An easy and logical solution might be the caring storage, providing appropriate amount of fuel to create safe and suitable conditions for energy generation.

This is not a new process, as it has been working by the Mátra power plant, where fuel storage is absolutely provided in order to maintain safe energy generation.

If we think further and try to adapt this train of thought to fuel support systems of coal-firing power plants, in order to plan the risk management and capacity plans we have to take

[1] Note: method based on pure coal, where coal is in reaction with oxigen and water vapour, thus fuel gas is created which consists of CO and H. The gas fuel is utilized after appropriate cleaning gas turbine, so it is burned. Heat generated from the process can be trasformed into electric energy. A great advantage of the technology is plants using it perform with greater efficiency. [6]
http://www.kankalin.bme.hu/Dok/eloadasok/energiatermeles/energia4.pdf

this structure into consideration, thus we can reduce risks, and also can increase the level of safety. It is essential that risk management controls and supervises the process of fuel support and maintenance, thus in the life of a power plant which combines fossil fuels with biomass it is the most important issue to maintain the level of safety in the operation and energy generation.

If we look at the process from a risk-reducing point of view, after the risk mapping, the amount of risk points have to be reduced which will be a responsibility of management.

We cannot forget about the fact that we examine a whole process, since the energy generation service is a complex system, with the basic element of the appropriate fuel-support and maintaining a safe operational background.

According to my idea and to Mavir Mazine 2003/II/1. basics of risk management methods can be used in power plant area, too, since the process can be created based on everyday, practical power plant processes. This method is built like it is illustrated on figure 6.

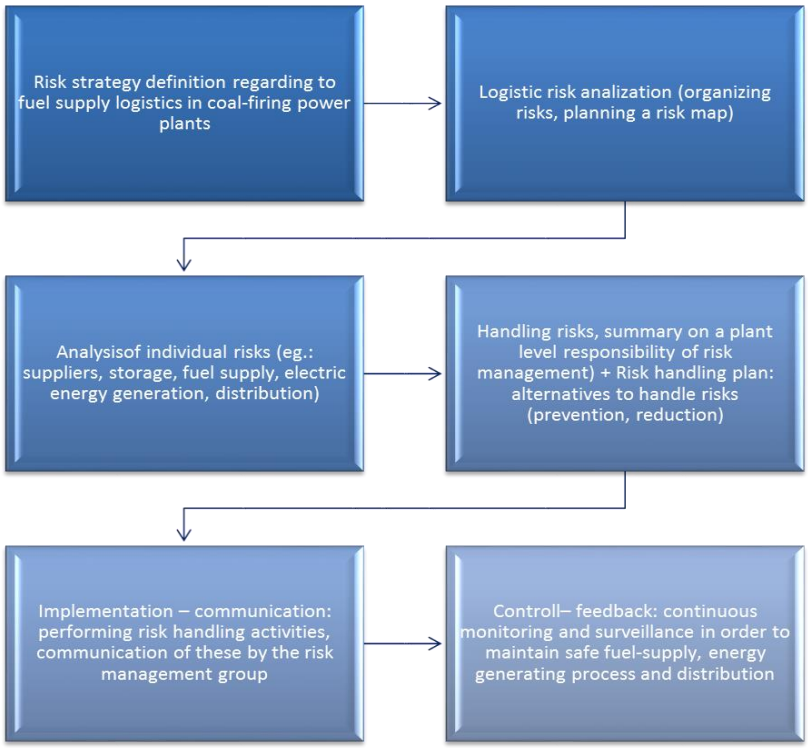

Figure 6: Risk handling on power plant level (figure created by Balázs Zele based on Mavir Mazine 2003/II/1.

After this, the method ends, then starts again from the beginning.

SUMMARY

After a literature overview I determined the role of risk and risk management operational system in power plant area.

I went through the risk management process and its application opportunities, and also examined the different activities in energy industry in Hungarian power plant industry area. Besides this I completed the cost side of fuel supply transport processes with the science of security, thus creating a more complex overview in connection with the subject.

In te framework of a more detailed examination I researched the structure of property protection in logistic support systems, and also covered the role and key issues, processes of management and risk management.

Management is a complex area in this topic: when we examined the different consequences of failures or breakdowns in the fuel support and supply system it was clear, that management

has the role of system surveillance in parallel with keeping an eye on the aspects of security techniques as well.

I also highlighted the meaning and definition of the management-focused logistic system in case of fuel-supply systems of power plants, basically in power plants using coals (or fossil fuels) and alternative energy resources.

Basics of risk management methods can be utilized on power plant level as I mentioned, since the process can be created based on everyday practical power plant processes. I created a model for this, which illustrates how it can be structured in the future by coal-firing power plants.

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