Thu Dau Mot University Journal of Science
ISSN 2615 - 9635
journal homepage: ejs.tdmu.edu.vn

Application of ISO 14001:2015 international standards in the determination of environmental aspects at DNA fresh vermicelli production facility

by ***Bui Pham Phuong Thanh, Tran Thi Khanh Hoa, Tran Cam Thi, Nguyen Thi Xuan Hanh*** *(Thu Dau Mot University)*

Article Info*: Received July 9th, 2023, Accepted Aug.15th, 2023, Available online Sep.15th, 2023*
Corresponding author: *buiphamphuongthanh2412@gmail.com*
https://doi.org/10.37550/tdmu.EJS/2023.03.457

ABSTRACT

Vietnam's economy is operated to serve more than ninety million people so this is a very vivid picture. The large population brings many advantages to the food production sector in general and the production of fresh noodles in particular. Fresh vermicelli is the raw material for processing many dishes of the Vietnamese people for a long time, that's why there are many Vietnamese dishes with indispensable ingredients, which as Noodles in the national culinary books. Vietnam. The production of fresh vermicelli with the main ingredient is fermented and shaped rice with simple steps, but hidden inside there are environmental issues that need to be considered. The production and business associated with environmental protection are the responsibility of most enterprises and production facilities in Vietnam. The fresh noodle food production industry is no exception. Instead of learning about the aspects that affect the environment in the traditional way of collecting information, analyzing, and evaluating the current situation, this time the research team looked at understanding the causes of environmental pollution in terms of consumption. ISO 14001 international standard.

ISO 14001 Environmental Management System is an international standard that helps businesses and establishments identify the important role of the environment as well as the risks brought by the environment, thereby realizing the environment as an activity of the Organization. In this standard, the commitment to prevent environmental pollution is a mandatory condition, so determining the environmental aspects to overcome the impacts is a key element of the standard. If

a business achieves ISO 14001 Certification, it will have a very good effect in promoting the corporate image of being responsible for the environment and the community. The study uses the multi-criteria method as the main method to calculate the environmental aspect score. Results from 6 research areas, the author found 31 activities with 11 significant environmental aspects. Meaningful environmental aspects are repeated in different activities.

Keywords: *fresh vermicelli, environment, environmental aspects, ISO*

1. Introduction

The fresh vermicelli production facility is located at the address: 304/2 Nguyen Tri Phuong Street, Chanh Nghia Ward, Thu Dau Mot City, Binh Duong Province. The facility has been built and operated for more than 15 years with over 50 employees. This is a production facility with a semi-automatic process with a combination of people and production machines. The main product of the establishment is fresh vermicelli for short-term use. Vermicelli is the main ingredient in many dishes in Vietnam. During the production process, the establishment partially affects the surrounding environment. (DNA, 2015). In this study, we approach the facility as a place to research, learn about the production process, activities in different areas, and input and output raw materials to initially understand the meaning of the product. definition of environmental aspects based on ISO 14001:2015. (InterConformity Assessment and Cefitication, 2016). Understanding environmental factors that result from activity in nearby communities helps business leaders have the most intuitive understanding of the environmental effects of their enterprises. to encourage activity that will help the facility's neighborhood form ties and ensure compliance with the Vietnam Law on Environmental Protection. This study acts as a foundation for how an owner should approach developing an environmental system by global standards. Building an environmental management system by ISO 14001:2015 will help the owner boost their reputation, increase the home market for consumption, and subsequently export their goods to other nations. The study offers advice on how to apply contemporary technologies to tackle environmental-related issues successfully. (Le Huy Ba, 2006), (Le Thi Hong Tran, 2008).

2. Methods

*2.1. Data collection (*TCVN ISO, 2015)

Gathering general information about the facility, such as learning about its history of the establishment, its layout, its activities in various areas, its processes, its input materials, waste streams, and output products, etc., to gain a general understanding of environmental factors affecting the facility's water, soil, air, landscape, occupational accidents and diseases, etc.

2.2. Flow diagram (DNA, 2015)

The study selected the following 6 areas because of their specific characteristics. These are the main operating areas within the facility. These areas often generate major environmental problems that need to be resolved such as noise, solid waste, emissions, dust, residual heat, etc. The 6 areas are as follows the facility area for soaking and washing rice; Wet grinding and fermentation zone; Mixing area; Gelatinization of vermicelli, the area for pressing vermicelli, boiling vermicelli; Cool the vermicelli area. In these 6 areas, there will be a total of 15 activities taking place. Each zone can have 1 or more activities taking place. All environmental aspects arising from activities or processes will be recorded and analyzed in depth.

– Soaking and washing rice area: Rice after cleaning is soaked in clean water for about 3 hours. After this stage, the rice will be softened by absorbing a certain amount of water so that when the flour is milled, it will be smoother and more flexible. A sufficient amount of water should be used to submerge the entire mass of rice.

During the soaking process, some additives can be used to keep the rice from turning black or yellow or to prevent the rice from becoming sour and moldy.

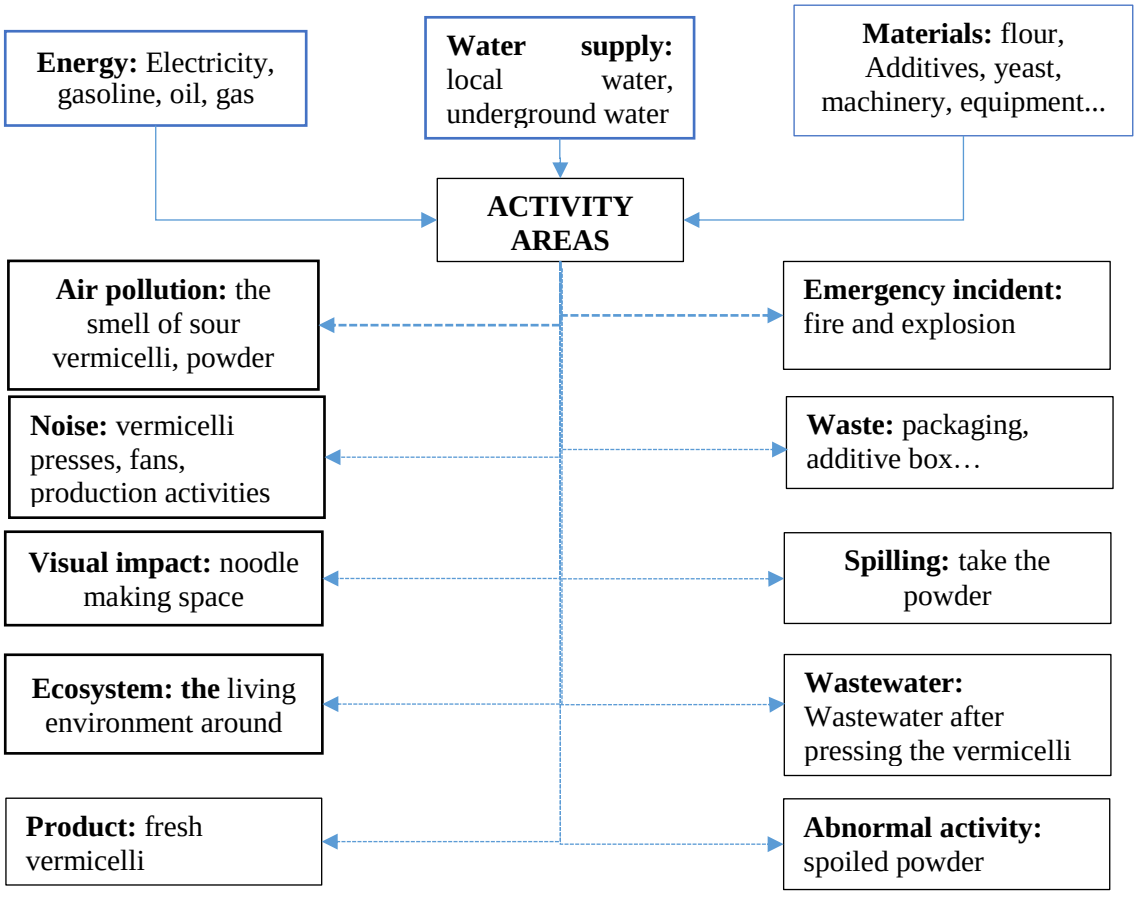

Figure 1. Flow diagram of input and output criteria of activity areas
(*Source: InterConformity Assessment and Cefitication, 2016)*

– Wet grinding and fermentation zone area: The grinding process can be done by hand by adding a tablespoon of soaked rice and a tablespoon of clean water to the mill, grinding until the rice is smooth and forms a white powder. This process can be mechanized to save time and increase capacity by using a vertical or horizontal 2-cutting board mill. Rice is ground with just enough water through a 2,400-hole/cm2 filter, forming a fine powder, making the dough easy to shape, quick to ripen, and increasing the toughness of the noodles later. When starch is heat treated in water to the gelatinization temperature, starch gelatinization will occur, which is the phenomenon where starch absorbs water, swells, and increases in volume and volume by many times.

– Gelatinization of vermicelli: The gelatinization temperature of each type of starch is different, depending on the ratio of amylose and amylopectin components that make up the starch, and the shape and size of the starch granules. Rice starch granules have a polygonal shape, the average amylose content is about 17%, the ability to swell at 95oC is about 19 times, and the gelatinization temperature of rice starch is about 67-78oC. As a result of gelatinization, the mixture forms a paste-like paste.

– The gelatinization process is carried out as follows: Put half of the drained dough into a pot of boiling water (the amount of boiling water used is equal to the amount of flour added). During the cooking process, it is necessary to stir the flour mixture continuously to ensure that the dough is thoroughly cooked. The cooking process ends when the dough is completely gelatinized (the dough becomes thick, pliable and clear).

– The area for pressing vermicelli: Put the dough after mixing into the vermicelli mold. The vermicelli mold has a cylindrical or rectangular shape, the bottom is covered with a mesh with many small holes, and the diameter of the hole is usually 3 mm. Press down on the dough block in the tube so that the dough fibers pass through the mesh hole as long as possible.

The shaping is taking advantage of the fibrous properties of starch. Starch fibers after gelatinization are capable of forming fibers when pressed through a perforated die.

– Boiling vermicelli area: The mold is usually placed above a pot of boiling water so that the dough after passing through the mesh hole is immediately dipped into the pot of boiling water below. Stir the water in the pot in one direction during cooking to avoid tangling and sticking to the noodles. Cooking time is about 1 minute. The cooking process aims to provide heat for the starch molecules in the dough (especially the starch molecules that have not been gelatinized in the previous stage) to absorb water, swell and gelatinize (make the starch fibers fully ripe). In boiling water, the noodles separate, stabilize the fiber structure, and cook the starch.

– Cool the vermicelli area: After cooking, the noodles must be taken out and cooled immediately with clean cold water. Cooling causes the starch fibers to rearrange and stabilize their fiber-forming properties, which makes the noodles tougher. The cooling process must be fast to prevent further gelatinization of the vermicelli fibers, causing

degradation of the starch fiber surface to prevent the vermicelli fibers from becoming soft and brittle. After cooling and draining, we get the finished vermicelli. Normally 1kg of rice makes 3kg of vermicelli.

2.3. Multi-criteria **(**InterConformity Assessment and Cefitication, 2016)

– Through the evaluation and scoring of the environmental elements, the multi-criteria technique is a method used to identify the important environmental factors. the frequency of occurrence and the seriousness of the incident, two criteria laid out by the assessment organization (see Table 1), to establish the significant environmental features. These two criteria were selected based on scientific research on risk assessment standards used by Assessment and Certification Organization InterConformity (Lê Th Hng Trân, 2008).

– Depending on the degree of environmental impact, each criterion will be scored using a scale from 1 to 3. If the average score for the two criteria above is greater than 6, the environmental factor will receive a higher value. If the average score is less than 6, the relevant field needs to be given priority for immediate repair. If the environmental element is not given priority, it will be fixed at the following time. The allocated mean score is not constant; instead, it changes depending on how many meaningful environmental aspects the study uncovers.

By the InterConformity Assessment and Certification Organization's (2016) document, a business that initially develops an environmental management system can achieve environmental improvement if the number of environmental aspects is less than 8 meaningful aspects. With so many significant factors, the company won't feel too much pressure, which will motivate it to make improvements.

– Convention: Significant environmental factors that are prioritized to be minimized and improved first and eliminated if possible include fire and explosion, occupational accidents, food poisoning, etc. Therefore, they will also be recognized as major environmental features if they receive 3 points on the hazard scale.

Formula = Frequency of occurrence X Severity of incident

TABLE 1. Scoring for 2 criteria

Criteria	Score
Frequency of occurrence: The number of times the environmental aspect occurs, the occurrence more or less will determine if the aspect is meaningful.	Low (1 point): May not appear or appear once per year or severals in several years. Medium (2 points): Occurs a few times in a month or a year. High (3 points): Appears weekly or daily.
The severity of the incident: How serious is the aspect to the surrounding objects?	Low (1 point): Only aesthetic impact, comfort. Average (2 points): Impact on water, air, soil quality… High (3 points): Unfavorable and harmful to humans, animal and plant populations...

Source: InterConformity Assessment and Cefitication, 2016

3. Results and discussion

3.1. Flow diagram of each area

The material flow diagram is determined in 6 areas as follows:

TABLE 2. Activities in the regions

Area	Activity
Area for soaking and washing rice	Rice soaking activity
	Rice sieving and drying activitie
	Rice washing activit
Wet grinding and fermentation zone	Wet crushing operation
	Fermentation activity
	Gelatinization activities
Mixing area	Rice sieving and drying activities
	Powder mixing activity
	Additive activity
Noodle pressing area	Noodle pressing activities
Boiling vermicelli area	Noodle boiling activity
Cool the vermicelli area	Noodle picking activity
	Cold blow operation

There are a total of 6 areas The area for soaking and washing rice; Wet grinding and fermentation zone; Mixing area; Gelatinization of vermicelli, The area for pressing vermicelli, boiling vermicelli; Cool the vermicelli area. In these 6 areas, there will be a total of 11 activities taking place. Each zone can have 1 or more activities taking place.

Material flow diagram in selected areas. The output of the flow diagram includes products and environmental aspects that have an impact on the environment.

TABLE 3. Environmental aspects of activities in 6 regions

Activity	Input	Output	Environmental Aspects	Environmental impact
Drying sieve	Electric power Ingredients: Rice Materials: Rice sieving machine	Clean rice Garbage: spoiled rice, sand and gravel mixed in rice, damaged gloves, rice bags	Damaged rice, sand and gravel mixed in rice, rice spilled	Energy consumption Noise pollution
Washing rice	Electric power Ingredients: Rice Materials: Rice washing machine, basket	Rice is washed clean	Rice residue	Water pollution Energy consumption
Soak Rice	Ingredients: Rice Water	Produces soft rice	Wastewater	Water pollution

Activity	Input	Output	Environmental Aspects	Environmental impact
Wet grinding	Electric power Ingredients: Rice has been softened Water Material: Crusher	Rice flour	Rice spilled Spilling powder out of wastewater	Water pollution Air pollution Pollution of the soil environment Energy consumption
Ferment	Ingredient; Rice flour, brewed yeast Material: Pot	Fermented rice flour mixture	Yeast packaging Odor Wastewater from fermentation	Water pollution Air pollution Pollution of the soil environment
Gelatinization process	Rice flour is drained Water at high temperature Material: Industrial pot	Gel-like crystalline mixture	Heat released from the process of baking powder Powder spilled out Wastewater from the gelatinization process	Energy consumption Water pollution
Squeeze out sour juice	Electric power Rice flour after soaking Material: Press machine	Powder after removing sour water	Sour smell, press noise, powder spillage, sewage	Air pollution Noise pollution Environmental pollution, loss of beauty Energy consumption
Add Additives	Powder after squeezing sour juice	Powder after adding additives	Additive smell, additive container	Air pollution Harm to human health
Mix the flour	Electric power Powder after removing sour water and adding additives Material: Mixing pot	Powder after mixing	Stirring noise, powder spilling	Noise pollution Environmental pollution, loss of beauty Energy consumption
pressed vermicelli	Electric power Powder after mixing Material: Noodle press machine	Starch fiber	Waste heat from noodle press machine The powder is scattered outs	Energy consumption
Boiled vermicelli	Electricity and Water Powder yarn after pressing Materials: Boiling trough	Fresh vermicelli	Waste heat from boiling vermicelli Wastewater from the process of boiling vermicelli	Energy consumption Water pollution

There are a total of 11 activities taking place in the selected areas, these activities generate environmental aspects such as waste, wastewater, exhaust gas, noise, and residual heat… causing impacts. to the soil, water, and gas environment in and around the area where the production facility is located.

Comment: According to the above list, the environmental aspects of each of the above areas will have a positive or negative impact on the environment. If the impacts are negative, they will deplete natural resources; causing environmental pollution of water, air, and soil; affect the health of workers. This environmental aspect will be further calculated to filter out the meaningful environmental aspects prioritized for remediation.

3.2. Evaluation of meaningful environmental aspects

The assessment determined the facility's environmental features through actions in 6 areas. The study team will evaluate each environmental factor to identify the significant environmental factors for management, better control, mitigating adverse effects, or preventing adverse effects on the environment and people. We employed a multi-criteria approach to determine the environmental factors, and the outcomes are as follows:

TABLE 4. The synthesis of significant environmental aspects

No	Activity	environmental aspect	Frequency	Level	total score	Explanation content
1	Wet grinding	solid waste	High (3)	Low (1)	3x1=3	- Frequency: wet grinding takes place every day → generates solid waste (rice, powdered spillage). - Level: Solid waste is powder, rice spillage affects the aesthetics of the work area and can be cleaned up.
		Wastewater	High (3)	Average (2)	3x2=6	- Frequency: wet crushing takes place every day → Continuous wastewater generation. - Level: Waste water generated causes water pollution but can be treated by wastewater treatment company → Hazardous level is 2
2	Ferment	solid waste	High (3)	Low (1)	3x1=3	- Frequency: fermentation takes place every day -> generates solid waste. - Level: solid waste is an unsightly enamel container in the work area, which can be collected daily.
		Bad smell	High (3)	Low (1)	3x1=3	- Frequency: fermentation takes place daily → odor generation. Level: The smell of rice flour causes unsightly, air pollution at the work area, but it can be overcome by wearing a mask.

No	Activity	environmental aspect	Frequency	Level	total score	Explanation content
	Ferment	Wastewater	High (3)	Average (2)	3x2=6	- Frequency: fermentation takes place every day → generation of wastewater Level: Waste water generated causes environmental pollution.
		solid waste	High (3)	Low (1)	3x1=3	- Frequency: fermentation takes place every day → generates solid waste (yeast container). - Level: solid waste is an unsightly enamel container at the workplace, which can be collected daily
3	gelatinized	solid waste	High (3)	Low (1)	3x1=3	- Frequency: gelatinization takes place every day → generation of solid waste (powder spillage) - Level: solid waste is scattered powder causing unsightly work area but can be collected daily.
		Wastewater	High (3)	Average (2)	3x2=6	- Frequency: sizing activities take place every day → waste water is generated. - Level: Waste water generated pollutes the water environment but can be treated by the wastewater treatment company.
4	Drying sieve	solid waste, Rice dirty, dusty bran from rice, sand and gravel mixed in rice, rice spilled	High (3)	Average (2)	3x2=6	- Frequency: Sieve drying takes place daily → bran dust is generated, excess rice is scattered. - Level: Small production facilities, dust flying into the air in small amounts, affecting workers in the production facility, surrounding outside the facility is not affected; Excess rice and spilled rice spilled on the ground can be collected.
5	Washing rice	Rice residue	High (3)	Average (2)	3x2=6	- Frequency: Rice washing activities take place every day → Generation of waste water containing rice residue. - Level: The rice residue is brought to the wastewater collection line by wastewater and another part is used to irrigate plants.

No	Activity	environmental aspect	Frequency	Level	total score	Explanation content
6	Soak rice	Wastewater	High (3)	High (3)	3x3= 9	- Frequency: Rice soaking activities take place every day → Generation of wastewater. Level: Part of the wastewater is discharged to the ground (no impact) and the rest is connected to the wastewater line.
7	Sour juice	Sour smell	High (3)	High (3)	3x3=9	- Frequency: The activity of squeezing sour juice takes place every day. Produces a sour smell - Level: In a relatively closed facility, the sour smell evaporates in the facility, there are few odor exits, but it can be handled by wearing a mask or using a deodorizer and aspirator.
		Noise	High (3)	Low (1)	3x1=3	- Frequency: The activity of squeezing sour juice takes place every day → Generated noise - - Level: In the facility with closed spaces, noise occurs inside the production facility, but it is not significant.
		powder spilled on the ground	High (3)	Low (1)	3x1=3	- Frequency: The activity of squeezing sour juice takes place every day → Sparkling powder generation - Level: In the establishment, there is a drop of powder inside the production facility in the sour press, but not significantly, it is possible.
8	Add Additives	Additive smell	High (3)	High (3)	3x3=9	- Frequency: Additive activity takes place every day Odor of additives Level: There are tight spaces in the body, the odor season of the odor-evaporating additive in the facility, few exits for the smell, can be handled by wearing a mask and using a vacuum cleaner and deodorizer.
		Additive container	High (3)	Low (1)	3x1=3	- Frequency: Additives are added daily → Additive odors are generated. Level: container for unsightly additives in the work area, which can be collected daily.

No	Activity	environmental aspect	Frequency	Level	total score	Explanation content
9	Mix the flour	Noise	High (3)	Low (1)	3x1=3	- Frequency: The dough mixing takes place every day → The noise of the mixing pot is generated. Level: In a facility with enclosed spaces, noise occurs inside the production facility, but is negligible.
		powder spilled on the ground	High (3)	Low (1)	3x1=3	- Frequency: Daily flour mixing activity Spawn powder generation Level: In the facility there is a powder drop inside the production facility in the mixing pot, but it is not significant, can be cleaned up.
10	Squeeze the vermicelli	Heat	High (3)	Low (1)	3x1=3	- Frequency: The vermicelli pressing takes place every day → Generating heat. Level: Although the noodle press works regularly, the heat generated is not high.
11	Boiled vermicelli	Heat	High (3)	Low (1)	3x1=3	- Frequency: The activity of boiling vermicelli takes place every day → Generating heat. Level: Although the vermicelli boiling trough works normally, the heat generated is not high.
		Wastewater	High (3)	High (3)	3x3=9	- Frequency: Boiling vermicelli takes place every day → Generating waste water. Level: Vermicelli boiling water contains impurities with a milky color, starch and easily biodegradable organic matter. When discharged directly into the environment, wastewater will interfere with the natural filtration process. If water is left for a long time, anaerobic biodegradation will occur, causing foul odors.

This table of identifying significant environmental aspects has calculated the scores for the criteria Frequency of Occurrence and Level of Hazard based on observations and inquiries about daily activities at the establishment. 31 environmental aspects at 11 activities are scored according to the convention based on the formula proposed by the assessment and consulting organization Interconformity. The content explained in the table in each environmental aspect was both observed and summarized by the research team while asking employees working in the production facility.

In the above table, there are 2 separate convention cases: For the environmental aspect of fire, explosion, short-circuit, occupational accident, although the frequency with a

score of 3 (not appearing, or rarely appearing), when it occurs, the level of risk is very high and dangerous. Therefore, with a score of 9, the aspect is classified as a significant environmental aspect that must be prioritized to be eliminated.

TABLE 5. Meaningful industrial zones of ADN fresh vermicelli production facility

No	Environmental aspect		Activity	Total score	Significant environmental aspects
1			Wet grinding	3x2=6	Meaningful environmental aspect
			Ferment	3x2=6	Meaningful environmental aspect
			soft cooking	3x2=6	Meaningful environmental aspect
			Boiled vermicelli	3x3=9	Meaningful environmental aspect
2	Waste: Damaged rice, rice bran dust, sand and gravel mixed in rice, rice spillage, rice residue		Drying sieve	3x2=6	Meaningful environmental aspects
			Washing rice	3x2=6	Meaningful environmental aspects
3	Bad smell	Sour smell	Squeeze the vermicelli into sour water	3x3=9	Meaningful environmental aspects
		Additive smell	Add Additives	3x3=9	Meaningful environmental aspects

After calculating, there are all 3 significant environmental aspects such as Wastewater, Solid Waste, and Odor in 12 activities taking place at the noodle factory with scores from 6-9 according to the convention. of the research team based on internal documents provided by Interconfomity Corporation. These aspects are identified as significant environmental aspects that require priority remedial action. The research team choosing a total score of 6 or more will be a meaningful environmental aspect because according to an experienced certification consultant, an organization (base) takes the first step to building The iso environment system should only have the number of environmental aspects from 6-9, which is suitable for the organization to build the easiest and least complicated environment system. To encourage organizations to step by step build the system without putting pressure on the organization. After the organization has completely remedied the aspects with a score of 6 or higher, other environmental aspects with a smaller score will also be addressed in turn.

4. Conclusion and recommendations

4.1. Conclusion

Through the process of understanding, observing, calculating, and assessing the current environmental status at the ADN fresh noodle factory, the topic has been identified as 31 environmental aspects at 11 activities in 6 areas at the facility. produce fresh noodles. From 31 environmental aspects, the topic has calculated 3 environmental aspects Solid, wastewater, and odor in 11 significant environmental aspects with scores from 6-9 points. Neighborhoods arise in the following areas:

Environmental aspects mean wastewater: generated in sunny and wet areas, fermentation, gelatinization, vermicelli,

Environmental aspects mean solids: sieving, and washing rice.

The environmental aspect means the smell: sour smell at the sour juice pressing area, additive smell at the step of adding additives, chemical odor

Despite some restrictions, the findings of our study could assist the facility in obtaining the most thorough overview of environmental concerns by ISO 14001:2015. From there, they might prepare to put corrective and preventive measures into place. It will be possible in the future to fully develop an environmental management system by the ISO 14001 standard, enhance its reputation, and export finished goods to other nations.

4.2. Recommendations

DNA fresh vermicelli production facilities should overcome significant environmental aspects that hurt the environment the research has found. Contributing to the protection of the environment where they operate is also one of their responsible actions to the community. On the other hand, the establishment can refer to the environmental management system TCVN ISO 14001: 2015 to initially have more attention and support for this standard.

In addition, to meet the requirements of the environmental management system according to ISO 14001:2015 standard, DNA fresh noodle production facilities should:

Thoroughly overcome significant environmental pollution causing negative impacts on the environment.

Encourage employees to actively participate in environmental protection.

References

Decree No. 15/2018/ND-CP detailing the implementation of a number of articles of the Law on Food Safety.

Decree No. 45/2022/ND-CP stipulating penalties for administrative violations in the field of environmental protection.

DNA (2015). DNA fresh vermicelli production facility. Internal documents.

InterConformity Assessment and Cefitication (2016). Internal documents.

Law on Environmental Protection 2020, No. 77/2020/QH14

Law on Food Safety 2010, No. 55/2010/QH12

Le Huy Ba (2006). ISO 14001 Environmental management system, Theory and practice, Publishing scientific and technical.

Le Thi Hong Tran (2008). Environmental risk assessment, Publishing scientific and technical

Vietnam Standard 4-20:2011/BYT National Technical Regulation on Food Additives – Group of Polishing Agents.

Vietnamese Standard ISO (2015). Environmental management systems - Requirements and guidelines for use 14001:2015.