

# Analysis of the Oil and Petrochemical Integrated Refinery Development Plan's environmental impact and its mitigation of public health status

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Received: 23/12/2020.

Reviewed: 16/06/2022.

Published: 31/07/2022.

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**Subject Area:** *Public Health and Environment*

## **Abstract**

*Development is a social process that aims to enhance the environment and the quality of communal life. Sustainability happens as a result of the environment serving as a living space and a source of additional value. The following environmental factors must be integrated into a development plan: biogeophysics, social, economic, cultural, and public health. PT PERTAMINA (Corporate Company) in collaboration with Rosneft Oil Company will build and operate a new oil and petrochemical integrated refinery and its supporting facilities. About 27,000 people were hired for the building phase, and about 3,000 for the operation phase. This study aims to lessen the detrimental effects of development plans on public health. This qualitative study is a cross-sectional descriptive investigation of the area surrounding the proposed refinery in East Java Province, Indonesia's Jenu District and Tuban Regency. The study's findings were determined through firsthand observation and a poll of 100 residents who would be impacted by the development plan. The findings show that, to prevent environmental disputes, environmental management and monitoring must be carried out.*

**Keywords:** *Impact Mitigation; Public Health; Environmental Impact; Oil and Petrochemicals Refineries*

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## **Introduction**

Development is a social process that involves the improvement of the environment and community's quality of life. The process is sustainable and aims to provide value in all areas, including public health and not only the economic one, so that the quality of life will occasionally improve. This will happen if the environment is improving because humans depend on the environment for both a place to live and for resources (Amsyari, 1996)

PT PERTAMINA (Corporate Company) in collaboration with Rosneft Oil Company will build and operate a new oil and petrochemical integrated refinery and its supporting facilities (Tuban Refinery) in Jenu District - Tuban Regency, East Java Province – Indonesia. This refinery is expected to meet domestic demand for fuel and petrochemicals. The total area of land planned for refinery and its supporting facilities activities is

1,016 ha, and an area 194.80 ha of it is coastal reclamation. This planned activity has potential impacts on the surrounding environment (Environmental et al., 1999).

Figure 1. Tuban Oil Refinery Plan



(Source: Tuban Oil Refinery 2020)

A development strategy for human welfare must include environmental aspects such as biogeophysics, social, economic, culture, and public health in order to ensure environmental integrity as well as safety, capability, welfare, and quality of life for current and future generations. As a result, an EIA (Environmental Impact Analysis) document, which is a study of the significant environmental impacts of planned development, is required for the decision-making process under Law No.32 of 2009. The basic concept of EIA is the process of identifying, predicting, evaluating, and mitigating environmental impacts from a development plan for decision making. Impacts may arise during the pre-construction, construction, operation, and post-operation stages of development activities (F. Gunarwan Suratmo, 2004). This impact will occur in the environment in the form of primary pollution on air, water, soil quality, and social environment, and can result in secondary impacts on public health in the study area, such as derivative impacts from large numbers of workforce mobilization or migration, derivative impacts from mobilization of equipment and materials with high rotation, and so on.

There are 4 mitigation studies that are used as a reference for this study. Sri and friends (Yuni Sri Wahyuni, 2017) in their research stated that the acceleration of housing development in Indonesia has been realized in the form of the one million house program that has been rolled out since 2009 to meet community needs, especially for low-income people. As a result, large procurement of building materials will occur and have a significant potential environmental impact in the procurement process, from the extraction, processing, manufacturing stages to ready-to-use building materials. Each of these stages will raise the potential for carbon emissions and require energy consumption. The following are the main strategies for mitigating environmental impacts: a) efficient use of materials beginning with design, b) design optimization, and c) substituting low Embodied Energy (EE) building materials for materials with the highest volume of use.

Yuliyati and friends (Simamora & Kurniat, 2016) in their research stated that Industry is an important element in development, but industrial activity will be followed by negative impacts on the environment. The negative impact is when liquid waste is produced has a potency to damage the environment. This environmental risk arises if the Wastewater Treatment Plant (WWTP) is unable to process liquid waste so that it exceeds quality standards. Therefore, it is necessary to apply systematic mitigation measures in order to reduce environmental risk. There are four dangers, including spilled liquid waste, lower effluent quality, dead WWTP bacteria, and environmental pollution, based on the results of risk identification and the causes of those risks.

Wibowo et al (Wibowo, 2018) in their research stated that the population density levels would increase the risk of disasters and multiply the consequences of natural hazards as dangers that arise. However, based on science of epidemiology disaster actually most of these disasters can be prevented or at least many ways to reduce the impact of a disaster (mitigation actions). Like the war against disease, warfare should be fought against disaster by any person jointly and involve society as well as changes in social behaviour as well as improvements in individual practices. In previous research stated the environmental permit for The Java Bali Crossing Development Plan of 500 kV Extra High Voltage Airway Paiton-Antosari and 150 kV Extra high Voltage Airway Antosasi-Kapal was rejected due to environmental disputes because of the emic view of the project affected community (Susilowati, Moerad, & Arifin, 2018).

Environmental problems become important because basically the environment has an influence on human life. Basically, the problems of human life are closely related to the state of individual and community health, even the ultimate measure of environmental problems is healthy or not the community who lives in the environment. The health impact changes studied in an environmental document to obtain environmental permits for the Tuban Oil and Petrochemical Refinery is the public health and environmental health status in the affected areas. This impact will arise during the construction and operation stages of the refinery and its supporting activities which originate from the mobilization of workforce, equipment, and materials. According to data from The Central Bureau of Statistics, Jenu District in Figures, 2020, the population in the areas affected by the planned project (Sumurgeneng, Wadung, Mentoso, Kaliuntu, and Rawasan Villages) is 22.47 km<sup>2</sup>, with a total population of 14,013 people, or an average density 658 people / km<sup>2</sup>, with a planned workforce mobilization for the construction stage of 27,000 workers, the population density will be 1,852 people / km<sup>2</sup> to almost 3 (three) times the initial density.

This condition will have an impact on the increasing density of settlements, the need for clean water, and the increase in solid and liquid waste generated by domestic activity. A sanitation change, such as the provision of clean water for consumption and toilets, solid waste, and non-hazardous liquid waste generation from domestic activities of the workforce at the base camp, has an impact on the environmental health status during the construction and operation stages. Based on this background and using the principles of environmentally sustainable development, research is being conducted for the mitigation of environmental impacts caused by planned development activities, so that the negative impacts, particularly those on public health, can be minimized through environmental management and monitoring.

## Methodology

This quantitative research is a descriptive analysis, which was carried out in cross-sectional, with the study areas as follows: Wadung; Mentoso; Kaliuntu; Rawasan; and Sumurgeneng Villages, the administrative area of Jenu District - Tuban Regency. After collecting fundamental hypotheses from the findings of the prior analysis, the interpretive critical analysis of the research is concluded. Meanwhile, the Environment Minister's Regulation No. 16 of 2012 concerning significant effect criterion is utilized to determine the significance impact to lessen the damage.

## Result and Discussion

The quality of environmental components, including public health, is significantly impacted by the consequences forecast and mitigation findings based on research on the development plan. Environmental health and public health status impacts in the vicinity of the project activities are the public health. These effects appear during the planning and building phases and include modifications to the nutritional state of the community, infectious and non-infectious diseases, access to medical facilities and services, and an increase in the abuse of additives (drugs, alcohol).

### 1. *Environmental Health Status*

Environmental Health is a condition of various environmental media that is reflected in the physical, biological, chemical and social characteristics of the environmental parameters quality that affect public health (Certificate of the Environmental Protection and Control Agency No. 124/12/1997). In this study, environmental factors such as water, air, and soil quality; housing circumstances; and access to sanitary facilities by locals are used to gauge the state of the environment's health. Clean water sources, sanitation infrastructure, such as bathing, washing, toilet, drainage, rubbish disposal, and disease vector management are all included in the sanitary facilities (Checkoway, 1981; Kementerian ESDM, 2015).

#### a. *Residents House Condition*

According to observation results of the area's current conditions, the majority of resident houses in the research area are classified as permanent residences with adequate environmental health quality criteria. These houses condition has cement or plaster or ceramics floors, walls, and roof tiles. Based on the survey results of 100 respondents, the permanent houses category reaching 87%, non-land floor area reaching 95%; and the widest wall reaching 92%; as well as tile-roofed houses reaching 96%. The largest number of house circulation conditions is good circulation or > 15% of wall area reaching 54% and moderate circulation or > 10 – 15 % of wall area reaching 46%.

#### b. *Residents Clean Water Source*

The quality of water used for home and non-domestic purposes, as well as for consumption, is the basis for the environmental health indicator of the respondent's clean water source variable. The findings show that all respondents (100%) use clean groundwater or wells for home purposes and consumption. 98 percent of respondents said the well water's quality is good, transparent, odorless, and tasteless.

*c. Residents Access to Clean Water*

In general, the field observations results concluded that the most access (35% of respondents) to water for household needs in the study area was the medium access category (50 - 99.9 liters / person / day); as many as 33% of respondents have basic access category (20 - 49.9 liters / person / day); and as much as 13% of respondents have optimal access category ( $\geq 100$  liters / person / day). While 16% of respondents have lack access category (5 - 19.9 liters / person / day) was, and there were still people who did not access (5 liters / person / day) as many as 3% of respondents. Distance and travel time to drinking water sources, as well as the ease of obtaining drinking water are very easy stated by 92%, and easy category are stated as many as 6%; difficult and quite difficult categories are respectively stated by 1% respondents.

*d. Residents' Toilet Facilities and Waste Management*

The environmental health indicators of the waste management variable are as follows: 99% of the respondents have used their own sanitary facilities, and none of the respondents used public toilet sanitation. The solid waste management system of respondents is not yet good because there are still many people who burn garbage stated by 82%, and the rest of the respondents 18% throw garbage into the yard as fertilizer. Almost all respondents (95%) have a liquid waste disposal system from domestic activities, in the form of an open ditch, and a small proportion of respondents directly dispose of their waste into their yards.

*e. Disease Vector Control*

The dominant disease vectors in the study area were mosquitoes stated by 80% and flies by 20% respondents. During specific months, there is an increase in the frequency of infectious illness outbreaks in the research area brought on by a vector like dengue hemorrhagic fever (DHF). For this reason, an insecticide spraying and fumigation program to manage disease vectors has been implemented. However, only 23% of respondents indicated that there was a vector control program, while the remaining 77% answered that there was no vector control. This indicates that vector control has not been carried out as effectively as it could have been.

*f. Environmental Sanitation at the Project Site*

Currently, the activities that have been carried out are only at the construction preparation stage, namely civil works which include: 1. Labor Recruitment and Mobilization; 2. Land Clearing and Preparation; 3. Equipment and Materials Mobilization; and 4. Breakwater Construction. 556 individuals are employed in the current setup during the construction phase of civil works. With a total workforce of 556 people, it will be necessary to generate a significant volume of clean water and solid and liquid waste, as shown in table 1.

Table 1. The Need for Clean Water, Liquid and Solid Waste Generation from Domestic Activity in Construction Stage

Sanitation Variable	Limitation	Total Manpower (Person)	Total
Clean Water	60 litres/person /day	556	33,360 litres/day or 1,000.8 m <sup>3</sup> /month
Liquid Waste	70% x 60 litres/person /day	556	23.352 litres/day or 700,56 m <sup>3</sup> /month
Solid Waste	0.75 litres/person /day	556	417 litres/day or 12,51 m <sup>3</sup> /month

Analysis Reference: The Minister of Environment and Forestry Regulation No. 01 of 2010; Indonesian National Standard No. 03-7065-2005 and No. 19-3983-1995

**Source:** Secondary Data Implementation of Environmental Management Plan (EMP) & Environmental Monitoring Plan (EMoP) Tuban Refinery Period I -2020

The amount of clean water provided on site is based on the number of workers, with a daily requirement of 60 liters for each worker (SNI No. 03-7065-2005 and SNI No. 19-3983-1995). Since there are 556 construction employees working under the current circumstances, a computation of the total amount of clean water required yields a very high figure of 33,360 liters per day, or 1,000.8 m<sup>3</sup> per month. Between 60 and 80 percent of clean water use is thought to be wasted. The 556 workers who were mobilized during the building preparation stage produced 700.856 m<sup>3</sup> of liquid waste each month from domestic activities, or 23.35 m<sup>3</sup> per working day. In this estimate, the consumption of clean water is restricted to 70%.

Within five years, 27,000 workers are hired for the workforce during the building phase, and 3,000 workers are hired for the workforce during the operational phase. It is vital to decrease the impact on environmental health degradation since this situation has the potential to significantly increase the need for clean water, the formation of liquid and solid waste, and the level of sanitation both at the project site and in nearby residential areas. By reducing this effect, adequate environmental management and monitoring may be carried out to prevent negative effects on the neighborhood's hygienic conditions, which may result in environmental disputes. It is hoped that after the refinery construction, the quality of environmental health will not decline so that it can disturb the community, as it was determined from the survey results of 100 respondents that the current environmental health conditions in the study area were categorized as quite good.

## **2. *Public Health Status***

Public health is a condition of physical and psychological endurance of a community in a certain area which is the implementation of the interaction between behavior which is a reflection of life habits and its environmental health quality (Environmental et al., 1999; Noerbambang & Takeo Morimura, 1986). Public health status variables measured in this study were: changes in community nutritional status, patterns of infectious and non-infectious diseases, health facilities and health personnel, as well as access to health services in the study area (MacArthur & Danzon, 2002).

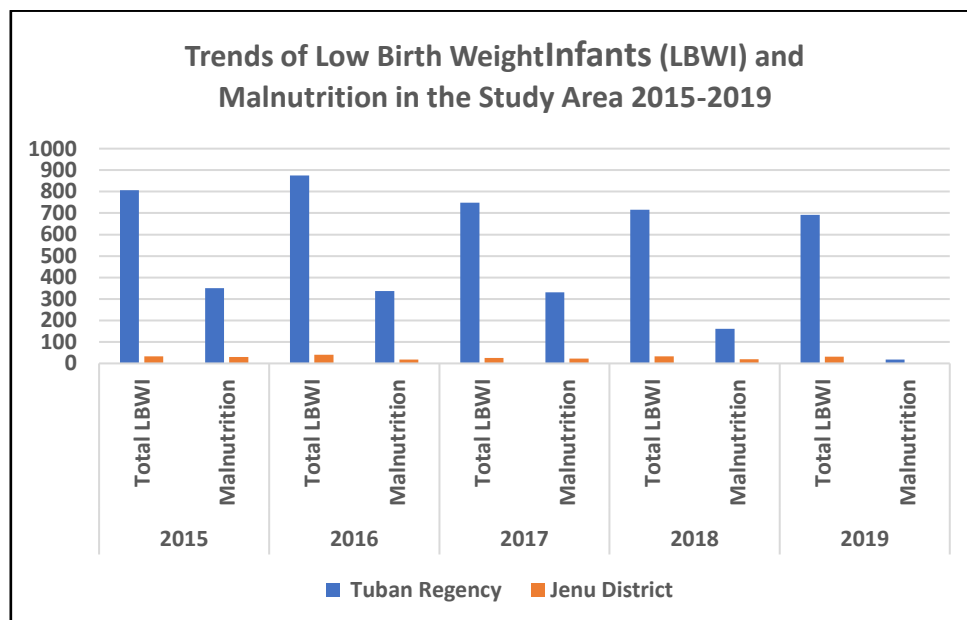
### **a. *Change in Nutritional Status***

The existence of significant worker recruiting and mobilization efforts during the building stage has a secondary effect on income levels, employment options, and local business opportunities in the community. Within the next five years, 27,000 local, regional, and national workers will be mobilized to the study area for the building phase, and 3,000 for the operation phase. The multiplier effect of the local economy from the formal and informal sectors, such as: trade, transportation, entertainment, tourism as well as stalls or shops for basic necessities, and so on, will be significantly impacted by this significant workforce migration or mobilization, increasing the income of communities. There will be changes in the nutritional status of the

community as a result of this rise in income, which will also have an impact on the pattern and fulfillment of family consumption in the study region.

Low birth weight infants are one of the nutritional statuses of the community's indicators. Data from the Central Bureau of Statistics for Tuban Regency and Jenu sub-district in Figures 2016-2020 demonstrates the current situation of the highest number of infants with LBW cases for five years, which occurred in 2016 in Tuban Regency with 875 cases and in Jenu District with 40 infants (4.57 percent) of the cases of LBW in Tuban Regency; in 2019, LBW in Tuban Regency decreased to 691 cases as many as 31 infants (4.49 percent). The year 2015 had 30 cases (3.43 percent) of Tuban Regency, the greatest number of malnutrition cases ever recorded in Jenu District. Since then, though, the number of cases has steadily declined, and as of 2019, there are no malnutrition cases in Jenu District.

Figure 2. Trends of Low-Birth-Weight Infants (LBWI) and Malnutrition in the Study Area 2015-2019

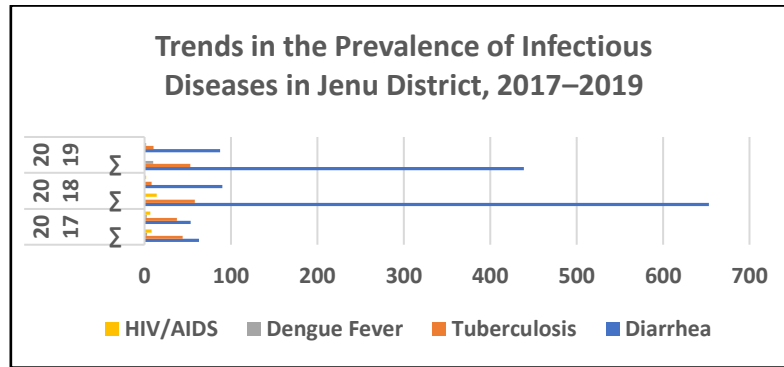


Source: The Central Bureau of Statistics for Tuban Regency and Jenu District in Figures (2016 – 2020)

#### b. Changes in Infectious Diseases

According to figures from the Central Bureau of Statistics, the study region has a density of 696 people per km<sup>2</sup> due to Jenu District's administrative area being 81.61 km<sup>2</sup> and population being 56,768. With a population of 14,013 people living in the 22.47 km<sup>2</sup> of the villages Sumurgeneng, Wadung, Mentoso, Kaliuntu, and Rawasan that are impacted by the activity plan, there are 658 persons per km<sup>2</sup> on average. Although the current density level is not very high, it will increase to a three times higher level throughout the development and operating phases, or it will become dense. The sanitation situation, which includes the availability of clean water, sanitary restrooms, waste generation, and disease vector control, will undoubtedly have an impact on the environment's health status. Infectious diseases can be brought on by causes such as unsanitary circumstances or a lack of environmental health protection.

Figure 3 Trends in Trends in the Prevalence of Infectious Diseases in Jenu District, 2017–2019



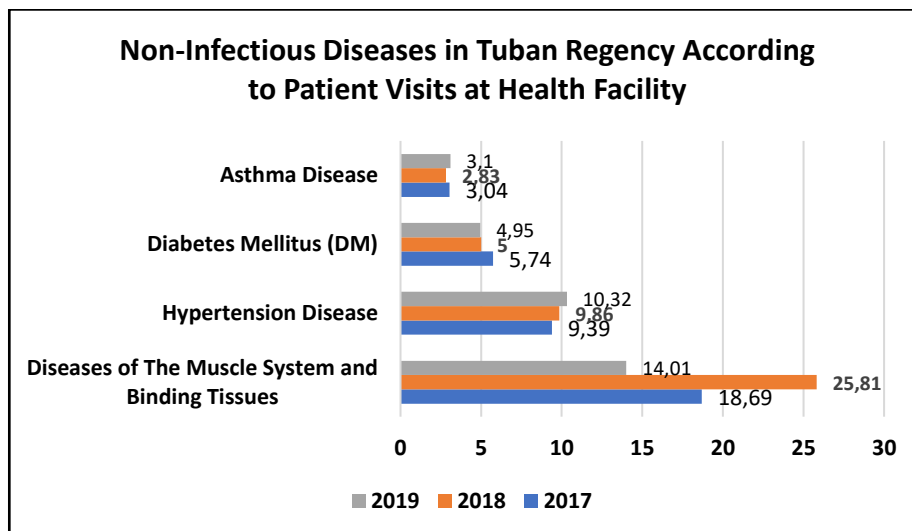
Source: The Central Bureau of Statistics for Tuban Regency in Figures (2020)

The survey's findings revealed that of the chosen respondents, 89.8% reported being in good health over the previous three months, while 10.2% reported being ill. Acute respiratory tract infection (cough, cold, shortness of breath), which affected up to 33% of people, itchy skin (19%), fever (14%), diabetes mellitus (10%), high blood pressure (5%), and other illnesses (such as cancer, uric acid, and osteoporosis) (5%).

#### c. Changes in Non-Infectious Diseases

The muscle system and connective tissue illnesses were the non-infectious diseases with the highest number of cases, ranking second (18.69%) in 2017, first (25.18%) in 2018, and second (14.01%) in 2019, according to statistics from the Central Bureau of Statistics of Tuban Regency (2018-2020). The following are the non-infectious disease trends from 2017 to 2019: In positions 4 and 5, respectively, are high blood pressure and diabetes mellitus. High blood disease and diabetes mellitus each made up 4.39 percent and 5.74 percent of patient visits to healthcare institutions in the research region, respectively, in 2017, 9.86 percent and 5.00 percent in 2018, and 10.32 percent and 4.94 percent, respectively, in 2019.

Figure 4. Non-Infectious Diseases in Tuban Regency According to Patient Visits at Health Facilities (2017-2019)



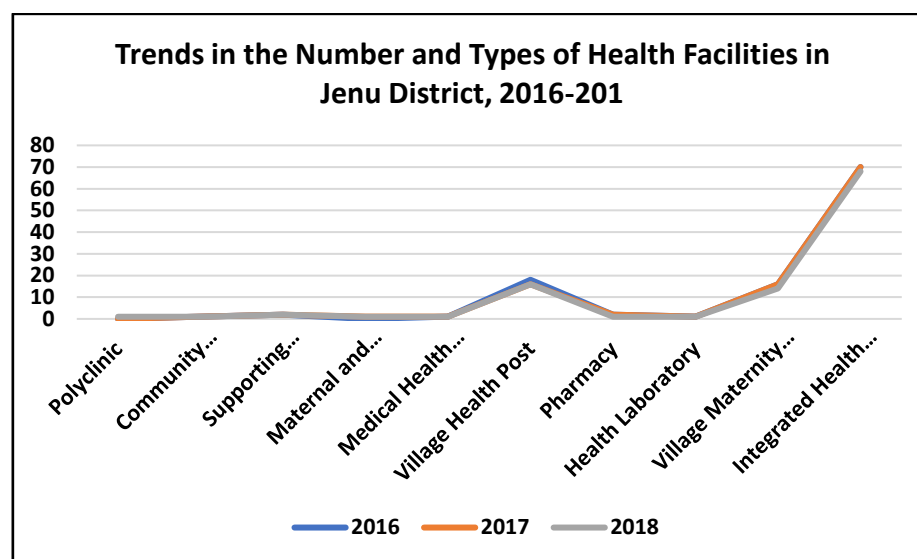
Source: The Central Bureau of Statistics for Tuban Regency in Figures (2018 - 2020)



*d. Changes in Access to Health Services and Facilities*

This significant workforce mobilization obviously necessitates health facilities in an endeavor to preserve and enhance the level of community health since the determinants of access to health facilities and services impact the degree of human health. The Central Bureau of Statistics reports that there are 56,768 people living in Jenu District as of Figures 2019 (BPS Kabupaten Tuban, 2021). In contrast, there were 14,013 individuals living in the activity plan's affected areas (the villages of Sumurgeneng, Wadung, Mentoso, Kaliuntu, and Rawasan). It won't be possible to rely entirely on the health facilities and services that are already in place if there is later population relocation during worker mobilization activities during the construction stage. Therefore, it is necessary to construct and develop health facilities and services.

Figure 5. Trends in the Number and Types of Health Facilities in Jenu District, 2016-2018



Source: The Central Bureau of Statistics for Jenu Subdistrict in Figures (2020)

In Jenu District, there are currently the following health facilities: 1 polyclinic, 1 community health center, 2 auxiliary community health centers, 1 maternal and child health unit, 1 medical health unit, 15 village health posts, 1 village health cottage, 1 pharmacy, 1 health laboratory, 14 village polyclinic units, and 14 integrated service posts. As there are currently no hospitals in the study area, either public or private, anyone who becomes ill and needs to visit the hospital must do so outside of Tuban Regency or at a private facility. In the same way, the number of medical professionals in the Jenu District is still small, and there are no specialists. Most health professionals in Jenu District (2016–2018) are those who work with pregnant people, kids, and childbirth, like midwives and traditional midwives (BPS Kabupaten Tuban, 2021).

*e. Increased Abuse of Addictive Substances (Drugs, Alcohol)*

In addition to having positive effects on the economy and human welfare, development activities, including industrial development, can also have negative effects in the form of physical, chemical, and biological environmental pollution as well as immaterial social pollution or social pathology in the form of imitating immigrant behavior, such as the use of addictive substances like alcohol and drugs. If this societal

pathology is not well addressed, it will have a detrimental effect on the rise in infectious diseases, such as HIV/AIDS (caused by drug addicts sharing needles), criminal activity, and social unrest. Domestic violence, child protection, and addictive substance usage are cases of social pathology in Tuban Regency for the past three years (2017–2019). (Drug cases).

### **3. *The Impact Mitigation of Changes in Public Health Status***

An environmental management and monitoring plan document is created with the following goals using effective impact prediction and mitigation: First, ensuring environmental and community protection through environmental impact management plans (physics, chemistry, biology, social, economic, cultural, public health, and transportation aspects) to prevent, control, and mitigate significant negative impacts while appropriately boosting positive impacts. Second, keep track of how well the impact management plan is working while it is being executed during project operations for all facilities that will be created as part of the project's scope for the development of the refinery. Third, as a model for environmental and social management during the design and building stages of high-performance refinery facilities. Fourth, as a reference that related governmental organizations can use to evaluate the performance of the project and compliance with management and monitoring commitments as stated in the Environmental Impact Analysis (EIA), Environmental Management Plan (EMP), and Environmental Monitoring Plan (EMoP) documents and/or against environmental quality standards (Environmental et al., 1999; MacArthur & Danzon, 2002).

Therefore, it is recommended by the impact mitigation and prediction results as well as research analysis on public health issues that environmental impacts of public health issues in the construction and operation stages be managed and monitored, find the source of the issue, analyze environmental management indicators, and construct environmental management strategies.

## **Conclusion**

The outcomes of impact mitigation and forecasting the planned development of oil refineries and ancillary facilities have a considerable impact, both positive and bad, on the public health aspect, thus they must be regulated and monitored to avoid igniting environmental disputes. According to the law on environmental protection and management, environmental management plans and environmental monitoring plans are implemented to maintain the functions of the environment and to prevent environmental pollution and/or environmental damage, and they include planning, utilization, control, maintenance, supervision, and law enforcement. Applying the principle of environmentally sustainable development, it is necessary to estimate and analyze the environmental effects of the planned construction of oil refineries and supporting facilities from the beginning of planning so that impact control or mitigation measures can be prepared as soon as possible to reduce negative impact and increase positive impact.

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