

Study of odor pollution by x slaughterhouse waste in Central Java 2021

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Abstract

Purpose: Bad waste management causes the slaughterhouse's environment to look unsightly and unpleasant. This research aimed to evaluate the factors that cause odor pollution by X Slaughterhouse waste. **Methods:** This qualitative research used a case study approach. Informants were recruited through purposive sampling. The primary informants were six people who lived or worked around slaughterhouses. The supporting informants were the Head of the Slaughterhouse Division, the slaughterhouse's daily waste officer, and the Environmental Service's Head of Impact Assessment and Waste Management Division. Research conducted in Central Java. Open Code 4.02 was used to analyze the qualitative data. **Results:** Overall, the slaughterhouse's facilities were not appropriate for the requirements in SNI 01-6159-1999. The odor pollution caused by the waste discharged into the environment without proper management was supported by the results of the BOD level test from the slaughterhouse's sewers, 261,5 mg/L. The most significant discharge in the slaughterhouse's sewer was when the slaughterhouse had been cleaned, 0,137 m³/s, and the most minor discharge was during the slaughter activity, 0,006 m³/s. The slaughterhouse was disinfected after slaughter activity to protect the environment from slaughterhouse waste. Meanwhile, the Environmental Service has not made any specific efforts. **Conclusion:** Lack of adequate waste management facilities caused the odor pollution. It is necessary to stipulate waste management guidelines, supervise the slaughterhouse's waste management, and coordinate relevant services to monitor and evaluate it. The following researchers can observe using all the requirements in SNI 01-6159-1999.

Keywords: odor pollution; slaughterhouse's waste; slaughterhouse waste

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INTRODUCTION

A slaughterhouse is a building or building in a cluster used to slaughter livestock. Slaughterhouses are designed appropriately to the requirements to prevent pollution [1]. Lousy waste management causes the slaughterhouse's environment to look

unsightly and smell unpleasant, polluting the water [2]. Slaughterhouses serve the community by slaughtering livestock correctly, the antemortem and postmortem inspections, and monitoring and surveillance of animal disease and zoonoses to ensure the meat product is safe, healthy, whole, and halal. Also, establishing a slaughterhouse must be

appropriate to the rules of SNI 01-6159-1999 [3]. The requirements for a slaughterhouse in SNI 01-6159-1999 are: a) The location accords Rencana Umum Tata Ruang (RUTR), Rencana Detail Tata Ruang (RDTR), and Rencana Bagian Wilayah Kota (RBWK), not in a densely populated area and does not cause pollution; b) Have a freeway, a minimum water supply for cows of 1000 liters/head/day, adequate electricity, and hot water installation with a temperature of 80°C; c) A slaughterhouse cluster must have a main building of dirty and clean areas, livestock storage and resting cages, isolation cage, veterinarian's office, employees' rest area, prayers room, changing room, rest room, waste facilities, incinerator, guard house, electric substation, water tower, cooling room, laboratory, sewer; d) Equipment for meat made from noncorrosive materials, easy to clean, equipped with rail systems and carcass hanging tools, and washing hands facilities; e) Employees must be healthy, have regular health checks at least once a year, and be trained on hygiene and quality; f) Antemortem and postmortem inspections done by a veterinarian or authorized officer [4].

Slaughterhouse liquid waste contains sources of contamination, such as pieces of meat, Total Suspended Solid (TSS), Chemical Oxygen Demand (COD), Biological Oxygen Demand (BOD), chloride, and phosphorus nitrate [5]. Slaughterhouses waste, such as feces, urine, rumen contents, blood, fat, and water from washing activity where microbes can grow and develop. A decomposition process will result in odor pollution [6]. Peraturan Menteri Lingkungan Hidup Republik Indonesia Nomor 5 Tahun 2014 Tentang Baku Mutu Air Limbah stipulates that the Maximum BOD level of slaughterhouse wastewater is 100 mg/L [7]. Waste water must be treated with a Waste Water Treatment Plant (WWTP) before being discharged into the environment through stages: a) Bar screen, functioned filtration of large garbage; b) Fat separator tank: Fat will be separated to precipitate sand, soil, or other things that cannot be decomposed; c) Equalization tank, functioned in controlling fluctuations in wastewater flow; d) a functioned deposit suspended silt, sand, and other organic substances in the initial sedimentation tank; e) Anaerobic contactor tank. Like a wasp's nest, a medium decomposes organic substances as a microbial film; f) The aerobic contactor tank also has a wasp's nest. Air will be blown to make the microbes decompose the organic substances, increasing the decomposition efficiency; g) In the final sedimentation tank, sludge containing microbes will be precipitated and pumped back into the net. The

overflow water will be flown to the chlorination tank, and finally, treated water that comes out can be discharged into rivers or canals [6].

Slaughterhouses' solid waste, such as animal bones, meat, and feces, are organic wastes, so utilization techniques can be used to manage that waste. The first is composting. Composting is an aerobic process in which organic materials are degraded due to the microbial's activity. The composting process is influenced by pH, aeration, humidity, and substrate availability. The pathogens are also inactivated by microorganisms in compost through the antibiotics produced by these microorganisms [8]. The second is biogas. Biogas is the result of an anaerobic process, and the advantages of using solid waste from slaughterhouses as biogas include catching CH₄, which is a greenhouse gas, reducing deforestation, improving air quality, and reducing organic pollutants in the aquatic environment [9]. The third is livestock feed. The content of cow's rumen can be used as an ingredient to make feed in various forms, such as flour or fibrous materials for making supplements, as silage and nutritional blocks, and the nutritional contents such as fiber and protein [10].

A study showed that of 40 informants who lived around the slaughterhouse, 23 people (57.5%) felt the odor pollution, seven people (17.5%) felt the water pollution, and 18 people (45%) had health problems [1,11]. Previous research examined the impacts of slaughterhouse waste but did not examine environmental protection by relevant services due to pollution from slaughterhouse waste; meanwhile, this research did.

METHODS

This qualitative research used the case study approach. Qualitative research is a technique used to describe and interpret the meaning of the data collected by considering the situation under study to obtain a representative picture of the actual situation [12]. Informants in this research were recruited through a purposive sampling technique. There were nine informants, divided into primary informants and supporting informants. The main informants were six people who lived or worked around the slaughterhouse according to the inclusion criteria, such as being within a maximum radius of 300 meters, being 17 years old, being the minimum age, and being 60 years old. Moreover, the exclusion criteria include living or working around the slaughterhouse for less than 6 months, having diseases that interfere with the smell (such as influenza) during this research, and

providing information but not wanting to participate. The supporting informants were a Head of the Slaughterhouse division, a daily waste officer in a slaughterhouse, and a Head of the Impact Assessment and Waste Management division at the Environmental Service. Data was collected through observation, in-depth interviews, the slaughterhouse's sewer measurement, and a BOD test of the slaughterhouse's wastewater. This research was conducted in Central Java from May until June 2021. Data was collected

after obtaining the research permissions such as Ethical Clearance numbered KE/FK/0559/EC/2021 from the Medical and Health Research Ethics Committee Faculty of Medicine, Public Health and Nursing Universitas Gadjah Mada.

RESULTS

Slaughterhouse's facilities

Table 1 shows the results of observation for slaughterhouse facilities based on SNI 01-6159-1999

Table 1. X observation results of slaughterhouse facilities based on SNI 01-6159-1999

Physical facilities requirements	Observations at X slaughterhouse
Apparatus:	
Freeway	The slaughterhouse was in a densely populated area at the T-junction, and some points on the road inside its cluster had holes.
Minimum water supply for cow 1000 liters/head/day	The water supply is only for cleaning, not drinking, because cows are slaughtered immediately.
Adequate electricity	Electricity will be provided to support lighting and the water pump in each room.
Hot water installation with a temperature 80°C)	Hot water installation was not available.
Building and layouts:	
Dirty areas and clean areas	There was no separation between clean and dirty areas.
Livestock storage and resting cage	Available but not used. Storage and animals in the slaughter area.
Isolation cage	An isolation cage was not available.
Veterinarian's office	Available but not used. The veterinarian's office was in the Livestock Service.
Employees' rest area	Employees' rest area was not available.
Prayers room	The prayer room was not available.
Changing room	Available but did not have a storage cupboard.
Restroom	Available but not used.
Waste facilities	Waste facilities were not available.
Incinerator Guardhouse	There was no incinerator available. Waste was burned. Available but not used.
Electric substation	Electricity will be provided to support lighting and the water pump in each room. Available for indoor spraying.
Water tower	A cooling room was not available.
Cooling room	The laboratory was available.
Laboratory	The sewer was opened and stuck.
Sewer	
Equipments:	
Equipments for meat made from noncorrosive materials, easy to clean	The blades used were noncorrosive and easy to clean and maintain.
Equipped with rail systems and carcass hanging tools	The carcass hanging equipment looks worn out.
Washing hands facilities	Washing hands equipment had faucets designed to touch the faucet, and there was no soap or dryer.
Employee and company hygiene:	
Regular health checks at least once a year	Regular health checks were not carried out.
Trained in hygiene and quality	Trained on hygiene and quality was not carried out.
Veterinary public health surveillance:	
Antemortem and postmortem inspections done by a veterinarian or authorized office	A veterinarian or animal nurse does Antemortem and postmortem inspections.

Slaughterhouse waste management

There were no guidelines for slaughterhouse waste management.

"... Guidelines, ma'am? There aren't any..." (AS, daily waste officer).

Liquid waste flew through the septic tank and then into rice fields.

"... It flows through the septic tank and then drains into the residents' rice fields..." (SP, Head of the Slaughterhouse Division).

Solid waste was burned, stacked, and transported by the Environmental Service.

"... When it's dry, we burn it. When it's full, we remove it, ma'am... We take the top part and dispose of it... The Environmental Department handles it, ma'am..." (AS, daily waste officer).

The waste management at X Slaughterhouse did not use adequate facilities, so waste was discharged without sound waste management.

Environmental pollution caused by slaughterhouse waste

The odor pollution from the slaughterhouse's waste smelled to the homes and businesses of the surrounding community.

"... Yes, the smell reaches here..." (KD, Retired).

The odor pollution smelt more pungent in the summer.

"... The smell, especially when the water is not running... When the water stops flowing, it stinks. It just stagnates..." (PR, Entrepreneur).

The severity of the odor pollution smelt differently by each informant.

"... The smell causes nausea, ma'am..." (MDH, Entrepreneur).

"... The smell ruins the appetite..." (PR, Retired).

A complaint was submitted to the Environmental Service.

"... I reported it to the Environmental Department. An officer once came here..."

"There were 10 people from the slaughterhouse who signed the report...'So, what do you want now?' ... 'I just want the smell to go away, sir...' However, there was no follow-up...It happened only once that I reported it... It was about two years ago, though I cannot recall the exact date..." (KD, Retired).

All informants said that they had never received compensation from X Slaughterhouse.

"... Never... It's necessary... Because the smell isn't just occasional, ma'am. It's like every day... [Compensation in] groceries or money..." (MDH, Entrepreneur).

The odor pollution felt by the society around the slaughterhouse is caused by waste.

Environmental protection by livestock service

The Livestock Service's efforts to protect the environment from slaughterhouse waste pollution included disinfecting the slaughterhouse's building after every slaughtering activity.

"... After every activity, disinfection is carried out..." (SP, Head of the Slaughterhouse Division).

Environmental protection by environmental service

The Environmental Service made no specific efforts to protect the environment from slaughterhouse waste pollution.

"... To address the impacts, the regulations are already established, but they're still general in nature. They don't specifically apply to slaughterhouses..." (SN, Head of Impact Assessment and Waste Management Division).

Slaughterhouse's Sewer Discharge Measurement

Table 2 shows the measurement results for the slaughterhouse's sewer discharge.

Table 2. Slaughterhouse Slaughterhouse's Sewer Discharge

Measurement	Discharge
First	0,137 m ³ /s
Second	0,006 m ³ /s
Third	0,040 m ³ /s
Fourth	0,070 m ³ /s
Fifth	0,019 m ³ /s

BOD level test

Sampling done by the Environmental Service team used a plastic jerrycan with a 2-liter volume after cleaning activity in the slaughterhouse's sewer because the slaughterhouse did not have a Waste Water Treatment Plant. The result showed a BOD level of 261,5mg/L.

DISCUSSION

Slaughterhouse's facilities

Sanitation facilities affect meat quality due to microorganism contamination from soil, employees, water, and facilities to support sanitation. Microorganisms could enter during meat processing because the equipment needed is unavailable, and areas are not separate for each flow of activity. Lack of security guarantees is seen through hygiene sanitation, which includes personnel, buildings,

equipment, production processes, storage, and carcass distribution [13]. The water supply is clean water in sufficient quantities [14]. Electrical function to move the restraining box and lighting [15]. Hot water to soak the blades [16]. Hygiene sanitation can be run and monitored if personnel supervises [17].

Slaughterhouse waste management

Wastewater from X Slaughterhouse was sprayed, entered the sewer, and flowed into the rice fields. Waste water must be treated with a WWTP before being discharged into the environment by going through stages: bar screen, fat separator tank, equalization tank, initial sedimentation tank, anaerobic contactor tank, aerobic contactor tank, and final sedimentation tank [6]. Solid wastes from X Slaughterhouse were burned. Slaughterhouse solid waste, such as animal bones, meat, and feces, are organics that can be managed with some techniques, such as composting. A process in which organic materials are degraded. [8]. Biogas is the result of a process, and the advantages of using solid waste from slaughterhouses as biogas include catching the CH₄ and reducing organic pollutants in the aquatic environment [9]—livestock feed. The content of cow's rumen can be used as an ingredient to make feed in various forms [10].

Environmental pollution caused by slaughterhouse waste

Slaughterhouse waste produces ammonia and hydrogen sulfide, increasing BOD and COD, changing pH during decomposition, and causing odor pollution [1]. The odor pollution will be smelt depending on the wind [2]. The odor pollution smelt more pungent in the summer when the smell comes from accumulated solid waste [1]. Response to odor depends on the individual. Slaughterhouse waste smells from feces, urine, blood, and feed [11]. Society can submit a complaint when odor pollution is smelt from slaughterhouse waste because it is environmental pollution.

Environmental protection by livestock service

Disinfected done every after slaughtering activity. Equipment must be cleaned and disinfected to maintain hygiene and sanitation [18]. It is necessary to tighten regulations related to waste management and impose sanctions on slaughterhouses that cause pollution to the government. Efforts to reduce pollution include making ponds, waste treatment and integrated waste disposal systems, rehabilitation, relocation, and education related to public health to

slaughterhouse employees [19]. The government must carry out development planning, economic activities, environmental funding, and incentives or disincentives. It is necessary to manage slaughterhouse waste to ensure the sustainability of human life and the environment [20].

Environmental protection by environmental service

No guidelines, regulations, or programs have been developed. Environmental pollution must be prevented through improvements and strategies in facilities, infrastructure, or management to ensure that slaughterhouse activities comply with the requirements [21]. Minimizing pollution can be done by periodic evaluation, monitoring, and education related to waste management [11].

Slaughterhouse's sewer discharge measurement

Measuring the slaughterhouse's sewer is done with a simple measurement. First, measure the sewer's area (A) by multiplying the width (L) and depth (H):

$$A \text{ (m}^2\text{)} = L \times H$$

Second, measuring the velocity (V) by dividing the length (P) and time (T) of the float following the wastewater's flow:

$$Q = A \cdot V \text{ [22]}$$

The most significant discharge in the slaughterhouse's sewer was 0,137 m³/s during the first measurement, when the slaughterhouse was being cleaned, and the most minor discharge was 0,006 m³/s during the second measurement when the slaughtering activity was being performed.

Discharge measurement aims to determine the potential water resources in the cross-sectional area [23]. Discharge is the amount of water flowing in a cross-section per unit of time [24].

BOD level test

The BOD level test showed that the BOD level is 261,5 mg/L. The quality standard for slaughterhouse's waste water's BOD level in the Peraturan Menteri Lingkungan Hidup Republik Indonesia Nomor 5 Tahun 2014 Tentang Baku Mutu Air Limbah is 100mg/L [25]. The BOD level beyond the standard causes the decay of organic matter by bacteria that use dissolved oxygen, causing oxygen to be consumed by microorganisms and causing odor pollution [26]. The weakness of this research is that it does not find people who want to participate because the local government manages X Slaughterhouse.

CONCLUSION

Slaughterhouse's facilities for all aspects of apparatus requirements, some aspects of building and layout requirements, some aspects of equipment requirements, all aspects of employee and company hygiene requirements, and some aspects of veterinary Public Health surveillance were not appropriate with requirements in SNI 01-6159-1999. Slaughterhouse waste discharged into the environment without proper management caused odor pollution; this was supported by the interview results with all of the primary informants and the outcome of the BOD level test from slaughterhouse sewers as much as 261,5 mg/L. Efforts made by the Livestock Service to protect the environment from slaughterhouse waste pollution were disinfected after slaughtering activity. Meanwhile, no specific efforts have been made by the Environmental Service because monitoring and evaluating the slaughterhouse have never been done. It is necessary to stipulate waste management guidelines, supervise the slaughterhouse's waste management, and coordinate relevant services to monitor and evaluate it. The last measuring the discharge by multiplying the sewer's (Q) area (A) and velocity (V): $V = \frac{P}{T}$

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