

Environmental Risk Evaluation of Air and Water Categories in Irrigation Development Activities in Sukasari Village, Indramayu Regency, Indonesia

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ABSTRACT

The process of development activities in Sukasari Village, Indramayu produces a number of environmental contaminants that may cause disruption to the health of the surrounding community. The pollution is in the form of exceeding the Threshold Value of the BOD agent in the water parameter and air pollution in the sound (noise) section. This study aims to determine the concentration and risk level of BOD agent pollution in water parameters and noise pollution. The research was conducted in the Sukasari Village area with a grab sampling method of water and air components (SNI 8995: 2021), based on Indonesian Government Regulation No. 22 of 2021 and KepMenLH No. KEP-48/MENLH/11/11: KEP- 48/MENLH/11/1996, as well as Environmental Health Risk Analysis (EHR) conducted on 32 people based on the purposive sampling method. The results showed that the BOD concentration in the

residential area was 13 mg/l with a safe risk category for 30 people with body weight criteria of 49 to 81 kg and unsafe for 2 people with body weight criteria ≤ 43 kg. The sound parameter measurement results showed a figure of 68 dB(A), which has exceeded the threshold value of 55 dB(A). Decreased BOD quality can cause several diseases, including skin irritation and digestive problems. The impact of noise on hearing can include balance disorders, hearing loss until permanent loss, increased blood pressure, psychological disorders, and behavioral disorders.

INTRODUCTION

Indramayu Regency is one of the regencies located in West Java. Indramayu itself became the center of government as well as the center of the crowd. The Regency is bordered by the Java Sea to the North, Cirebon Regency to the Southeast, Majalengka Regency and Sumedang Regency, and Subang Regency to the West. According to data from indramayukab.go.id. Indramayu has 31 sub-districts which are divided into 313 villages and kelurahan. According to data from pertanian.sragenkab.go.id, Indramayu is the largest rice barn in Indonesia, the largest in Indonesia with a land area of 226,626 hectares (ha) and the acquisition of production of 1,363,312 tons GKG or equivalent to 782,132 tons of rice. With the development and modernization irrigation, which is a program of the Center for River Basin, it is expected that the increase in the results of the production process will increase and can reduce the process of rice import activities from abroad. But on the other hand, the construction of irrigation that too intersects with some areas of the village with the residence of residents, which can potentially cause inconvenience and problems to residents living around the development area. Based on a journal written by (Badmus et al., 2021), the balance and sustainability of natural ecosystems can be managed through assessment, practical analysis, and treatment of surfactants.

High BOD levels can cause several new types of problems. For Indramayu district, which is known as a national rice granary, an excessive increase in BOD levels can cause new problems in the future. For example, in irrigation water if the BOD level has exceeded the Threshold Value that has been set, it can cause glooming algae problems where the algae there will cover the entire surface of the water which will then kill the entire ecosystem in it (water biota). As for humans, if water polluted by BOD enters or is ingested by humans, it will cause problems such as skin irritation and digestive problems. This is supported by research conducted by (Rachmawati, 2019). Meanwhile, excessive noise can cause balance disorders, hearing loss until permanent loss, increased blood pressure, psychological disorders, physiological disorders, and behavioral disorders. This is in accordance with research conducted by (Mukhlis et al., 2018). Environmental monitoring supported by the awareness of the

surrounding community in maintaining their living environment is a sure step in regulating the levels of pollution that occur in the area where they live.

Referring to (Sa'ban et al., 2020), social capital can be used for communities channeled through basic knowledge, which can then be used as a means of socializing the importance of awareness of protecting the environment where they live. This social capital activity is carried out through several stages, including socialization to provide initial capital understanding to the community. Then proceed with assistance to monitor and direct the community so that they can practice managing their environment in a correct and directed manner. Then, supporters can seek supporting facilities and facilities so that environmental management that occurs in the area can be carried out more optimally.

The purpose of this study was to identify what pollutant agents can be caused by irrigation development activities carried out in Sukasari Village, Indramayu. Based on initial observations, it appears that the river around the construction area has a thick green color, which is thought to be the result of pollution caused by the construction. This study is important to do because looking at river irrigation in the area, it has begun to appear that the algae that live there are very fertile. Based on research from (Sellner et al., 2003) the growth of algal blooms is caused by two main factors, namely the natural circulation process, the reversal of water mass and river flow; and anthropogenic activities that cause eutrophication.

MATERIALS AND METHODS

Location and Time of Research

Administratively, this study was conducted in Sukasari Village, Indramayu which is one of location for irrigation development and modernization carried out within the scope of the BBWS program. Data retrieval of environmental components (air, air, and sound) can be seen in the colored dots shown in Figure 1. Sampling is carried out at the project site to be and are being implemented to see how the influence of changes in risk agents that occur at the construction site takes place. This research was conducted from August 2023 to March 2024. The sampling point was chosen because, based on observations with the environmental consultant, the air and sound sampling point is the busiest point of activity in the area. Meanwhile, for water sampling, because the water was calm and there was no sign of movement, the sample point was taken as a reference sample to determine the chemical components of the water.

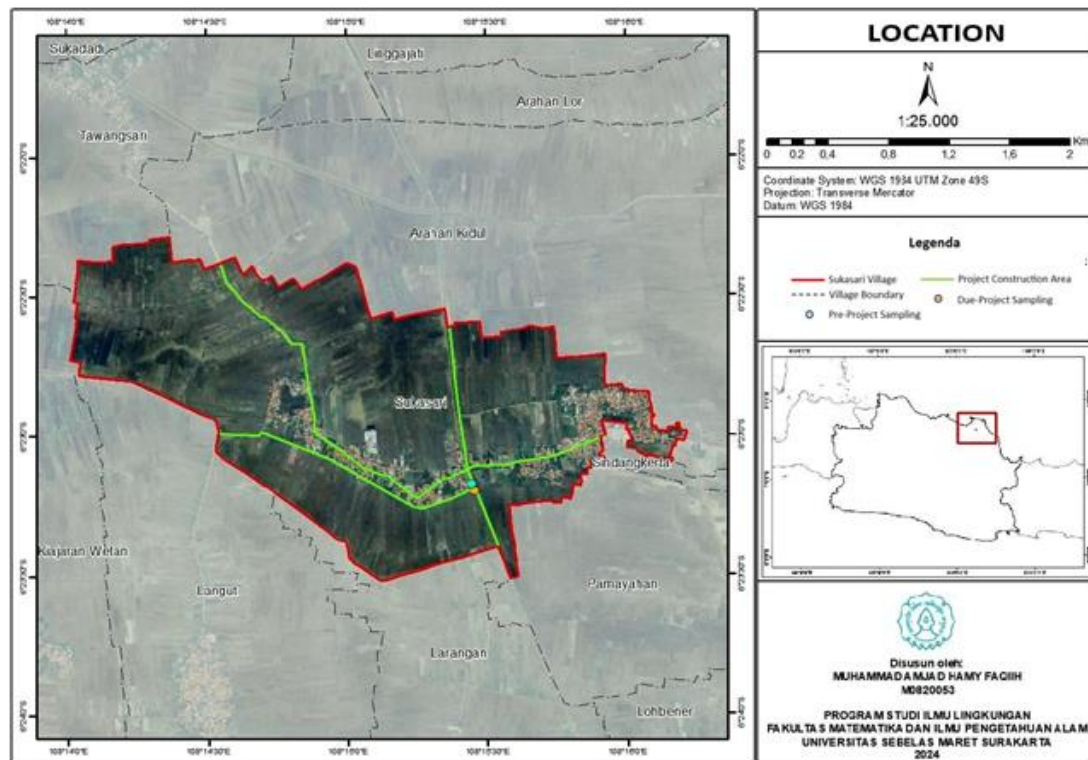


Fig. 1: Research Map Area

Types of Research and Data Collection Techniques

In this study the research method used is a combination of qualitative and quantitative descriptive analysis methods. The Data used in this study include primary data such as sampling point data, surface water; dust; and noise, interview data, as well as documentation and secondary data including data related to the characteristics of sukasari village. The primary data collection technique used is through direct data collection in the field and interviews with relevant parties

Data Analysis

Interview and Observation

According to (Djaelani, 2013), the main qualitative data collection is by participatory observation and in-depth interviews, supported by document review which aims not only to explore data, but to reveal the meaning contained in the research setting. The use of this data collection technique is intended to determine the effect of the irrigation development work stage on the air and water components. As well as, respondents' personal data

along with some other important data needed by researchers such as responses to development, age, weight, and symptoms or complaints of diseases experienced related to pollution exposure in residential areas. The respondents studied in this research are a population consisting of the people of Sukasari Village, Indramayu. The total number of people in Sukasari Village consists of $\pm 5,985$ people (Cidempet Health Center data). Researchers only took a representative sample of 32 families using purposive sampling method which has a location that actually intersects with the area where the project work is running. Researchers have sampling criteria, namely, people whose residences are adjacent to irrigation channels that are being built and people who often move around the water body / construction site. Purposive sampling is a technique widely used in qualitative research to identify and select effective information with limited resources (Patton, 2002 in Palinkas et al., 2015)).

Environmental Condition Analysis of Sukasari Village

The data of the measurement of the quality parameters of environmental components (water, air, and sound) obtained from field measurements and laboratory tests are compared with the established regulations, as well as the water component is compared with PP No.82 of 2001 (water class classification), PPRI No.22 of 2021 (National Water Quality Standard); air compared with PPRI No.22 of 2021 (ambient air quality standard); and sound compared with KepmenLH No: KEP-48/MENLH/11/1996 (noise level standard). Then the flora observation data in Sukasari village were analyzed for pollution absorption based on data from (Dahlan, 2008; Handayani, Nesya Putri, 2024). Then the environmental component assessment step using Environment Sensitivity Index method based on reference from (Damayanti et al., 2004).

Analysis of Public Health Status Sukasari Village

The water quality parameter measurement data obtained from field measurements and laboratory tests are then analyzed and calculated using the Environmental Health Risk Analysis/Environmental Protection Agency (EPA) method to see whether the levels of the tested environmental components can be accepted or used in community activities in the village area. According to (Junarto, 2016), EPA itself consists of 4 steps, namely: hazard identification, dose-response analysis, exposure analysis, and risk characterization. Pollution from a component part cannot be determined only from its concentration, but by determining the value of RfD, RfC, or SF obtained from the results of research or experimental studies from several sources, whether carried out directly on human or animal experimental objects. RfD, RfC, and SF of a component part can be seen in Integrated Risk Information System (IRIS) which can be accessed at www.epa.gov/iris. EPA calculation uses 2 related formulas, the first formula is used to see the safe limit of use while the next formula is used to see whether the water is fit for use.

Determining the dose-response analysis does not have to be done by conducting their own experiments, but can be by reading toxicological reviews, journals and related scientific articles (Tsani et al., 2018). The formulas used include:

Intake non-carcinogenic (Ink) ingestion

$$Ink = \frac{CxRxExDt}{Wbxtavg}$$

Risk level calculation non-carcinogenic ingestion

$$RQ = \frac{I}{RfD}$$

Description:

- Ink : the amount of concentration of risk agents that enter the human body with a certain body weight every day (mg/kg/day).
- C: concentration of risk agent in clean water (mg / l).
- R: the rate of consumption or the amount of water volume (liters/day), has a default adult (settlement) of 2 liters/day and children (settlement of 1 liter/day.
- Dt: duration or number of years of exposure (years). It has a value for residential (residential)/lifetime exposure of 30 years for adults and 6 years for children.
- fE: duration or number of days that exposure occurs annually (days/year). a for exposure to the settlement of 350 Days/year and exposure to the work environment of 250 days / year.
- Wb: human body weight/population / population group (kg). It has a value for adults of 55 kg and for children of 15 kg.
- tavg: average time period of non-carcinogenic effects (days). Can be determined by the equation of length of Work x 365 days.
- I (Intake): Intake that has been calculated by the formula Ink above.

Univariate

Univariate analysis in this study serves to summarize the data set of measurement results in such a way that the data set turns into useful and easy-to-understand information. The summary can be in the form of statistical measures, diagrams, tables, or graphs. Univariate analysis was carried out on each variable studied in this study.

Environmental Sensitivity Index

Referring to research (Ardiansyah, 2019), the environmental sensitivity index in this study is carried out by combining data into variables and accumulating the weight of the criteria of each variable that has been determined.

Cause Root Analysis

Mengacu pada penelitian (Charles et al., 2016), untuk menentukan akar masalah yang menjadi kemungkinan-kemungkinan dalam penelitian ini, digunakan metode ‘5 Why Tools’, dimana digunakannya metode mempertanyakan dan menjawab setiap masalah yang muncul secara berulang kali, hingga pada akhirnya menemukan akar dari permasalahan yang telah dirumuskan.

RESULTS AND DISCUSSION

Environmental Condition of Sukasari Village, Indramayu

Table 1: Flora Observation Data

No	Species Name	Latin Name	Number of Species
1	Noni Tree	<i>Morinda citrifolia</i>	2
2	Srikaya Tree	<i>Annona squamosa</i>	4
3	Mango Tree	<i>Magnifera indica</i>	3
4	Banana Tree	<i>Musa paradisiaca</i>	12
5	Guava Tree	<i>Psidium guajava</i>	2
6	Jackfruit Tree	<i>Artocarpus heterophyllus</i>	4
7	Bamboo Tree	<i>Bambusoideae</i>	10
8	Singapore Orchid Flower	<i>Orchidaceae</i>	2
9	Long Beans	<i>Vigna sinensis L.</i>	1 garden
10	Cassava	<i>Manihot esculenta</i>	1 garden
11	Red Shoots	<i>Syzygium oleana</i>	3
12	Papaya Tree	<i>Carica papaya</i>	3
13	Lime Tree	<i>Citrus aurantifolia</i>	4
14	Rambutan Tree	<i>Nephelium lappaceum</i>	5

The data obtained were compared with the calculation of plant pollution absorption based on data (Handayani, Nesya Putri, 2024) and (Dahlan, 2008). With the existing data on the location can be seen that, mango trees planted in Sukasari Village is a plant that has the highest absorption with absorption value of 455.17 kg/Tree / year

compared to other planted plants. However, when compared with the data collected by (Dahlan, 2008) the plant is not included in the category of 5 plants absorbing the highest pollution that has been studied.

Based on the interview activities that have been carried out by Mr. Waskadi as Mr. Kuwu (Village head), if there is currently no integrated disposal site (TPT), so for waste management it is usually collected at the edge of the river to be burned together or personal burning is carried out on his own vacant land. In the past, garbage bins were made which were then called cars from the Environment Agency (DLH), but only lasted 1 month because the local community did not want further contributions, because it was cheaper to dispose of garbage by burning and throwing it into water bodies. Sometimes to bring meeting activities to discuss these problems, the local community is difficult and sometimes even nagging. The provincial government has also planned a waste bank/maggot activity for the waste treatment, but it has not been carried out until now. However, the villagers themselves have never complained to the local government regarding the problem, because they are afraid of being considered as problematic people themselves (Tini, villagers).

Table 2: Upper Respiratory Tract Infection Data January-December 2023

Village	Population	Child (10% Population)	Child Pneumonia	Child That's Hard to Breathe	Child Cough	Pneumonia	Severe Pneumonia	Total	% Coverage
Sukasari	5,983	598	28	3	3	2	0	36	86.83

Table 3: Water and Sanitation Latrine Data

Village	Clean Water Facilities			Toilet	
	Families Don't Have Clean Water Facilities	Families Have Unprotected Clean Water Facilities	Means of Clean Water Protected Behavior	Families Have Sanitary Latrines	Family Doesn't Have Any Pets
Sukasari	3	1	13	9	3

Village	Population	Child ppl	Case Discovery Target		Toddler Diarrhea				% Coverage
			All Ages	Child	<6 month	6-<12 month	1-<5 years	Toddler Diarrhea	

Sukasari	5,995	91	162	15	4	0	0	4	26.67
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Table 4: Diarrhea Coverage Data

Public Health Sukasari Village, Indramayu can be said to be very sad according to the results of field surveys and interviews with the head of the Local Health Center (Posyandu, Puskesmas). Based on the results of interviews with 30 residents and Mr. Kuwu, it was found that the people of Sukasari village prefer to seek treatment from midwives in the area and wait for a mobile health car that comes every month. This was made clear by an interview from the head of the puskesmas who said that the people of Sukasari village were not so aware with his own health. The posyandu policy, which is almost routinely carried out 2X a month, is still relatively quiet for enthusiasts. Based on Tabel 2 it is noted that very few people are affected by upper respiratory tract infections (ARI), it itself is explained not because there are few who are affected, but those who are recorded affected by the disease are only a few people who feel disturbed by the disease they have experienced. Likewise with health surveys conducted door to door referred to by the puskesmas as the introspective Survey program, this activity was not carried out too smoothly because some local people did not want and did not care about the health data collection activities carried out by the puskesmas itself. As well as those listed in the data Tabel 3, it can be seen that there were still 3 families who did not have private latrines and 9 families did not have sanitized latrines. Recorded on Tabel 4, that the diarrhea experienced by the indramayu community recorded that there were about 162 people and 15 toddlers, the treatment given by the puskesmas was by giving Ors and zinc to overcome the diarrhea. However, until now there have been no recorded people who have died due to diarrhea and Ari that occurred in the Sukasari Village area.

Environmental Parameter Tes Results

Table 5: Measurement Sukasari Village Air Parameters

No	Parameter	Measurement Time	Unit	Regulation Limit *)	Result
1	Sulfur Dioxide (SO ₂)	1 hour	µg/Nm ³	150 *)	28
2	Carbon Monoxide (CO)	1 hour	µg/Nm ³	10,000 *)	599
3	Nitrogen Dioxide (NO ₂)	1 hour	µg/Nm ³	200 *)	20
4	Oxidant (O ₂)	1 hour	µg/Nm ³	150 *)	32
5	Particle < 100 µm (TSP)	24 hour	µg/Nm ³	230 *)	80
6	Particle < 10 µm (PM ₁₀)	24 hour	µg/Nm ³	75 *)	56
7	Lead (Pb)	24 hour	µg/Nm ³	2 *)	0,01
8	Ammonia (NH ₃)	1 hour	ppm	2,0 **)	0,03

Information:

*) = Peraturan Pemerintah Republik Indonesia Nomor 22 Tahun 2021 (Attachment VII) Ambient Air

Quality Standards

**) = Keputusan Menteri Negara Lingkungan Hidup Nomor 50 Tahun 1996 Odor Quality Standard.

Table 6: Sukasari Village Sound Parameter Measurement

Sample ID	Measurement Time (WIB)	Noise dB (A)
K.2	06.00 - 09.00	45
	09.00 - 11.00	68
	14.00 - 17.00	55
	17.00 - 22.00	40
	22.00 - 00.00	41
	00.00 - 03.00	42
	03.00 - 06.00	46
	Ls	63
	Lm	44
	Ls-m	61

Table 7: Measurement of Water Parameters Sukasari Village

No	Parameter	Unit	Regulation Limit *)	Result AP 4
A.	Physical Properties			
1.	Temperature	°C	Deviation 3 ^a	29.8
2.	Total Suspended Solid (TSS)	mg/L	400	56
B.	Chemical Properties			
1.	pH	-	6 - 9	7,2
2.	BOD (5 Day 20°C)	mg/L	12	13
3.	COD	mg/L	80	20
4.	DO	mg/L	1 ^b	3
5.	Chloride (Cl ⁻)	mg/L	600	21
6.	Nitrate as N (NO ₃ -N)	mg/L	20	1
7.	Manganese (Mn)	mg/L	-	< 0,004
8.	Zinc (Zn)	mg/L	2	< 0,002

Information:

*) = Peraturan Pemerintah Republik Indonesia Nomor 22 Tahun 2021 (Attachment VI.I, Class IV) National Water Quality Standards

a = Temperature deviation from air temperature above the water surface

b = Minimum value

In this case, the measurement of the field parameters that have been implemented (Tabel 5, Tabel 6, and Tabel 7), it can be seen that the results of measurements that have been carried out almost all the parameters tested have a value below the threshold. However, in one of the water and sound parameters tested, it has results that are above the proper threshold value. As well as BOD agents in the tested water parameters have a test result value of 13 mg/L, while according to SNI 6989.72:2009 which has been agreed on February 23, 2009, the river water limit that can be utilized is in Class IV with a threshold value (NAB) of 12 mg / L. As well as on the sound measurement results in the range at 09.00 – 11.00 has a measurement result of 68 dB(A), which is in accordance with KEP-48/MENLH/11/1996 the sound limit that can be accepted by homes and settlements is 55 dB(a). This can affect the problems that may occur in the future, for example in BOD agents that exceed NAV, can cause unexpected problems in the future. As well as in the BOD itself contains bacteria *Pseudomonas fluorescens* which can cause a green color in a pollution, and according to data from PubMed Central (PMC), these bacteria can cause pneumonia. According to the University of South Carolina, on how to prevent bacteria *Proteus vulgaris* addition, these bacteria can cause infection in a wound and infection of the urinary tract. While the risk that may occur in noise pollution is the occurrence of increased stress levels, hearing loss, disturbances when resting, and can weaken the immune system.

Environmental Health Risk Analysis

Hazard Identification

One of the hazards identified as a risk agent in the Sukasari Village area, Indramayu is the discovery of Biological Oxygen Demand (BOD) that exceeds the threshold value (NAB) that has been set. The results of the analysis of BOD levels in the water sampling test used as irrigation construction sites showed BOD levels of 13 mg / L. As discussed earlier, this value has exceeded the NAV of the BOD parameters as set out in the Indonesian national standard agreed on February 23, 2009 (SNI 6989.72:2009).

The activities carried out by this project found the main source of the BOD contamination findings in the Sukasari Village irrigation area. However, according to (Lusiana et al., 2020), household wastes such as feces and food waste still dominate as a cause of environmental pollution of water. Heavy equipment and raw materials in the process of ongoing development activities may also be influential in the process of pollution of water bodies located in the village Sukasari. According to, (Rachmawati, 2019), the declining water BOD quality can cause several diseases, including skin irritation and digestive problems.

Based on interviews with 32 residents of Sukasari village, it was found that the majority of the surrounding community did not have expenses for self-medication. The villagers prefer to seek treatment from the local midwives whose medical costs can be negotiated, or wait for Dokmaru (Doctor On Call program from the Regent) or wait for a mobile health car. Based on interviews with Mrs. Wartani and Mrs. Saringkem, they were affected by a disease that attacks the skin that has been running for 2 years and until the time these data were obtained, has not improved. Some other residents, also experienced the same thing but prefer to remain silent because they are afraid to be asked more deeply. As well as Mr. Naspan, who in appearance has irritation wounds on the skin of his hands and neck, but he insists that it is not a big problem.

Response Dose Analysis

The concentration of BOD on water characteristics in Sukasari village has exceeded the applicable NAB limit so that it will cause some direct impacts on public health and the environment around the area. Some of the impacts on public health that have been identified include symptoms of skin irritation, digestion, and respiratory tract such as shortness of breath, diarrhea, purulent skin that does not heal, itching, and scabies. The findings are in line with the statement (Rachmawati, 2019), which also states that high levels of BOD have a relationship with the incidence of digestive disorders and skin irritation than lower levels of BOD in water, and also in accordance with the statement (Indriyani et al., 2017), which states that exposure to dust that has entered the respiratory system can cause non-specific body defense mechanism reactions such as coughing, sneezing, shortness of breath, and wheezing. Although the air levels in the area are still below NAV, it is still necessary to be aware of climate change, natural conditions, and industrial growth/development in each area (Urbanus Rumselly, 2016). The government sets regulations to regulate the requirements and supervision of clean water quality that must meet the requirements, among others: chemical, physical, microbiological, and radioactive requirements; these regulations are set based on PerMenKes No: 416/MEN.CASE / PER/IX / 1990. Government Regulation of The Republic of Indonesia No. 22 of 2021 on Environmental Protection and management organizers have also set the maximum limit for BOD levels in river water for Class One at 2 mg/l, Class Two at 3 mg/l, Class Three at 6 mg/l, and Class Four at 12 mg/l. Further, several chemical mandatory parameters that have a value Reference Dose (RfD) which is where if on these parameters there is an increase in concentration exceeding the quality standard, it will be able to interfere or endanger public health (Agustina, 2019).

Exposure Analysis

Exposure analysis is done by calculating the value intake or intake of risk agents experienced by people who interact directly with risk agents from nitrate (NO_3^-), Seng (Zn), Mangan (Mn), dan Besi (Fe). Value intake for non-carcinogenic effects were analyzed using dose response values (RfD) of previously known risk agents. Some data are needed in conducting exposure analysis that includes anthropometric parameters and other parameters related to the existing condition of the Sukasari Village Community, Indramayu. The value of some of these parameters can be obtained through literature studies or through the results of measurements or research that has been carried out in the field. Some of the parameters used in the analysis of exposure in this study include the respondent's body weight (Wb) obtained from the results of interviews of respondents and measured in kilograms (kg), the rate of ingestion (R) or the amount of incoming volume (mg/l), has a default of 2 L / day for adults and 1 L / day for a child (6-12 years), frequency or number of days of exposure (fE) which has a default for settlement of 350 Days/year and working environment of 250 days/year, concentration of polluting agent for 24 hours (C) obtained through field measurement results and measured in mg/l units, number of years of exposure (Dt) which has a default value for residential (residential)/seumut exposure life span of 30 years for adults and 6 years for children, and the period of exposure time (tavg) which can be determined by the equation of length of Work x 365 days. After the value of the existing condition parameter is known, there is no need to calculate the value intake in identifying what age range is safe in the consumption or use of water, the next value can be calculated Intake non-carcinogenic (Ink) of the BOD risk agent which is calculated based on the currently accepted risk calculation as can be seen in Figure 2.

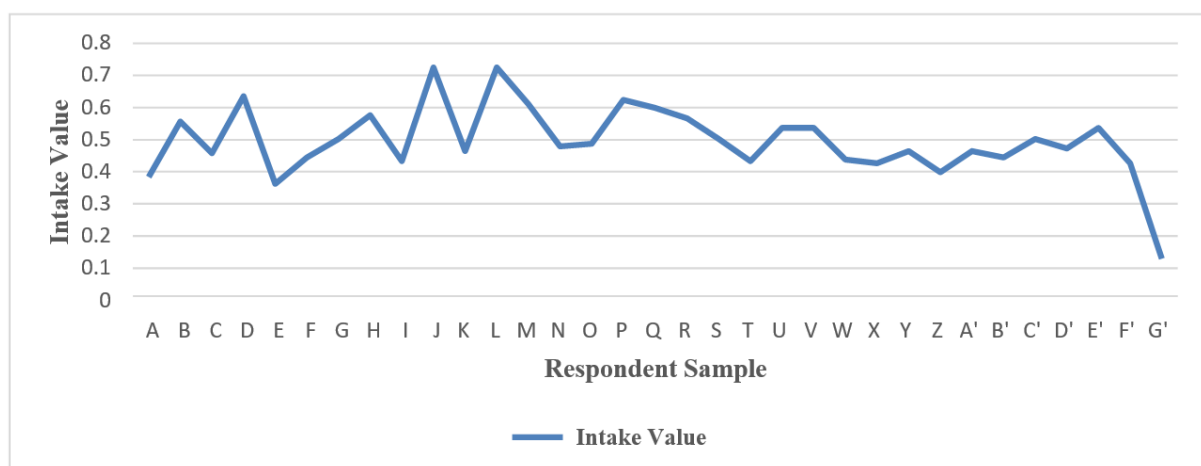


Fig. 2: Intake calculation Tabel non-carcinogenic

Based on Figure 2 above, can be seen the value intake non-carcinogenic from the overall 33 samples of respondents who were given the Code A to G'. The calculation results show the value intake the smallest non-

carcinogenic is in the community sample coded G ' with the value intake 0.1299 mg/kg /day. The G ' community is taken from the sample data of young children listed in the data collection that has been carried out with a body weight of 24 kg with an age range of 9 years, while the value intake terbesar exist in the sample coded J and L which has a value intake 0.7248 mg/kg / day. People J and L have a body weight of 43 kg with an age range of 60 and 82 years. Then for the average calculation results with average body weight ($W_{baverage}$) amounted to 62.03 kg and the average duration ($D_{taverage}$), obtained results intake amounted to 0.4957 mg/kg / day. These findings indicate that the weight factor (W_b) has a strong influence on the value intake than the duration factor (D_t), which is in accordance with the findings (Nur et al., 2021) which states when the value intake inversely proportional to the weight, so the greater the weight, the smaller the value intake accepted. The relationship between the value of community weight with the value intake local communities are described as on Figure 3.

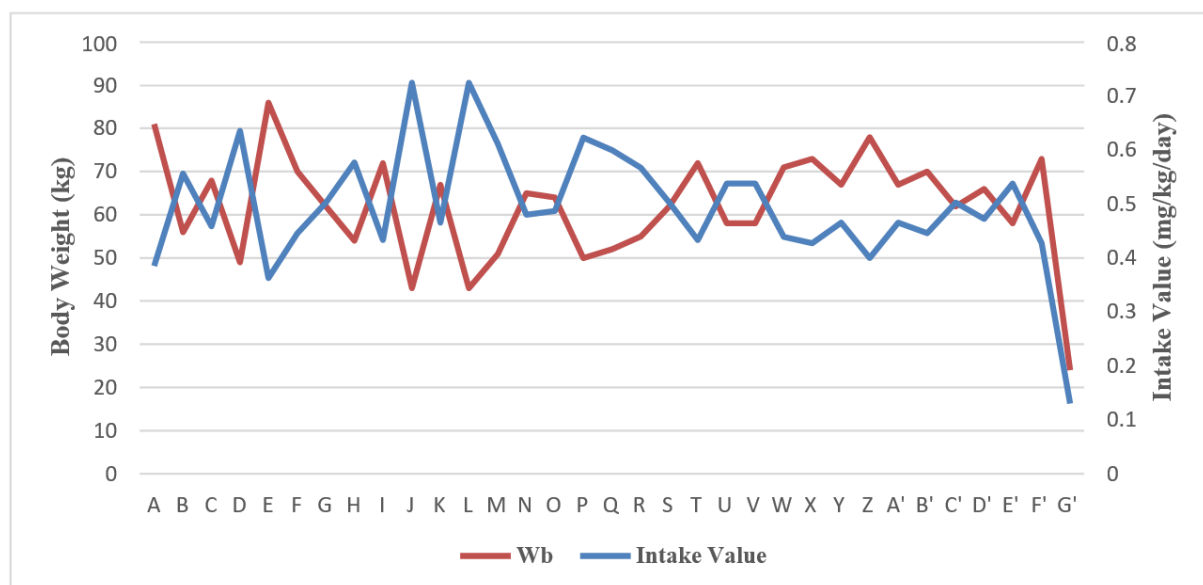


Fig. 3: Relationship between large values Intake by weight

Based on Figure 3 above, it can be seen that the form of relationship between the graph value intake with the weight of the Village Community Sukasari inversely proportional. The figure can explain the inverse relationship between the value intake with the weight of the community, which is where the greater the weight of the community, the smaller the value intake produced. The relationship between the value of body weight with the value intake this is in accordance with the findings of (Wahyuni et al., 2018) dan (Darmawan et al., 2018), which states that the greater the body weight it will make the intake value (intake) small, which will be the smaller the health risk. Based on (Mallongi et al., 2018), stated that in the concept of risk analysis, the greater a person's body weight, the risk received by respondents due to pollution sources will be smaller because people who have larger

bodies also have greater nutrition. In addition, research from (Lan et al., 2023), also stated that the daily intake (daily intake) for children to be five times larger than adults, mainly due to hand-to-mouth activity (hand to mouth) are higher and the size of the body weight is classified as smaller.

Risk Characteristics

Risk characterization stage is done by determining the level of risk Risk Quotien (RQ) untuk efek non-karsinogenik (Ardhaneswari and Wispriyono, 2022). The level of risk is calculated based on mathematical calculations between the value intake by value Slope Factor (SF). Using values Dose Reference (RfD) of the BOD is unknown. In this calculation, use 2 values of the component parts of SF, that is, with the value of *Pseudomonas fluorescens* with a value of 1.05 which can cause Greening problems in water and the value of *Proteus vulgaris* with a value of 0.965 that can cause urinary tract infections (UTIs) (Jouanneau et al., 2014). The results of these calculations can be seen in Figure 4.

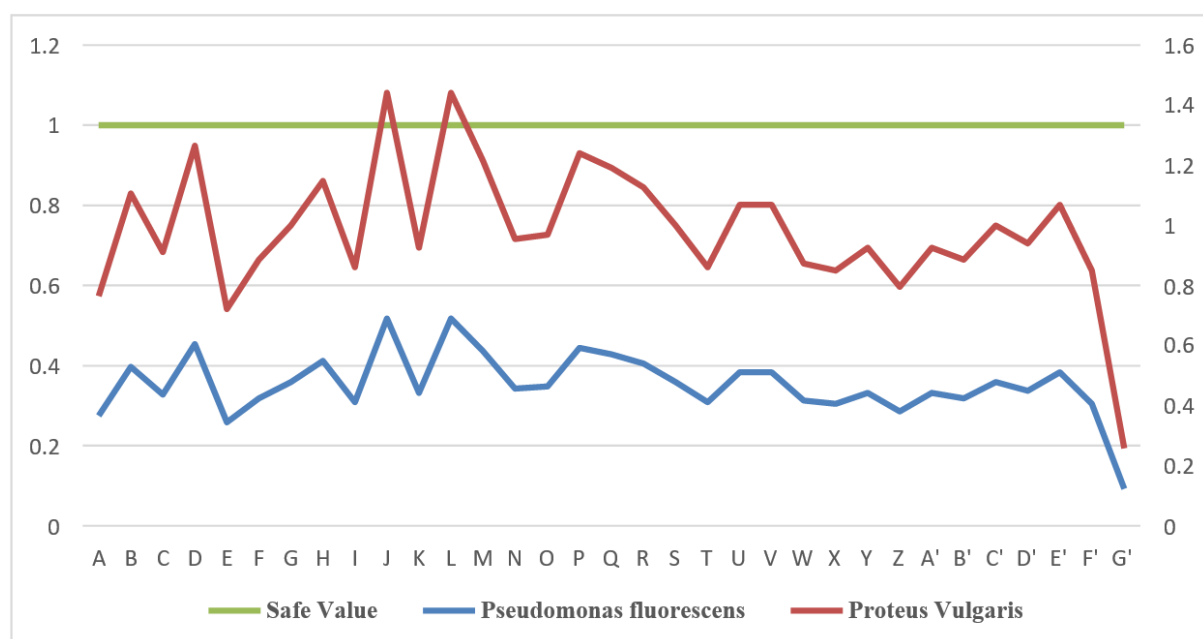


Fig. 4: The results of the calculation of the risk level (RQ) in the Village Community Sukasari, Indramayu

Figure 4 above, it only includes two biological components contained in the BOD water polluting agent in the Sukasari Village area. The risk level for non-carcinogenic health effects (RQ) is said to be safe if the RQ is < 1 and is said to be unsafe if the RQ value is > 1 (Pangestika and Wilti, 2021). Can be seen in Figure 4, the safe value is designated by the number 1 and is denoted by a line in green. Seen from the results above, almost the majority of people in Sukasari Village, Indramayu have a risk level value below 1, which shows that the majority of people have a risk level that is classified as safe and there are 2 people who are classified as unsafe in terms of *Proteus*

vulgaris. Same as value intake, the value of the risk level also has a significant relationship with the value of people's body weight. To show this, the value of the risk level can be classified by value weight of society, which can be seen in Figure 5.

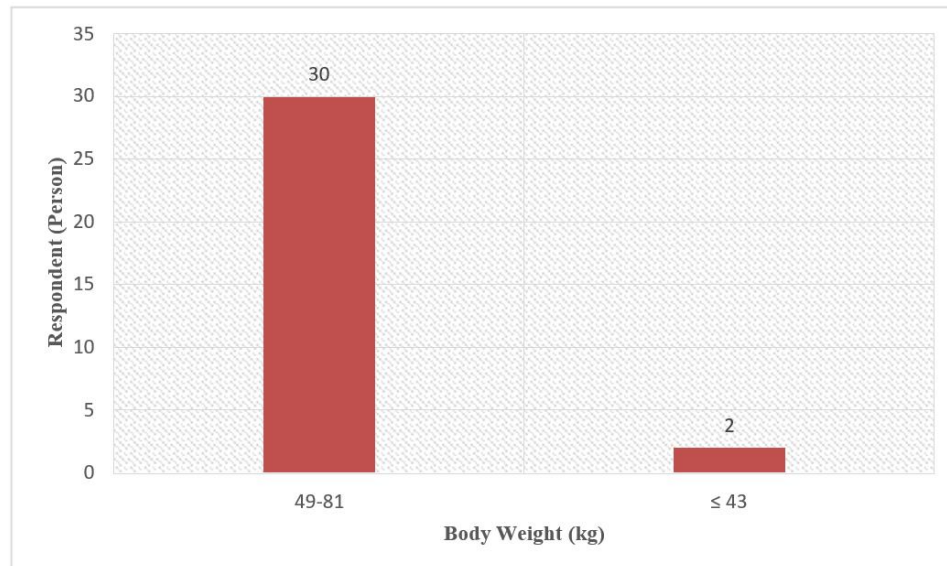


Fig. 5: Distribution Of Risk Levels Based On Community Weight

Based on Figure 5 above, there are 2 communities that are categorized as unsafe and 30 communities that are in the safe category. For people who have a body weight range of 43 kg has a range of values of 0.7510, which is where the RQ value is said to be safe but the greatest potential for Disease is high, while in people who have a body weight with a range of 49-81 which has a range of values of 0.6591 to 0.3987 can be biology). These results are in accordance with the results that have been proposed by (Erdinur et al., 2021), the greater the value of body weight, the less risk it faces.

Risk Management

Risk Management Strategies: Based on water class classification, it can be seen that the BOD polluting agent owned by the water component in Sukasari Village, shows that the river water in the area is already classified as polluted and cannot be used for irrigation in large quantities. With this classification, it can be made clear that the river water cycle in Sukasari Village is not suitable for use and if used it will cause new problems in the future. In accordance with research from (Sellner et al., 2003), which suggests that growth Bloom (blooming this is due to the fact that there are two main types of algae, namely the natural circulation process, the reversal of the mass of water (upwelling), and river flow; and anthropogenic activities leading to eutrophication. Here is an example if in a water occurs eutrophication and algae growth:

- a) **Nutritional Advantages:** A high BOD indicates a high level of organic matter in the water, which causes a high amount of nutrients contained and excessive for algae and other aquatic plants.
- b) **Rapid growth of algae:** a lot of nutrients can cause algae growth to be difficult to control, and algae can cover the surface of the water, blocking sunlight and oxygen.
- c) **Decreased Diversity:** excessive algae growth can inhibit and even kill biodiversity and aquatic organisms in it.

According to the New York Times (World Health Organization) states that, polluted water can be a means of spreading diseases such as diarrhea, cholera, dysentery, hepatitis, typhoid, and polio.

How To Manage Risk: After knowing about the risk management strategies that can be applied, it can then be determined how to manage risk in accordance with the circumstances that have occurred in the field (Sukasari Village, Indramayu). According to the Indonesian Ministry of Health in 2012, the way of risk management can be arranged in Tabela to facilitate interpretation, especially for laypeople who do not understand aspects of risk analysis. As for how the management can be done in the following ways.

Table 8: Risk Management Based on Regulation

No	Management	Alternative Approaches		
		Technology	Socio-Economic	Institutional
1	Reduction of risk agent concentrations to below safe limits ➤	Nothing	<ul style="list-style-type: none"> ➤ Make a statement about the No.18 of 2018 about throwing garbage in its place. ➤ Do not use fertilizers immeasurably, in accordance with PerMenTan No.13 of 2022. ➤ Do not place livestock adjacent to water bodies or with the guidelines stated in PerMenTan No.31 of 2014. 	<ul style="list-style-type: none"> ➤ Conduct appeal activities, whether the water pollution that has occurred is really caused by the company or not. ➤ Conducting water control accompanied by cooperation with related BBWS.

Irrigation development project activities that are being carried out in Sukasari Village, Indramayu itself, according to the data that has been discussed in the previous discussion, shows that there is a potential that pollutes, namely the BOD agent on water and noise parameters in the range of 09.00 - 11.00 hours. The impact that can be caused from the implementation of this development activity, from the data that has been compiled above, can be seen in the results of the Sensitivity Index assessment that has been compiled in Table 9.

Table 9: Matrix of Frequency and Magnitude of Risk Events

Risks	Frequency of Occurrence	Magnitude of Occurrence	Description
Decreased Air Quality	5	2	Air pollution due to dust generated in cement stirring activities, heavy vehicle traffic, and soil dredging. However, based on laboratory results show that air pollution levels are completely below the specified quality standards.
Water Quality Decline	5	5	Water pollution due to mobilization of tools and materials; rehabilitation of primary, secondary, sluice, and siphon channels; physical improvement of weirs; and construction of sediment traps.
Public Health	3	2	Public health is affected due to the mobilization of tools and materials; as well as Channel rehabilitation, and supporting facilities.

Description: 1 = No risk, 2 = The risks and effects are small, 3 = Moderate risk, 4 = Big risk, 5 = Huge risk

Table 10: Risk Event Sensitivity Matrix.

Risks	Incident Sensitivity	Description
Decreased Air Quality	3	Regional/local attention
Water Quality Decline	4	Become a national concern
Declining Levels of Public Health	3	Regional/local attention

Description: 1 = Not a public concern, 2 = Attention of the group, 3 = Regional/local attention, 4 = National

Attention, 5 = Not being international/world / media

Table 11: Total Risk Value Matrix Results.

Risks	Frequency(F)	Quantity (S1)	Sensitivity(S2)	Risks Value(F x (S1+S2))
Decreased Air Quality	5	2	3	25
Water Quality Decline	5	5	4	45
Declining Levels of Public Health	3	2	3	15
			Total Risk	85

Description: R = 1-150 : Low risk, management is done with routine procedures only; R = 151-300: Moderate risk, high level of management attention required; R = 301-450: High risk, detailed research and management required

The method is done with semi-quantitative, the frequency of occurrence and the amount of influence on the activities of irrigation development projects can be seen from Tabel 9 and the sensitivity value can be seen in Tabel 10 so that the value of the total risk that occurs in the development activities of this project can be calculated, and shown by Tabel 11. Analysis using semi-quantitative methods known risk value of each part of the problem that can be reviewed to be considered in depth. In accordance with the statement of (Damayanti et al., 2004); that Environmental Risk Analysis is an activity to estimate the possibility of the emergence of a risk and to determine the impact of ongoing activities. From the results of these measurements, we can see that the risks posed by the ongoing project activities are classified as low risk, with a value of 85. The resulting risk only needs to be done by managing it with routine and monitored procedures, so that the estimated risk does not become a serious impact that will be faced in the future. In accordance with (Silva and Lopes, 2017), periodic monitoring of pollutant sources is necessary so that the process control of these activities can be better maintained. By looking at the data from Tabel 11 it can be seen that the development activities carried out in Sukasari Village, Indramayu still have the potential risk of damaging the water/land ecosystem located in the Sukasari Village development site area. The mobilization of heavy equipment and the processing of materials to be used for development activities can affect the surrounding ecosystem. As in the case of heavy equipment that will be used to carry out the construction, if it is known that there are obstacles in the mobilization process, all means will be sought to be able to send the goods and usually the disturbing flora will be cut down for the smooth mobilization of the tools to be used. Based on data Tabel 7 it can be seen that the value of BOD levels owned by water parameters in Sukasari village exceeds NAV. These possible risks can be seen from research conducted by (Sellner et al., 2003), that the possibility of occurrence blooming the algae got bigger. Especially by seeing that Indramayu Regency is a national rice barn where the maintenance and growth of rice in the region will definitely not escape the name of fertilizer. In practice, algae blooming is a serious problem that can potentially kill aquatic biota within the area covered by it. If an area has been covered by algae, it will be more difficult to restore it, especially since algae blooms are very fast. Where, the fertilizer will certainly have the potential to further increase the burden of water BOD located in the Sukasari Village area itself. To determine the root cause of the problems that may arise from the environmental conditions of Sukasari village can reflect on the theory of (Charles et al., 2016), namely by using the theory Cause Root Analysis (CRA). In looking at the root of the problem results can be seen from Figure 6.

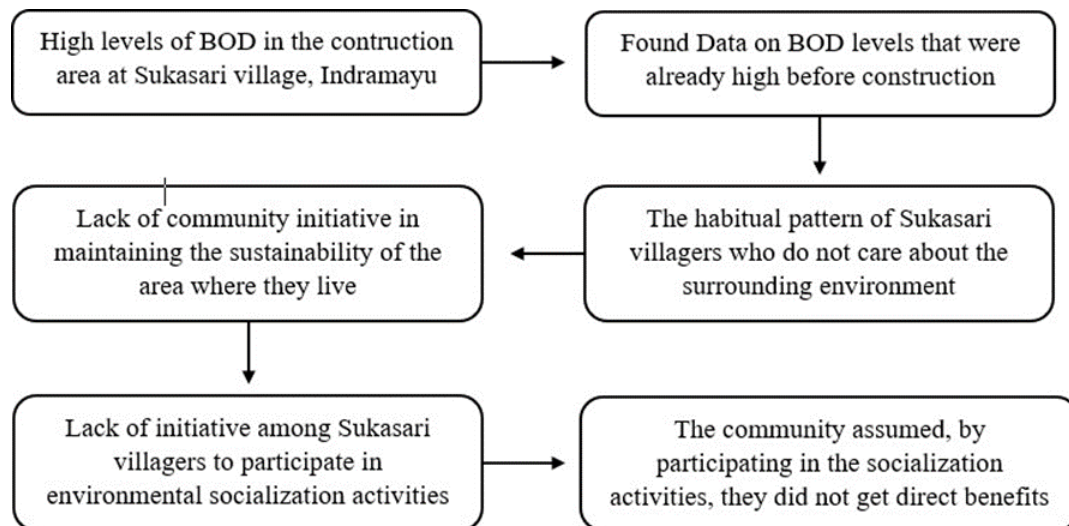


Fig. 6: Cause Root Analysis Sukasari Village, Indramayu

From Figure 6 it can be seen that the root problem of the cause of the high levels of BOD water parameters in the Sukasari Village area is due to the assumption of the community that by participating in the socialization activities will not change the environmental conditions directly, it is confirmed by the head of Sukasari Village, Indramayu(Mr. Waskadi), at the time of socialization many villagers were also present at the event. This is in accordance with the pre-construction activities in which the majority of villagers were present in the socialization activities (because it concerns the issue of citizen activities directly).

CONCLUSIONS

Project development work activities carried out in Sukasari Village, Indramayu that can have an impact on the environment, namely the mobilization of tools and materials that can cause air and noise pollution. B3 waste (oil and batteries), construction activities on water bodies, and waste generated by the activities of workers around which can cause pollution in the water. Indramayu city, is an area that is included in the national rice barn in Indonesia. If the government does not pay attention to the circulation of water there, let alone farmers do not pay attention to the use of fertilizers in the region, then the water conditions there will get worse day by day. An activity that the government can do, in order to prevent pollution from becoming more widespread, is to conduct in-depth education which is then consciously and obediently carried out by the village community. Air parameters do not have a value above the threshold that has been set, so the risk of pollution is relatively low. However, the level of pollution risk that has a result exceeding the threshold value (NAB) exists in BOD agents in water and sound. Where it is not in accordance with the threshold value that has been determined by SNI 6989.72:2009 which for the classification of water pollution limits that can be used (for the BOD category) is 12 mg/L, which

in the field measurement results show the value for the BOD agent has a value of 13 mg/L. As well as on noise pollution according to KEP-48/MENLH/11/1996 the sound limit that can be accepted by homes and settlements is 55 dB(A), which in the field measurements at 09.00 – 11.00 shows the value of 68 dB(a). Bod pollution is not affected by the development, before the development of BOD tested and produced a value of 16 mg/L. And, on the noise parameters before the project activities, at 09.00-11.00 showed the results of the value of 54 dB (a). There is no Sukasari Village community who filed complain (disclaimer) and feel disturbed about the project activities to the village or to the project directly. And, based on the results of the assessment formulated by measuring the sensitivity index, the overall value reached 85, which indicates that the results of the risks posed are low (not too impactful) and only need to be managed regularly.

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