ENVIRONMENTAL RISK ASSESSMENT of A COLD STORAGE WAREHOUSE

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ÖZET

Çevreyi korurken kalkınmak günümüzde tüm dünyanın ulaşmaya çalıştığı noktadır. Çevresel risk hemen hemen tüm üretim tesisleri için söz konusudur ve çevreyi kirletme potansiyeline sahip endüstriyel tesisler ulusal ve uluslararası yaptırımlara maruz kalabilmektedirler. Bu nedenle çevresel risk yönetimi işletmeler için her geçen gün daha fazla önem kazanmaktadır. Bu çalışmada, Eğirdir/Isparta'da faaliyet gösteren bir gıda soğuk hava deposu ve ofisleri için çevresel risk değerlendirilmesi L matris metodu ile belirlenmiştir. Tesisten çıkan atıklar, atık miktarları, geri kazanım yöntemleri belirlenmiş ve olası çevresel tehlikeler tespit edilmiştir. İşletmede atıksu, katı atık, tehlikeli atıklar, hava kirliliği ve gürültü kirliliği konularında çevresel riskler analiz edilerek, risk değerleri hesaplanmıştır. Sonuç olarak çevresel risk değeri en yüksek çıkan aksiyonlar; (1) Meyvelerin yıkanması ve ofislerde su kullanımı nedeniyle atıksu oluşumu, (2) Aydınlatmada kullanılan floresan lamba kaynaklı oluşabilecek civakirliliği, (3) Soğuk hava deposu ve ofislerden temizlik için kullanılacak deterjanlar nedeniyle kontamine olmuş ambalajların doğaya zarar vermesi olarak tespit edilmiş ve alınması gereken önlemler belirlenmiştir.

Anahtar kelime: Çevresel risk analizi, L matris metodu, Soğuk hava deposu.

ABSTRACT

Progressing while protecting the environment is the point that the whole world is trying to reach today. Environmental risk exists for almost all production facilities and industrial facilities with the potential to pollute the environment may be exposed to national and international sanctions. For this reason, environmental risk management is gaining more and more importance for businesses every day. In this study, the environmental risk assessment for a food cold storage warehouse and offices operating in Egirdir/Isparta was determined by the L matrix method. Wastes from the warehouse and offices, waste amounts, recycling methods have been determined and possible environmental hazards have been identified. Environmental risks in wastewater, solid waste, hazardous wastes, air pollution and noise pollution in the enterprise were analyzed and risk values were calculated. As a result, the

activities with the highest environmental risk value; (1) Wastewater generation due to water use in offices and fruit washing, (2) Mercury pollution that may occur due to fluorescent lamps used in lighting, (3) Contaminated packaging due to detergents to be used for cleaning from cold storage and offices has been identified as harming nature and precautions to be taken determined.

Keywords: Environmental risk analysis, L matrix method, Cold storage warehouse.

1. INTRODUCTION

Cold storages play a very important role in terms of consumption of the products outside the harvest period and preserving their freshness. High energy consumption is required for cold weather facilities that allow the consumption of food throughout the year (Zheng et al., 2022). For this reason, energy saving and environmental protection are of great importance for cold storage as well as for other sectors. There is a need to establish environmental management and quality management systems in order to ensure the sustainability of food use and to protect the environment (Marmiroli et al., 2022). However, businesses should evaluate the environmental risks and potentials at the project stage, and implement management practices to minimize these risks (Jones, 2001).

Hazard identification, risk assessment and management are of great importance for the safe and efficient production of the industrial system (Hao and Nie, 2022). Risk assessment is the science-based component of risk analysis, which consists of four basic steps (hazard identification, hazard characterization, exposure assessment and risk characterisation) (Mahoney, 2022). Environmental risk assessment is the process of identifying, evaluating, selecting and implementing actions to reduce risks to human health and the ecosystem (Celik, 2000). In developed countries, studies such as emergency plans and data banks are carried out to assess environmental risks (Sunar, 1998).

As a result of developing quality management systems, the importance of environmental risk analysis studies has increased. Although there aren't many articles in the literature, a few case studies have been identified. Kuleyin and Asyali (2007), calculated the environmental risk analysis for Aliağa port using the L-type matrix method. A risk checklist of 5 items has been created and measures have been specified for 8 identified hazards (Kuleyin and Asyali, 2007). These hazards include storage and handling operations of cargoes (dry-liquid bulk cargo, general cargo, chemical), port cargo equipment, refueling operations, hazardous and non-hazardous wastes, maintenance operations in the building and port area, air pollution, noise, light, odor. and is formed during garbage. According to the research, legal obligations must be complied with and implemented in order to prevent hazards. Ciftci and Beyhan (2021), The environmental risk assessment of ready-mixed concrete plants in Denizli and Adana was carried out and compared with the L-type matrix method. The environmental risk of the ready-mixed concrete plant in Denizli is less, and it has been determined that all environmental risks in the plant can be reduced to a minimum with the implementation of the recommended measures. It has been observed that the unacceptable risks are higher in the ready mixed concrete plant in Adana (Ciftci and Beyhan, 2021).

Within the scope of this study, the environmental risk assessment of the selected food cold storage was made with the L-type matrix method and solutions were determined about the identified risks. Increasing environmental risk assessment studies will contribute to raising awareness of preventing environmental pollution while creating environmental protection policies and establishing quality management systems.

2. MATERIALS AND METHODS

Since the L-type matrix method can be applied in small and large enterprises, it is both an easy method and the most applied risk analysis method in the occupational health and safety sector (Selcuk and Selim, 2018).

The L matrix method, which is a two-dimensional matrix graph, has different meanings for horizontal and vertical coordinates.The horizontal coordinate shows the risk consequences (C), and the vertical coordinate shows the likelihood (L) of the risk (Wang and Wang, 2020). Çalışmada L tipi matris yönteminin tercih edilmesinin sebebi bu yöntemin çevresel anlamda risk analizi mantığına uygun olmasıdır (Gul et al., 2014).

In this method, the risk score is calculated for each environmental element. According to the result of the risk score, suggestions were made to the facility according to whether the risk is acceptable risk, significant risk, high risk and very serious risk. The risk score was calculated with the following formula (MSANZ, 2004).

Risk (R) = Likelihood (L) x Consequences (C)

In this place; L = Likelihood (Table 1), C = Consequences (Table 2), R = data and the result is the degree of risk (TablE 3), for risk results are given in Table 4.

Table 1. Likelihood (MSANZ, 2004)

	LIKELIHOOD	**CLASSIFICATION**
1	Very small	Hardly ever
2	Small	Very little (once a year), only in abnormal situations
3	Middle	Few (several times a year)
4	High	Often (monthly)
5	Very high	Very often (once a week, every day)

Table 2. Consequences (MSANZ, 2004)

	CONSEQUENCES	**CLASSIFICATION**
1	So light	Insignificant environmental impact
2	Light	Minor operational rash
3	Middle	Significant environmental damage
4	Serious	Environmental life suffers serious losses
5	So serious	Disaster

Table 3. Risk score (Ceylan and Helvaci, 2011)

Risk score	**Consequences**					
Likelihood		5	4	3	2	1
		So serious	Serious	Middle	Light	So light
5	Very high	25	20	15	10	5
4	High	20	16	12	8	4
3	Middle	15	12	9	6	3
2	Small	10	8	6	4	2
1	Very small	5	4	3	2	1

Table 4. Risk results (Ceylan and Helvaci, 2011)

Risk score	**Action (activity)**	
15,16,20,25	Unacceptable	Action should be taken immediately to reduce risks.
8,9,10,12	Considerable risk	Risks should be addressed as quickly as possible.
1,2,3,4,5,6	Acceptable risk	Immediate action may not be required.

2.1. Facility Data

A food cold storage located in the Mediterranean Region was selected for the study. It operates in cold storage operations in the selected facility. There are 2 packing houses and 2 cold storages with a capacity of 20 thousand tons. 250 people work at the facility.

Wastes in the company are defined in 7 categories. These wastes; 16 06 04 waste code alkaline batteries, 20 01 21 waste code waste fluorescent lamps and mercury lamps, 15 01 01 waste code paper and cardboard packaging, 15 01 02 plastic packaging, 15 01 10 packaging containing residues of dangerous substances or contaminated with dangerous substances , absorbents, filter materials (oil filters, if not otherwise specified), cleaning cloths, protective clothing contaminated with hazardous materials with waste code 15 02 02, non-hazardous mixed municipal waste with waste code 20 03 01. Table 5 gives the waste amounts in 2021. These categories are determined in the Waste Management regulation published by the Ministry of Environment and Urbanization in Turkey (Anonymous, 2015).

Table 5. Waste codes of the selected company and waste amounts in 2021

WASTE CODE	DEFINITION	AMOUNT OF WASTE(kg/year)	DISPOSAL / RECYCLING METHOD
16 06 04	Alkaline Batteries	0,5	**D5**
20 01 21	Waste Fluorescent Lamps and Mercury Bulbs	1	**R13**
15 01 01	Paper and Cardboard Packaging	5000	**R12**
15 01 02	Plastic Packaging	500	**R12**
15 01 10	Packages Containing Residues of Hazardous Substances or Contaminated with Hazardous Substances	50	**R12**
15 02 02	Absorbers Contaminated by Hazardous Substances, Filter Materials (oil filters unless otherwise specified), Cleaning Cloths, Protective Clothing	5	**R1**
20 03 01	Non-hazardous Mixed Municipal Waste	1000	**-**

3. RESULTS AND DISCUSSIONS

The environmental risk assessment of the selected company was made using the L-type matrix method. The cold storage environmental risk assessment is given in Table 5. There are 8 hazards in Table 6. The risk values of these hazards have been found and precautionary methods have been determined.

There is no environmental risk related to air emission and noise at the facility. Because there is no point and area emission source for air emission, there is no combustion boiler and chimney, it is not subject to the industrial air pollution control regulation. For noise, it is not within the scope of the environmental noise assessment and management regulation and is outside the scope of the environmental permit.

Table 6. Cold storage environmental risk assessment

ACTIVITY	DANGER	RISK	LIKELIHOOD	CONSEQUENCES	RISK SCORE	PREVENTION
Office work	Printer usage and correspondence	Damage to environmental resources due to heavy paper use	5	1	5	Waste should be sent to licensed companies.
Office work	Battery powered devices	Mixing of alkaline batteries with the soil and harming living things	1	15	15	Waste should be sent to licensed companies.
Office work	Lamps and bulbs used in lighting	The mercury content of waste fluorescent lamps and mercury lamps mixes with nature and harms living things.	1	20	20	Lighting should be turned off when not in use. Automatic lighting can be used. Waste should be sent to licensed companies.
Cold storage	Crates in which fruits are collected	The harm of plastic crates to nature	5	1	5	Plastic waste should be collected and sent to licensed companies.
Cold storage and office work	Cleaning detergents	Contaminated packaging harming nature	1	20	20	Contaminated packages should be collected and sent to licensed companies on a regular basis.
Cold storage and office work	Cleaning detergents	Cleaning cloths, protective clothing harming nature	1	20	20	Cleaning cloths and protective clothing should be collected and sent to licensed companies on a regular basis.
Cold storage and office work	Organic waste and other office waste	The unused parts of fruits and other wastes harm nature	5	1	5	Waste should be sent to licensed companies.
Cold storage and office work	Washing fruits and using water in the office	Wastewater generation	5	5	25	It should be stored in a sealed septic tank and cleaned regularly.

In Table 6, there are 8 environmental hazards identified for cold storage. No activity in the notable risk (R= 8, 9, 10, 12) class has been detected in the cold storage. Many activities in the study area were evaluated in the unacceptable risk group (R= 15, 16, 20, 25). These hazards can be listed as battery operated devices, lamps and lamps used in lighting, contaminated packaging, cleaning cloths and protective clothing. Paper waste, non-hazardous mixed municipal waste and wastewater generation from the use of printers are included in the acceptable risk group (R= 1, 2, 3, 4, 5, 6).

Activities at the facility are divided into office work and cold storage. The danger is the use of printers and correspondence, and the risk is the damage to environmental resources due to heavy use of paper. Battery-operated devices are shown as a danger, as the risk of alkaline batteries getting into the soil and harming living things. Lamps and bulbs used in lighting are dangerous, and it is a risk that the mercury content of waste fluorescent lamps and mercury bulbs will mix with nature and harm living things. The source of danger is the crates in which the fruits are collected, and the risk that the plastic crates will damage the nature. Cleaning detergents, contaminated packaging harming nature, and cleaning cloths and protective clothing harming nature are shown as hazards. Organic wastes and other wastes in the office are hazards, and unused parts of the fruit and other wastes pose a risk to nature. Washing fruits and using water in the office are dangerous, and the formation of waste water is determined as a risk.

CONCLUSIONS

In the research, the risks were evaluated by using the L-type matrix method of the cold storage operating in the food sector in order to reduce the damages to the environment. As a result of this evaluation, a total of 8 risks, 5 of which are unacceptable risks, were identified and control and precautionary activities were determined separately for these risks.

Wastes as a result of heavy use of paper resulting from the use of printers and correspondence should be sent to licensed companies once a year. Waste alkaline batteries resulting from battery-operated devices should be sent to licensed companies every 6 months. For lamps and bulbs used in lighting, lighting should be turned off except for use, there may also be automatic lighting, and it should be sent to licensed companies every 6 months for wastes. The plastic wastes of the boxes where the fruits are collected should be sent to licensed companies once a year in order not to harm the environment. Packages, cleaning cloths and protective clothing contaminated by cleaning detergents should be collected regularly and sent to licensed companies every 6 months. Organic and other office waste should be stored regularly and sent to licensed companies. Finally, the waste water caused by washing the fruits and using water in the office should be collected in an impermeable septic tank and cleaned regularly or sent to a waste water treatment plant.

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