Detailed Environmental Impact Assessment (DEIA) for Proposed Petroleum Hub and Maritime Park in Tanjung Piai, Pontian, Johor, Malaysia (Health Impact Assessment - HIA)

1.0 Introduction

Health Impact Assessment (HIA) is one of the important aspects in an Environmental Impact Assessment (EIA) requested by the Environmental Quality Act, 1985 that identified the proposed project as one of the prescribed activities. The primary purpose is to safeguard the health of apparently exposed communities to potential pollutants arose from the nominated project.

In addition, this HIA was carried out identify the current sanitation and health status of the communities, to characterize the potential hazards from the proposed project and their impact on the present burden of disease of exposed communities, and to suggest any mitigation measures if necessary. Therefore, health assessment is legally required and important as a baseline and also for future reappraisal of the project possible consequences on human.

The baseline health status of affected populations, include assessment of their physical, mental and social well being, as defined by the World Health Organisation (WHO, 1946). All potential secondary health impacts of the existing surroundings, particularly the ambient air and noise monitoring were also integrated.

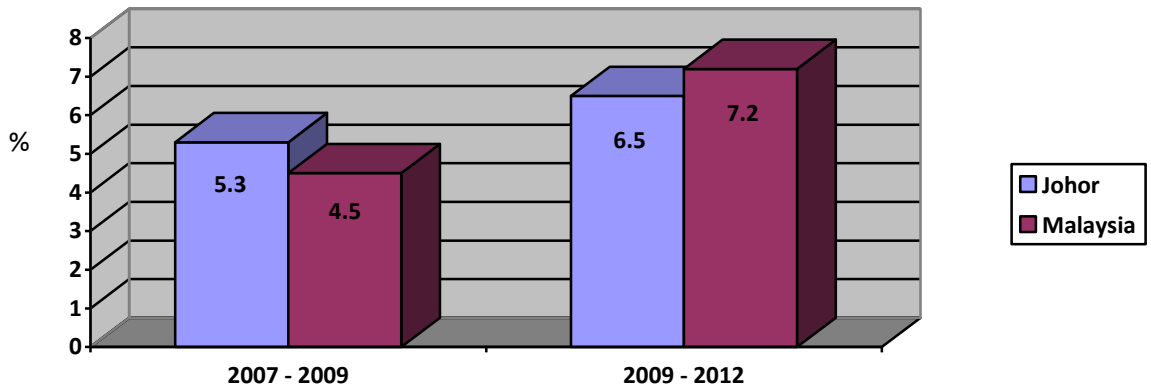
Basically, the study was conducted based on the Guidance of HIA in EIA Document, DOE Malaysia (2013). The survey report also provides a detail of related health data and adequate coverage of the impact zone for the approval agency to decide on whether to approve or not, if so with certain conditions that need to be met throughout the phases of the development by the project proponent and other parties of interest.

2.0 Existing Environment

2.1 The State of Johor

Johor is one of the highest rapid developing states located at the south of the Peninsular Malaysia. Between 14 states in this country, Johor is known for its richness with natural resources and economic opportunities for local and international investments. The citizen of Johor has better annual growth in their monthly household income compared to the national achievement in 2009 (Figure 2.1.1). And it was increased further in the financial year of 2009 to 2012 of about 0.8 points, but lower than the national mark.

With the existing of the proposed project and others existing ongoing projects, the future household income growth is expected to be boosted. The state might become the most developed and advance state in the coming future. The higher income growth caused better power of buying among people to purchase good food, shelter, education and vehicle. The socioeconomic improvement usually gives positive feedback onto the health of their citizen, including better accessibility to health facilities and predicted mortality (Mackenbach et al. 2008; Hagger-Johnson et al. 2010; Birmeta et al. 2013).



Source: Department of Statistics, Malaysia (2012)

Figure 2.1.1. Comparison between Johor and Malaysia Mean Annual Growth Rate of Monthly Household Income, 2007 - 2012

In addition, compared with the national figures, the state of Johor has a lesser annual population growth rate (Table 2.1.1). By the present of the proposed project, the study is for seeing a tremendous increase in the growth rate due to more deliveries after more marriage due to a better income and salary, either directly or indirectly, from the job opportunities in the plant or works chances as support entities like food stalls and restaurant. Deliveries by female foreigner and illegal single parents might further contribute to the high growth rate. It might involve teen pregnancy due to sexually abuse and neglected woman, especially those staying near to the proposed plant. However, with an effective intervention by protective provider activities and teen health strategies, the problem could be minimised (Goldani et al. 2013).

The state is among the most populated states in Malaysia, just after Selangor. And nearly 0.1% of its population are categorized as hardcore poor, higher compared to Selangor (0.0%) but lower with the overall total in Malaysia (0.2%). Still, the land is comparable with Negeri Sembilan and Kuala Lumpur based on the distribution between urban and rural hardcore poor people. The life expectancy after birth for Johor people, for male and female, is most similar to the national. Johor has even or better records for all death rate cases compared to the national scores. These indicate that the quality of health care in Johor is at par or excellent enough to control and to secure the health status of local people. They also showed the absence of other factors like malnutrition, poor accessibility to the health center or negligent in the health care management and good coverage of safe drinking water supply in Johor.

Most of the households in the state of Johor have a safe drinking water supply (99.8%), either in-house or as stand pipe outside their house as sharing basis. This amenity is very important in prevention of waterborne diseases like food poisoning, cholera, typhoid and dysentery. On the other hand, broken secondary rubber pipe from the stand pipe might expose the individual household to the disease if an outbreak occurred in the locality. By practicing of boiling of water may reduce the risk significantly. Enough safe chlorinated water is also important in ensuring good nutrition status of the growing children in Johor by elimination of microbes and helminths from the food chain. The state doesn’t take any supply from its ground water.

Table 2.1.1. Comparison of health indicator between the state of Johor and Malaysia (2013)

Parameter			Johor	Malaysia
Mid-year population estimates (population)			3,500,000	29,950,000
Annual population growth rate (percent)			1.1	1.4
Population density (people per square kilometer)			184	88
Life expectancy (year)	Male		72.4	72.6
	Female		77.0	77.2
Crude Birth Rate (per 1000 population)			16.6	17.2
Crude Death Rate (per 1000 population)			4.9	4.7
Neonatal mortality rate (per 1000 live births)			4.0	4.2
Infant mortality rate (per 1000 live births)			6.5	6.6
Maternal mortality ratio (per 1000000 live births)			21.4	25.5
Water supply (%):	Piped water in household	Total	99.7	93.7
		Urban	99.8	98.5
		Rural	99.1	81.8
	Public water stand pipe	Total	0.1	0.2
		Urban	0.2	0.1
		Rural	0.0	0.2
	Other water supplies	Total	0.2	6.1
		Urban	0.0	1.4
		Rural	0.9	18.0
Electricity supply (%)		Total	100.0	99.8
		Urban	100.0	99.9
		Rural	100.0	99.3
Toilet (%):	Flush toilet	Total	90.7	80.1
		Urban	96.0	90.8
		Rural	74.8	52.5
	Pour toilet	Total	9.3	19.2
		Urban	4.0	8.8
		Rural	25.1	46.0
	Other types	Total	0.0	0.7
		Urban	0.0	0.4
		Rural	0.1	1.5
Present of garbage collection facilities (%)		Total	58.3	35.2
		Urban	84.2	58.1
		Rural	16.6	17.6

Source: Department of Statistics, Malaysia (2014)

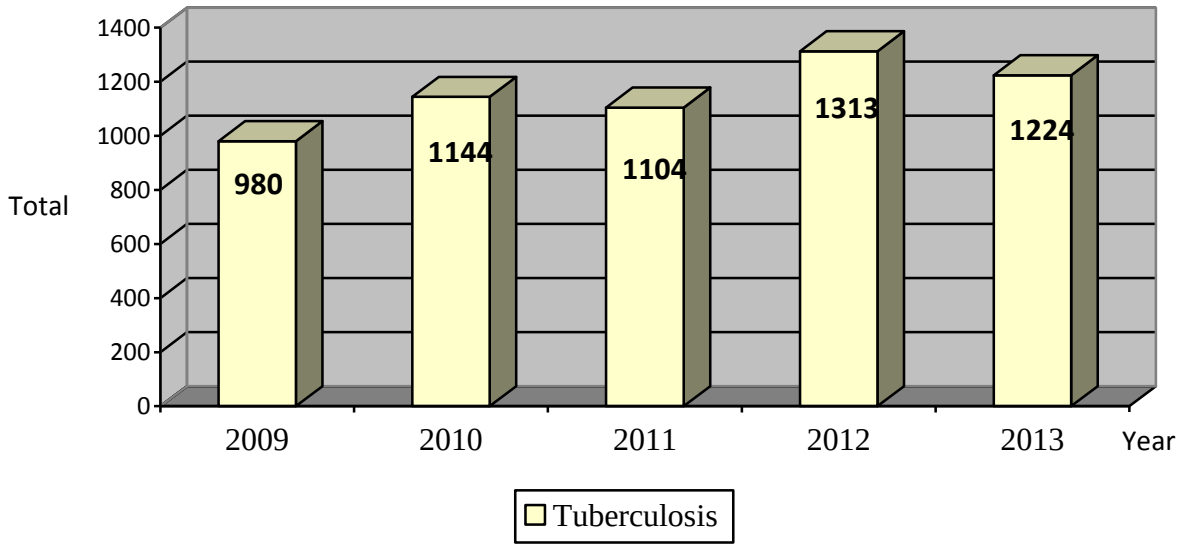
All houses have an electric power supply which is very significant for food safety and preservation of the cold chain in preventing microbe's growth, especially on foods. Spoilt food causes food poisoning and reduces individual work productivity or learning concentration. Sanitary latrines, such flush and poor toilets are important in facial-oral diseases like cholera, typhoid, hepatitis B or dysentery.

The state of Johor has good coverage of aseptic latrines throughout its areas. Merely 0.1% in rural areas use other types of toilet like surface water bodies such as a river or irrigation canal. Nearly 83.4% of the houses in Johor remote areas have no option for their solid waste disposal. Inadequate management of domestic waste usually associated with vector borne outbreak, open burning and poor air quality, and contamination of surface water bodies.

As one of the rapidly developing states, Johor gives numerous job opportunities, and this causes massive human movement, either local people or immigrate. However, for such massive physical development, common health issues identified are communicable diseases that spread as air aerosol, vector borne or food water borne types. They are mainly caused by a big multiracial work force with poor housekeeping and sanitation, mostly during the construction phase.

2.1.1 Airborne Diseases In Johor

Tuberculosis is one of the airborne communicable diseases that have high spread and virulence type of features. It is one of the notifiables diseases in Malaysia. In 2009, there were 980 new cases tuberculosis notified by the state (Figure 2.1.2). The incidence rates were raised slowly until last year, but actually lower compared to the national rates (Table 2.1.2). Employing 5-year average incidence rate and an upper control limit (±2 Standard deviation, 2SD), the annual rates for the Johor State were stable since they well below the point of accumulation (Figure 2.1.3).



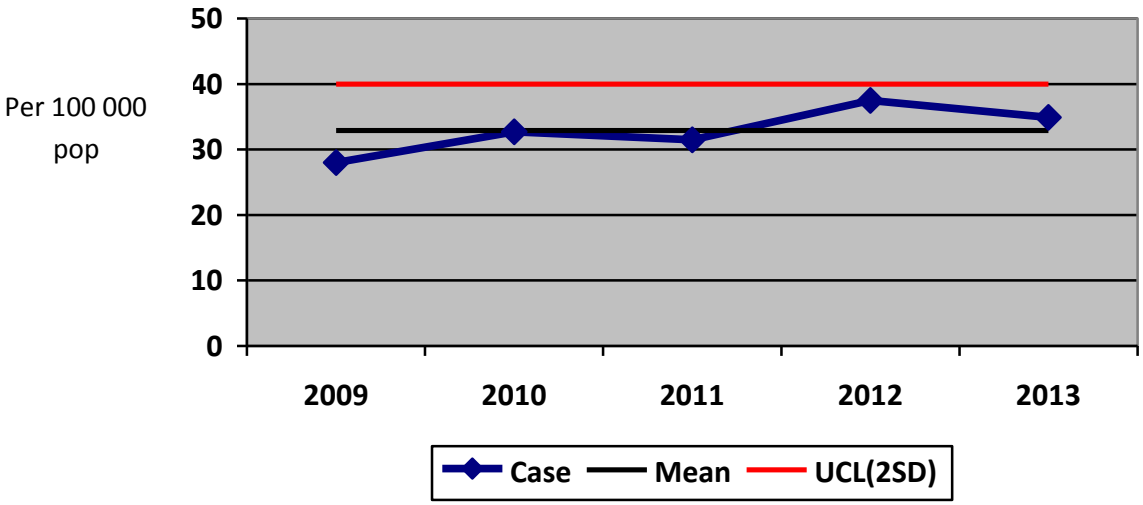
Source: Johor Weekly Epidemiological Report (2013)

Figure 2.1.2. Number of new tuberculosis cases for the State of Johor, 2009 - 2013

Table 2.1.2. The annual incidence rate for tuberculosis compared between Johor and Malaysia

Diseases	Annual Incidence Rate (per 100,000 population)									
	Johor					Malaysia				
	2009	2010	2011	2012	2013	2009	2010	2011	2012	2013
Tuberculosis	28.0	32.7	31.5	37.5	34.9	63.9	68.2	71.3	77.4	78.3

Source: Ministry of Health Malaysia 2014



Source: Ministry of Health Malaysia 2014

Figure 2.1.3. Comparison between the Mean, Upper Control Line (±2SD) and Incidence rate for tuberculosis in the State Johor, 2009 - 2013

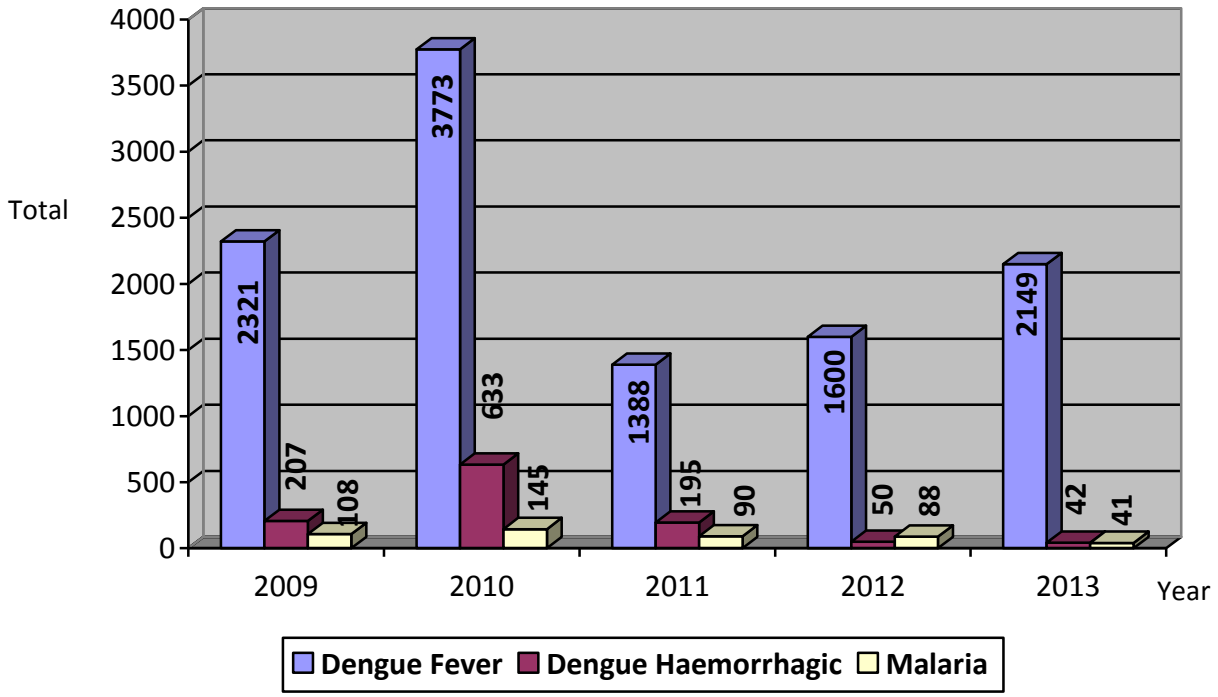
Discussion

From the figure, it showed that tuberculosis was well controlled without any obvious incremental number of cases in the state of Johor for the past five years. These were due to good housekeeping practices, higher health awareness and faster seeking medical attention among the people in Johor. Active surveillance and monitoring of the Johor health offices in tuberculosis detection, improved further in both disease control.

Using the 5-year average incidence rate, the Johor State maintained good tuberculosis controls. The assessment suggested for 40 per 100,000 population for the upper control limit for tuberculosis in the state of Johor. Any rates exceeded this limit need urgent control and prevention measures.

2.1.2 Vector-borne diseases in Johor

Most of the communicable diseases in Malaysia are classified as vector-borne diseases. These include dengue fever (including dengue haemorrhagic fever), malaria and typhus. In Johor, dengue fever is the most troublesome vector-borne health ailments that occurred every year and almost every month (Figure 2.1.4). The trend is fluctuating and unpredictable that involved urban and rural areas. Malaria is another disease that usually associated with the influx of foreign migrants from nearby countries. Nevertheless, the incidence of malaria is decreasing and well moderated.



Source: Johor Weekly Epidemiological Report 2013

Figure 2.1.4. Number of vector-borne disease cases for the state of Johor, 2008 - 2013

Compared the incidence rates between the state of Johor and national achievement, dengue haemorrhagic fever was the vector-borne diseases that present excessively in Johor but only in the year 2010 and 2011 compared with the national rates (Table 2.1.3). Others, were well below the Malaysian incidence rate, according to years. Again, for trend analysis, the 5 year average incidence rate with an upper control limit was applied. From the figures below shows that the occurrence of dengue fever, dengue haemorrhagic fever and malaria were well below the control limits of 123, 21 and 5 cases per 100,000 population of dengue fever, dengue haemorrhagic fever and malaria respectively.

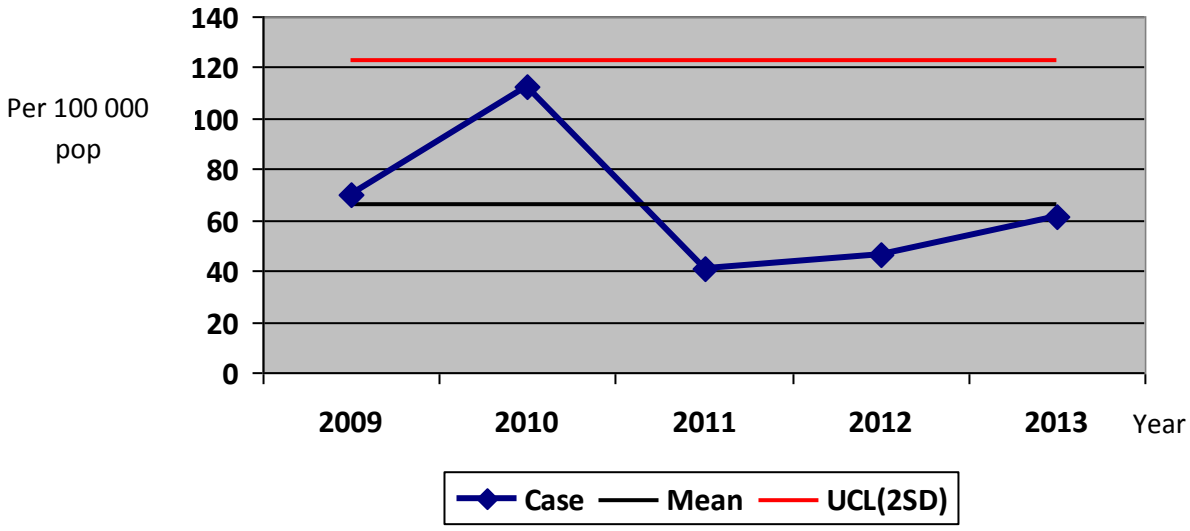
Nevertheless, for the dengue fever, it has shown an incremental trend since 2011 until last year (Figure 2.1.5). For dengue hemorrhagic fever, the trend was a plateau (Figure 2.1.6) and for malaria, it was decreasing (Figure 2.1.7).

Table 2.1.3. Incidence rate for Vector borne diseases between Johor and Malaysia

Diseases	Incidence rate (per 100,000 population)									
	Johor					Malaysia				
	2009	2010	2011	2012	2013	2009	2010	2011	2012	2013
Dengue fever	70.2	112.3	41.1	46.5	61.4	138.0	147.4	63.7	72.2	143.3
DHF*	6.2	18.7	5.5	1.0	1.2	9.7	14.1	4.9	2.4	2.6
Malaria	3.3	4.3	2.7	2.5	1.2	25.0	23.3	18.3	16.1	13.0

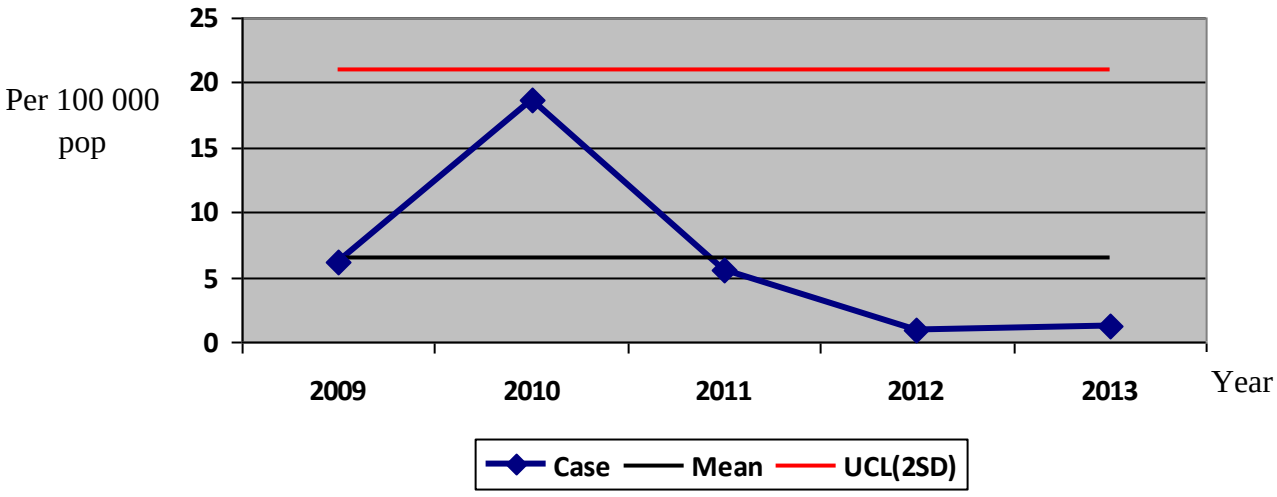
Source: Ministry of Health Malaysia, 2014

*Dengue haemorrhagic fever



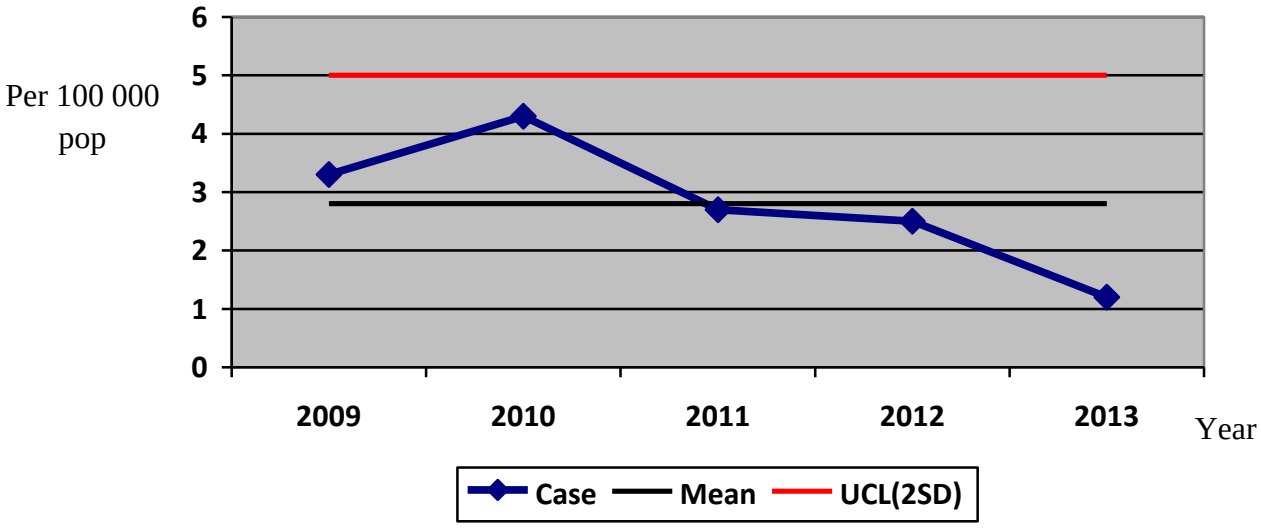
Source: Ministry of Health Malaysia 2014

Figure 2.1.5. Incidence rate for Dengue fever in the State Johor



Source: Ministry of Health Malaysia 2014

Figure 2.1.6. Incidence rate for Dengue haemorrhagic fever in the State Johor, 2009 – 2013



Source: Ministry of Health Malaysia 2014

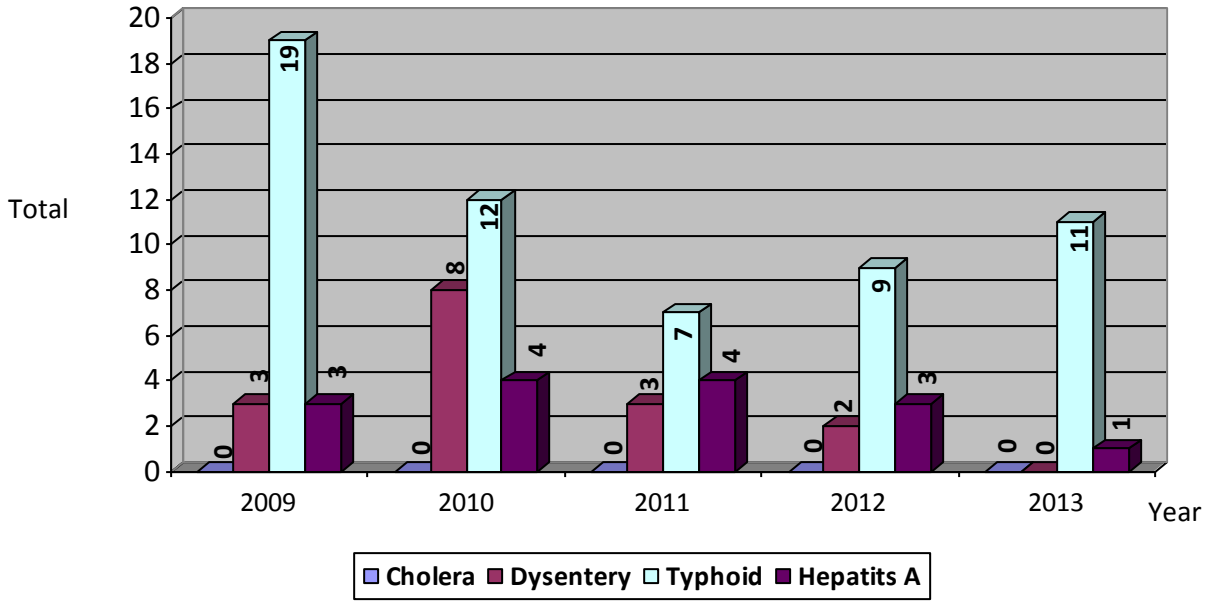
Figure 2.1.7. Incidence rate for Malaria in the State Johor, 2009 - 2013

Discussion

For the important vector-borne diseases, the state of Johor has achieved a very effective control and preventive measures for the final five years. By putting on the UCL, the state of Johor showed its effectiveness in dengue fever, dengue haemorrhagic fever and malaria control programmes.

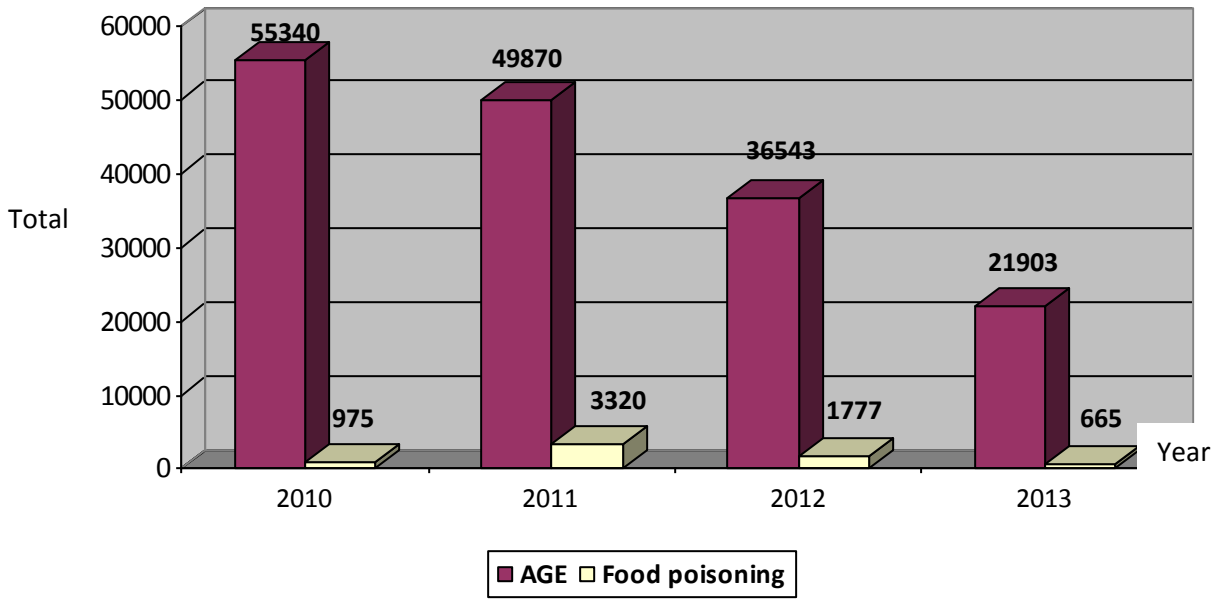
2.1.3 Food Waterborne Diseases in Johor

As one of the developing countries, Malaysia still faces health problems due to food and water borne diseases like dysentery, typhoid and hepatitis A, which all are faecal-oral infections. In the state of Johor, all these diseases were occurring, but only at minimal number of cases (Figure 2.1.8). And fortunately, Johor has been free from cholera since many years ago. On the other hand, food poisoning is still remain the main disease in this group of diseases (Figure 2.1.9). Fortunately, it's only comprised of a small percentage from the total acute gastroenteritis surveillance, which was reduced each year.



Source: Johor Weekly Epidemiological Report 2013

Figure 2.1.8. Number of cases for selected diseases in Johor, 2009 - 2013



Source: Johor Weekly Epidemiological Report 2013

Figure 2.1.9. Number of cases of selected diseases in Johor, 2009 - 2013

On the other hand, compared to the national incidence rate, Johor had higher rates of food poisoning, particularly in 2011 (Table 2.1.4). Afterwards, the food poisoning incidence rates were far beneath the national pace. This presented a fantastic effort and efficient control measures that had been run out by the health agencies in treating with the food poisoning. Other diseases like dysentery, typhoid and hepatitis A do occur every year, but only at low rates that very far less than the national incidence rate.

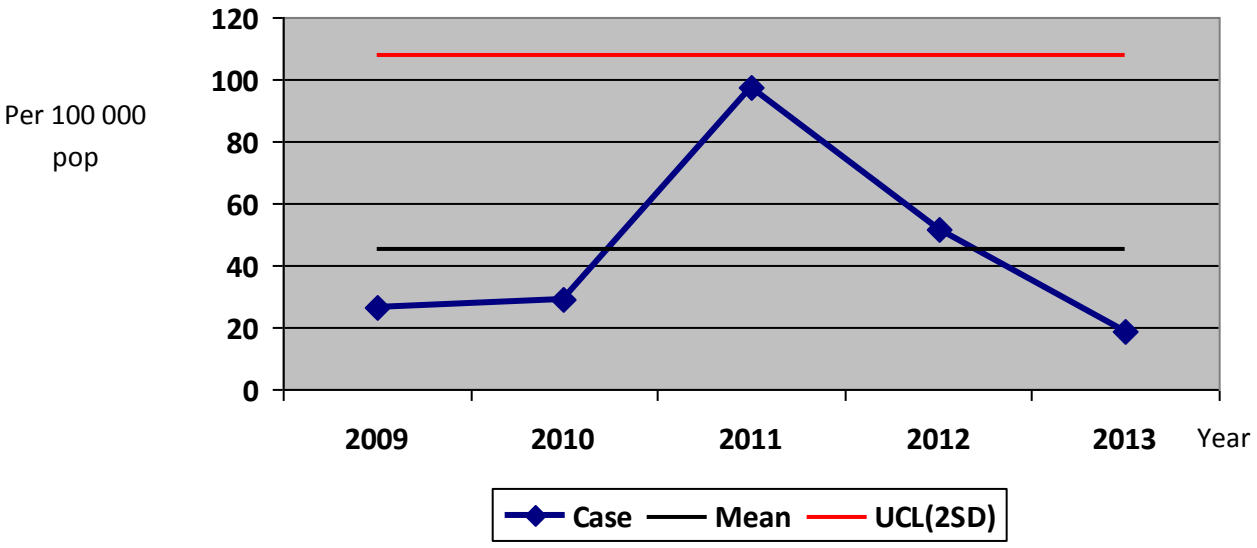
The annual mean (±2SD) of incidence rate for food poisoning in the state of Johor was 45 (±63) cases per 100 000 population. Based on the calculation of UCL (108 cases per 100 000), all yearly incidence rates from 2009 to 2013 were obviously conformance (Figure 2.1.10). This 108 cases per 100,000 population is the maximum incidence rate of food poisoning in the state of Johor. Any that exceed the limit need prompt control and prevention measures.

Table 2.1.4. The incidence rate for Food-water borne diseases between Johor & Malaysia, 2009 - 2013

Diseases	Incidence rate (per 100,000 population)									
	Johor					Malaysia				
	2009	2010	2011	2012	2013	2009	2010	2011	2012	2013
Cholera	0.0	0.0	0.0	0.0	0.0	1.0	1.6	2.0	1.0	0.6
Dysentery	0.1	0.2	0.1	0.1	0.0	0.5	0.4	0.2	0.3	0.3
Food poisoning	26.6	29.1	97.6	43.2	19.0	36.2	44.2	56.3	44.9	47.8
Typhoid	0.4	0.4	0.2	0.3	0.3	1.1	0.7	0.8	0.8	0.7
Viral hepatitis A	0.1	0.1	0.1	0.1	0.1	0.1	0.1	1.7	1.6	0.4

Red number = nonconforming year

Source: Ministry of Health Malaysia, 2014



Source: Ministry of Health Malaysia 2013

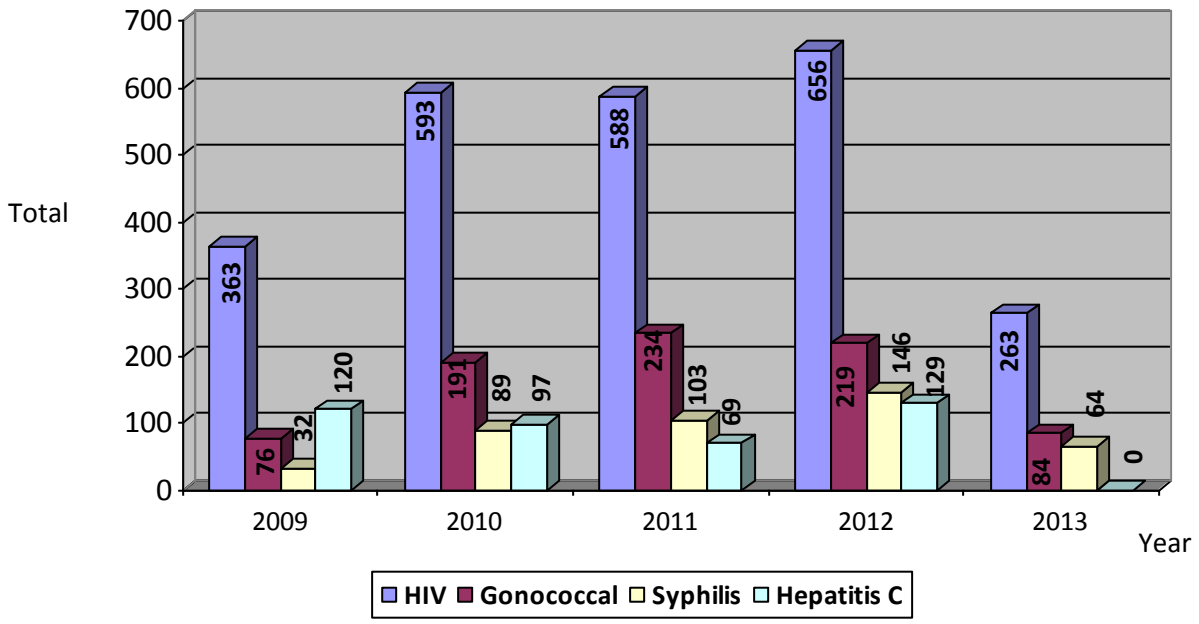
Figure 2.1.10. Comparison between Annual Incidence rates with Mean and UCL for Food Poisoning in the State of Johor, 2009 - 2013

Discussion

Among food and waterborne diseases, food poisoning is one of the preventable diseases that needed more intervention and effective prevention programmes in Johor. Even though it have been controlled effectively, basic sanitation and cleanliness need to be maintained or improve further which include infrastructure and installations. It must also include institution like school and office since most of the cases were school kids.

2.1.4 Sexually Transmitted Infections (STIs)

Human Immunodeficiency virus (HIV) infection, gonorrhoea, syphilis and hepatitis C are among important sexually transmitted illnesses (STI) that have been notified in the state of Johor. Most cases were those diagnosed with gonorrhoea and HIV, increased every year (Figure 2.1.11). It was also similar to other infections, which touched the highest point in 2012. Since 2010, both HIV and gonorrhoea incidence rates were found to be more eminent than the national rates (Table 2.1.5). However, both were well managed and became less by the last year. The Health Department has established an effective control and mitigating measures pertaining to both STIs. Both are among the major infections that usually needed more care and active management, including early detection among high-risk groups like foreign workers. By plotting down the incidence rates over the annual mean and standard deviation, the state of Johor achieved a good control on HIV (Figure 2.1.12), and gonorrhoea cases (Figure 2.1.13) within the acceptable limits.



Source: Johor Weekly Epidemiological Report

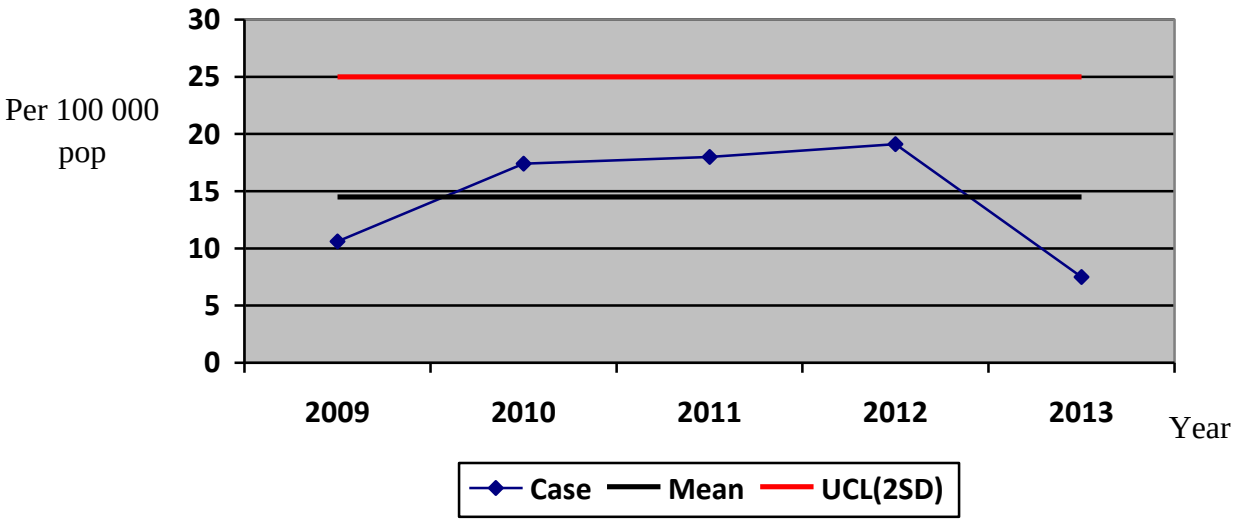
Figure 2.1.11. Number of sexually transmitted diseases reported in Johor, 2009 – 2013

Table 2.1.5. Incidence rate for Sexually transmitted diseases between Johor and Malaysia, 2009 - 2013

Diseases	Incidence rate (per 100,000 population)									
	Johor					Malaysia				
	2009	2010	2011	2012	2013	2009	2010	2011	2012	2013
HIV	10.6	17.4	18.0	19.1	7.5	10.9	12.9	12.0	11.7	11.4
Gonorrhoea	2.3	5.8	6.9	6.4	2.4	3.2	4.2	4.7	5.1	4.8
Syphilis	1.0	2.5	3.0	4.0	1.8	3.1	3.0	3.5	5.7	5.4
Hepatitis C	3.6	2.8	2.0	3.8	0.0	3.7	2.6	3.6	5.9	6.8

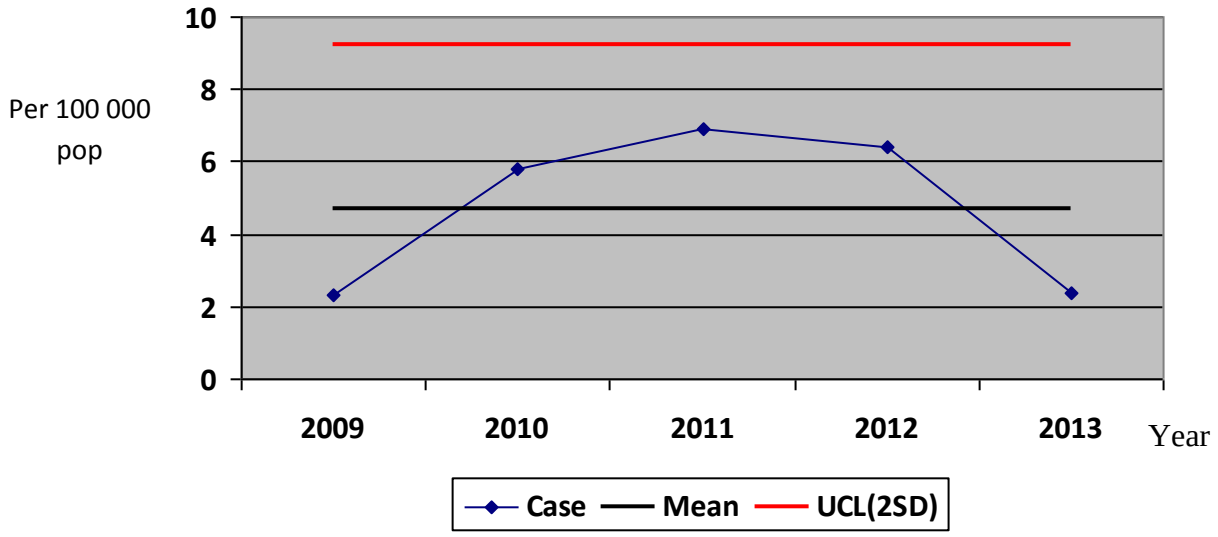
Red number = nonconforming year

Source: Ministry of Health Malaysia 2014



Source: Ministry of Health Malaysia 2014

Figure 2.1.12. Comparison between annual incidence rates with the Mean and Upper Control Limit of HIV cases in the State Johor, 2009 - 2013



Source: Ministry of Health Malaysia 2014

Figure 2.1.13. Comparison between Annual Incidence rates with the Mean and Upper Control Limit for Gonorrhoea in the State Johor, 2009 – 2013

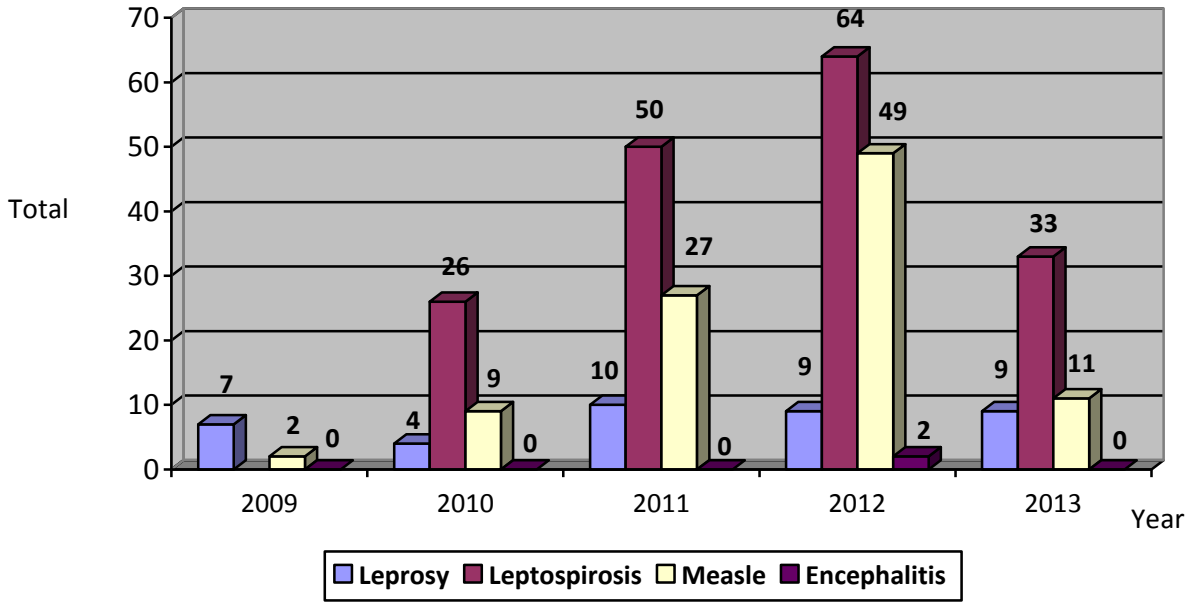
Discussion

The state was not spared from STIs problem as other states in Malaysia. The previous upraising trend, especially for HIV and gonorrhoea needs urgent and extensive attention from the health authorities and all related agencies like religious and youth development. Different from HIV and syphilis, gonorrhoea infection is usually symptomatic and easy to treat, but late medicine may lead to meningitis. Fortunately, the current trend showed that all STIs in the state were well maintained and controlled.

2.1.5 Other Communicable Diseases in Johor

Some communicable diseases are caused by poor unhygienic conditions and direct contacts like leprosy, leptospirosis, measle and viral encephalitis. For the state of Johor, two diseases that showed an incremental progress from year 2010 to 2012 were leptospirosis and measle (Figure 2.1.14).

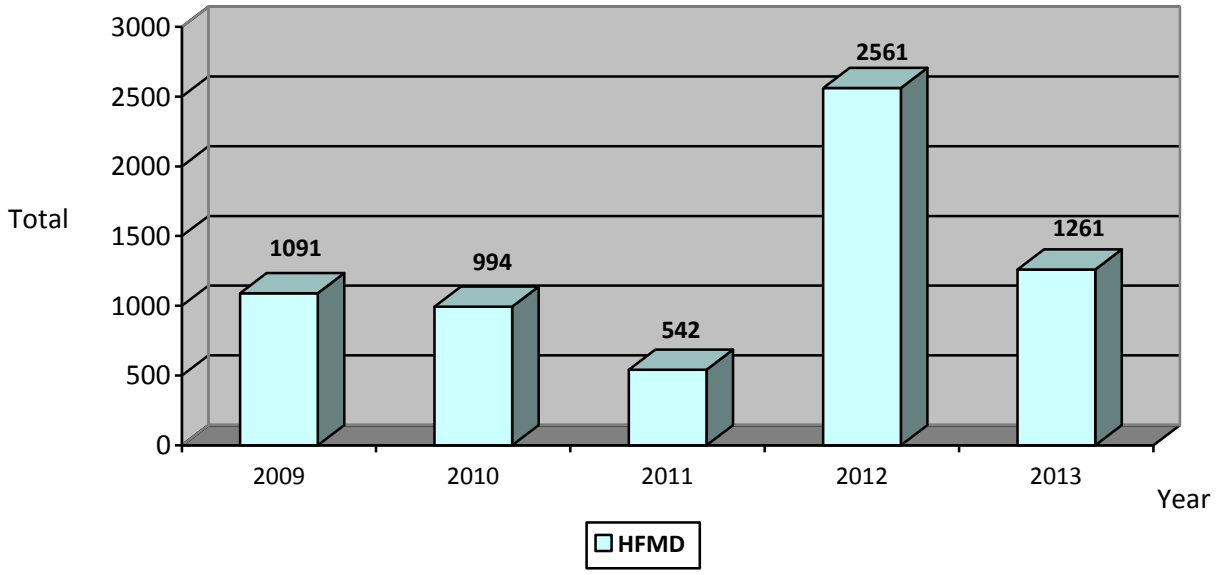
Both diseases are due to exposure through direct skin contact with polluted water or soil with rat's urine (leptospirosis) and with infectious patients (measles). Still, they were well controlled in 2013.



Source: Johor Weekly Epidemiological Report 2013

Figure 2.1.14. Number of other communicable diseases in Johor, 2009 - 2013

Hand, foot mouth disease (HFMD) is also present in this state, but under control except for high notification in 2012 (Figure 2.1.15). HFMD usually associated with the unhygienic nursery condition and inadequate ventilation. After comparing the incidence rates for the state of Johor and Malaysia, figures indicated there weren't any nonconforming incidence rates (Table 2.1.6). The occurrences of leprosy, leptospirosis, measles and viral encephalitis were far beneath the national benchmarks. For leptospirosis, data only available from 2010 onwards after it has been comprised into the list of notables diseases.



Source: Johor Weekly Epidemiological Report 2013

Figure 2.1.15. Number of HFMD in the state of Johor, 2009 to 2013

Table 2.1.6. Incidence rate for other communicable diseases between Johor and Malaysia

Diseases	Incidence rate (per 100,000 population)									
	Johor					Malaysia				
	2009	2010	2011	2012	2013	2009	2010	2011	2012	2013
Leprosy	0.2	0.1	0.3	0.3	0.3	0.7	0.7	0.8	1.1	1.0
Leptospirosis	ND	1.3	1.5	1.9	0.9	ND	ND	7.8	12.5	15.0
Measles	0.1	0.1	1.7	1.4	0.3	0.2	0.3	5.4	6.4	0.7
HFMD*	33.0	29.0	15.9	74.5	36.0	60.6	47.3	24.2	117.7	78.5
Encephalitis	0.0	0.0	0.0	0.1	0.0	0.2	0.2	0.1	0.1	0.1

Source: Ministry of Health Malaysia 2013

*****Hand, Foot and Mouth diseases

ND = no data available

Among all other contagious diseases, HFMD and leptospirosis are among health ailments that required a more effective surveillance and monitoring programme since the latter had claimed few fatality cases. Measles is a vaccinated disease in which a better vaccine coverage needs to be carried out and further maintained. The state of Johor has a very good control on sanitation related communicable diseases for the past five years.

2.1.6 Social Well-being

In view of Johor's citizen getting medical treatment from health care centres, they have a better accessible compared to Malaysia (Table 2.1.7). A total of 67.9% of houses in Johor are located less than 5 km away from public health centres. And more houses are actually nearer to private health centres compared to any public centres. The situation is more obvious in urban areas compared to rural areas in Johor.

Relocation of any settlement areas in the proposed project might contribute to changes in those numbers which mean an alteration of accessibility of localized people to health care services might occur. A part of that, the distance from home to the nearest school is also important in view of education; self-hygiene practices, and nutrition status of the local children. Johor has better educational coverage for primary and secondary levels compared to Malaysia (Table 4.1.8). Youngsters in the state of Johor have more feasible condition to receive knowledge. Nevertheless, in rural areas, the percentage is scaled down to 83.3% for primary school and 75.0% for secondary school within 5km from their families.

Table 2.1.7. Comparison of health care accessibility between Johor and Malaysia (2012)

Health Care		Johor	Malaysia
Public health centres (%)	Less than 5km	67.9	65.9
	5 to 9 km	12.8	12.9
	More than 9 km	19.3	21.2
Private health centres (%)	Less than 5km	77.6	55.3
	5 to 9 km	12.8	11.0
	More than 9 km	9.6	33.7

Source: Department of Statistics, Malaysia (2013)

Table 2.1.8. Comparison of government school distance between Johor and Malaysia (2012)

Government school		Johor	Malaysia
Primary school (%)	Less than 5km	93.6	91.4
	5 to 9 km	6.4	4.6
	More than 9 km	0.0	4.0
Secondary school (%)	Less than 5km	87.2	65.5
	5 to 9 km	6.4	12.8
	More than 9 km	6.4	21.7

Source: Department of Statistics, Malaysia (2013)

At present, Johor citizen and their children have a good access to both, health care and education centres. Most of the homes are situated less than 5 km from both government service centres, which allowed for a better health care coverage and effectiveness, and decent educational opportunities until secondary schooling to all in Johor. For the health care services, they have accessibility of an option either to government or private clinics which most of the facilities are located only as far as 5 km away from their homes.

Discussion

Johor is one of the most developing states in Malaysia in the past five years. Rampant industry's construction lately, has invited huge influx of workers from neighboring states and countries. As for the current burden of diseases in this area, the influx will, directly or indirectly, pressure the present health institution and sanitation infrastructures. Improper management, particularly tight health screening will expose the vicinity communities to certain outbreaks.

From the annual incidence rate, among those diseases are food poisoning, STIs (HIV and gonorrhoea), leptospirosis and HFMD. Those diseases required consistent surveillance and monitoring by the health authorities and integrated management with other agencies.

2.2 The District of Pontian

Pontian is one of the districts in the State of Johor with the total land of 919.9 km square located in the southwest part of the Peninsular Malaysia; which is about 62km from Johor Bahru with an entire population of 187,824 in 2010. It is less populated with only 61 people per km^2 compared to the whole of Johor (184/km^2), managed by a local district council manned by a district officer with ten mukims. The proposed project is located in Mukim Serkat with a total population of 7994 people (2010), far towards the south of Pontian Kecil town about 20km. Tanjung Pai has advantages of large undeveloped land, and strategic location near to international shipping line.

The district has about 99.1% coverage of sanitary latrines, 97.2% of safe drinking water supply and 90.7% sullage system. All townships are readily connected with available good tarred road all over the areas with 100% electrical coverage.

The study area is served by the Pontian district hospital with 120 beds, with a complete range of medical and surgical care facilities (Photo 2.2.1). It's a non-specialist hospital with average number of admissions of 33 cases per day with a bed occupancy rate of 57.2%. And with good medical care and treatment, most of the patients only stay in for an average of 2.2 days. The entire number of in-patient was about 12,000 per-year. There are nine doctors with 14 staff nurses handling four main wards, gynaecology ward, obstetric ward, peadiatric ward and multidisciplinary ward. The three main reasons for hospital admission were pregnancy and deliveries, respiratory problems, and cardiovascular diseases. Main causes of hospital mortality were cardiovascular diseases, infections, and respiratory problems.

The District Health office of Pontian provides multiple health care services and prevention programmes to the local communities through its eight main health centres. It includes Pontian health clinic, Pekan Nenas health clinic, Ayer Baloi health clinic, Penerok health clinic, Benut health clinic, Kayu Ara Pasong health clinic, Parit Ismail health clinic and Serkat health clinic. The latter is the health centre that responsible in providing health care services in the area of the proposed project.

Source: pontian.plj.com

Photo 2.2.1 Hospital Pontian

In general, the district is not a problematic area with no frequent outbreak occurred in the area. Nevertheless, the attributable percentages for certain diseases found to be increased in 2012 compared to the state of Johor, as the denominator (Table 2.2.1). Influenza-like-illness (ILI) was found to be more common in 2012 compared to the previous year. Luckily, there weren't any cases of influenza A reported at the same time. Those ILI might be just a common cold that normally present in this country during raining monsoon or draught.

A more serious disease found to be increased in the district was food poisoning with a attributable percentage of 3.2% in 2012. There were many factors contributing to the occurrence, mainly unhygienic food handling. However, another type of food borne diseases was not reported such as cholera, dysentery, typhoid and hepatitis A. Hence, those food poisoning might be isolated events which only affecting the household food preparation. Pertaining to STI, hepatitis C was the only illness that increased in the year 2012. This was also true for measles, which might be due to increased screening and health awareness among the population. Other types of diseases were found to be well controlled and managed.

Discussion

The district of Pontian, where the proposed project will be built, is free from excessive burden of diseases except for food waterborne diseases and STIs as the state of Johor. Since both diseases are preventable, the health authorities need to closely supervise the surveillance system, especially to both groups of diseases. Any development needs good housekeeping, especially at the base camp as one of point for the outbreak. They should be screened for STIs and limit their social interaction with the population and communities.

Table 2.2.1 Attributable Percentage of Selected Diseases Reported in Pontian Compared to The State of Johor, 2011 to 2012

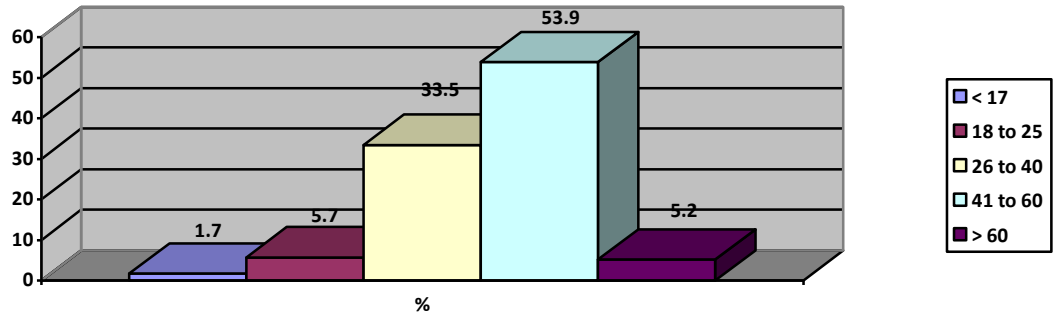
Diseases reported	Pontian				Johor	
	2011		2012		2011	2012
Airborne diseases	n	%	n	%	n	n
Influenza A (H1N1)	0	0.0	0	0.0	103	42
Tuberculosis	88	4.4	103	5.1	1980	2011
Influenza-like-illness (ILI)	289	5.5	1938	22.6	5223	8571
Food Waterborne diseases						
Cholera	0	0	0	0	0	0
Dysentery	0	0	0	0	3	2
Food poisoning	46	1.4	57	3.2	3320	1777
Typhoid	1	14.2	0	0.0	7	9
Hepatitis A	0	0	0	0	6	3
Acute gastroenteritis	4170	8.4	3475	9.5	49870	36543
Sexual transmitted infections						
HIV	2	0.3	9	1.4	614	656
Gonoccocal	2	0.8	3	1.4	234	219
Syphilis	4	3.8	5	3.4	103	146
Hepatitis C	0	0.0	5	3.9	69	129
Vector borne diseases						
Dengue fever	45	3.2	59	3.7	1388	1600
Dengue haemorrhagic fever	0	0.0	1	2.0	195	50
Malaria	2	2.2	1	1.1	90	88
Unhygienic environment						
Leprosy	2	20.0	0	0.0	10	9
Leptospirosis	0	0.0	2	3.1	50	64
HFMD	53	10.0	71	2.8	542	2561
Measles	0	0.0	8	16.3	59	49

2.3 Community survey

In evaluating the current environmental status of the proposed project site, both human and environment conditions were judged and assessed. For those communities within the zone of impact, their sanitation and health status were obtained from a combined socio-health survey using a standardized questionnaire conducted by trained enumerators.

A sum of 230 respondents was consented upon to be involved in the study. The majority of them were male respondent (n=185; 80.4%) following by female respondents (n=45; 19.6%). Four (1.7%) of them aged less than 17-year-old; 13 (5.7%) respondents aged 18 to 25-year-old; 77 (33.5%) respondents aged between 26 to 40-year-old; 124 (53.9%) of them aged between 40 to 60-year-old, and the remaining of 12 (5.2%) respondents were aged more than 60-year-old (Figure 4.3.1). Thus, the majority of the respondents were within the working age group between 18 to 60-year-old (93.1%).

Most of the respondents (n=219; 95.2%) hold their own in-house latrine either as pouring or flush toilet. However, only 11 of them (4.8%) claimed that they still used nearby irrigation or river water as their choice, which was obviously unhygienic and posed a risk of faecal oral water borne diseases. The condition was even worse since some of them (n=4; 1.7%) still uses a tube well water daily as one of their sources of drinking water. This may further increase the cross contamination of the drinking water source from contaminated surface water and soils.



Source: Study survey 2014

Figure 2.3.1 Percentage distribution based on respondents age groups

Most of the surveyed household (n=142; 61.8%) disposed their domestic wastes by burying it under the soil, followed by municipal collection system (n=61; 26.5%), open burning (n=17; 7.4%), and throw onto open space (n=10; 4.3%). These behaviors as shown in Table 2.3.1 are obviously polluting the environment and pose multiple health risks like upper respiratory tract problems, skin problems and even food chain contamination through soil contamination.

Cough and cold or upper respiratory tract infection (URTI) was the most common complaints (n=47; 20.47%) claimed by the respondents and their dependents (Table 2.3.2). This can be due to various causes like hay fever, allergen reaction, or air pollution. Headache, chest discomfort and shortness of breath were the next most common health complaints (10.0% each). It followed by eczema (n=12; 5.2%), vomiting / diarrhoea (n=10; 4.3%), conjunctivitis (n= 7; 3.0%) and high fever (n=1; 0.4%).

Yet, from those above complaints, dengue fever was the most common diagnosis made among the respondents and their dependents in the past six months (Table 2.2.3). Considering the point of dengue fever may also manifest as headache or vomiting, the above calls were not wrong. Hypertension was the next health problem (n=8; 3.5%), followed with heart problems (n=7; 3.0%), asthma (n=5; 2.2%), eczema (n=4; 1.7%), chest infection and malnutrition (each n=2; 0.9%), and diabetes mellitus and anemia (each n=1; 0.4%).

From those diagnoses, only 13 respondents were admitted into a hospital for further treatment as inpatients. Dengue fever (n=6; 2.6%) was the most common cause of the hospitalisation (Table 2.3.4). This followed by heart problem cases (n=3; 1.3%), uncontrolled hypertension and eczema (n=2; 0.9%), and uncontrolled diabetes mellitus (n=1; 0.4%)

Table 2.3.1. Method of household waste disposal by respondents (n=230)

Method	Frequency	Percentage
Bury under the soil	142	61.8
Municipal collection	61	26.5
Open burning	17	7.4
Open ground	10	4.3

Table 2.2.2. Type of health problems experienced by respondents and their dependents in the past six months

Health complaint	Frequency	Percentage
Conjunctivitis	7	3.0
Cough and cold	47	20.4
Chest discomfort or pain	23	10.0
Eczema	12	5.2
Fever	1	0.4
Headache	23	10.0
Shortness of breath	23	10.0
Vomiting / diarrhoea	10	4.3

Table 2.2.3. Type of health problems among the respondents and their dependents diagnosed by a medical doctor in the past six months

Diagnosis	Frequency	Percentage
Anemia	1	0.4
Asthma	5	2.2
Chest infection	2	0.9
Dengue fever	11	4.8
Diabetes mellitus	1	0.4
Eczema	4	1.7
Heart problem	7	3.0
Hypertension	8	3.5
Malnutrition	2	0.9

Table 2.2.4. Type of health problems among the respondents and their dependents that being admitted into a hospital in the past six months

Diagnosis	Frequency	Percent
Heart problem	3	1.3
Uncontrolled hypertension	2	0.9
Eczema	2	0.9
Uncontrolled diabetes mellitus	1	0.4
Dengue fever	6	2.6

Discussion

From the community survey, the communities found to practice unhygienic methods in their solid waste disposal. This may create water collection and best for vector breeding. Since dengue fever was among prominent infectious diseases among the respondents and their dependents, management of the solid waste is crucial in this area.

5.0 Health Risk Assessment

The health risk assessment takes on a significant role in any environmental impact assessment in ensuring the wellbeing of the communities staying inside the zone of impact. The assessment was performed to detect any excess of risk from any potential hazards in environments such as ambient air and noise. It's covered both the existing and predicted level from the modelling of both environmental monitoring exercises.

The main steps in this health impact assessment were consisted of identification of health hazards, interpretation and management of health risks. In addition, the proposed project area was found to have high burden of diseases like tuberculosis and URTI that are indirectly related with the quality of ambient air.

5.1 Hazards Identification

From the scoping exercise, few substances are expected to be emitted particularly during the operational phase of the proposed project. The ground monitoring was done for those substances as such total suspended particulate (TSP), particulate matter 10µm (PM_{10}) sulphur dioxides, nitrogen dioxides, and volatile organic compound (VOC) (Table 5.1.1). Beside those pollutants, noise from the proposed project was also envisioned as one of important community hazard.

Most of the identified substances are irritant to the respiratory tract mucosal lining and skin due to their corrosive characteristic or as a secondary acid aerosol in the ambient air. The VOC is a group of compounds that may indicated by the type of the process involved. In this assessment, benzene was used as the proxy for VOC of jet fuel for its health risk assessment purposes. Since VOC is not mentioned in the RMAQG, other legislative body, such as the Office of Environmental Health Hazard Assessment (OEHHA) in Canada was used. American Conference of Industrial Hygienist (ACGIH) limit was not suitable in this case since it’s meant for an occupational exposure.

Table 5.1.1. Types of potential pollutants with health effects and their recommended level

Pollutant	Health effect	Guideline
TSP	Respiratory & skin problems	260 µg/m^3 (24-hour) *
PM_{10}	Respiratory system	150 µg/m^3 (24-hour) *
NO_2	Respiratory system & skin problems	75 µg/m^3 (24-hour) *
SO_2	Respiratory system & skin problems	105 µg/m^3 (24-hour) *
VOC (Benzene)	Reproductive problem & carcinogen	1300 µg/m^3 (6-hour) **

NO_2 conversion factor = 1 ppm = 1.88 mg/m³ @ 20°C
Sources: RMAQG, Department of Environment, Malaysia*
OEHHA 1999**

5.1.1 Suspended solids and particulate matter (PM).

Total suspended solids and PM_{10} are capable of provoking respiratory irritation causing exacerbations of lung disease and increasing blood coagulability in susceptible individuals. This fine particulate with a mass median aerodynamic diameter less than 10 microns may mediate some of the adverse health effects reported in which there is toxicologic evidence to support this contention. These particles are able to enhance calcium influx on contact with macrophages. Oxidative stress is also to be anticipated, which augmented by oxidants generated by recruiting inflammatory leukocytes to produce atheromatous plaques form in the coronary arteries, which one of the causes of morbidity and death associated epidemiologically with particulate air pollution. Direct exposure might trigger skin problems like eczema and dermatitis due to mast cell response to foreign bodies.

5.1.2 Sulphur dioxides (SO_2)

Studies have shown that inhalation of SO_2 by asthmatics can cause a significant degree of wheezing at concentrations considerably lower than those which affect non-asthmatics. Concentrations as low as 0.2 ppm have a significant effect, especially in subjects who are mouth breathing or undergoing heavy exercise. The effects appear to be short-lived and not increased by more prolonged exposure.

5.1.3 Nitrogen dioxides (NO_2)

The effects of NO_2 inhalation are similar like SO_2. On balance, the evidence suggests that any effect on asthmatics is likely to be modest. Similarly with acid aerosols, impairment in lung function in asthmatics have been small and of brief duration. Acute exposure to NO_2 has caused pulmonary edema, pneumonitis, bronchitis, and bronchiolitis obliterans. NO_2 is considered a relatively insoluble, reactive gas, such as phosgene and ozone. Once inhaled, it reaches the lower respiratory tract, affecting mainly the bronchioles and the adjacent alveolar spaces, where it may produce pulmonary edema within hours. Many deaths from pulmonary oedema have been caused by acute inhalation of high concentrations of NO2.

5.1.4 Volatile organic compound (VOC)

The compound is a mixture of several substances based on the production process. In this case of jet fuel, benzene will be the main chemical of concerned other than kerosene which is noncarcinogen. Benzene is a very lipophilic chemical that normally affect human health through skin absorption and inhalation. The latter is the most common type of environmental exposure to vicinity communities. OEHHA set the limit of 1.3 mg/m^3 of ambient air concentration for 6-hour exposure in which to protect fetus development. The substance is known as a Group 1 carcinogen.

5.2 Ambient Air Monitoring

Four stations were selected within 5 km radius from the proposed project area (Table 5.1.2). Their hazard quotients for baseline ground level concentrations for all pollutants were calculated for each point. Hazard quotient was calculated by dividing the concentration with its guideline limit respectively. The guideline is considered to be a safe limit in which no health effects are expected to arise from the exposure to each substance. A healthy or no risk, hazard quotient must be less than one. Particularly for VOC (benzene), a lifetime cancer risk is usually used to assess the health risk. All four monitoring stations revealed a good ambient air quality based on the baseline concentration (Table 5.1.3). This indicated that the baseline ambient air in the proposed area was in good quality status. During normal operation of the proposed project, it was predicted to emit a small volume of those identified pollutants. The model computed a small increment in pollutant concentrations in which contributed for a minute change in hazard quotients and hazard index (Table 5.1.4). Since VOC was very small in quantity, its lifetime cancer risk would be negligible.

Table 5.1.2. Location of Air Monitoring Stations

Air Monitoring Station	Location
AN1	Tanjung Piai Ramsar Site
AN2	Futsal Court
AN3	Sekolah Seri Sinaran Chokoh
AN4	Kampung Sungai Cengkeh

Table 5.1.3. Hazard quotient (HQ) calculation of Baseline Ground Level Concentration for each air monitoring station

Pollutant	Guideline ($\mu g/m^3$)	Air Monitoring Station							
		AN1		AN2		AN3		AN4	
		$\mu g/m^3$	HQ	$\mu g/m^3$	HQ	$\mu g/m^3$	HQ	$\mu g/m^3$	HQ
TSP	260	63.8	0.24	60.8	0.24	66.4	0.26	68.6	0.26
PM_{10}	150	31.0	0.21	32.0	0.21	34.0	0.23	35.0	0.23
NO_2	75	2.3	0.03	5.8	0.08	4.8	0.06	7.3	0.09
SO_2	105	4.4	0.04	1.2	0.01	1.1	0.01	10.5	0.10
VOC	1300	57.1	0.04	57.9	0.04	57.4	0.04	59.6	0.05
Cumulative (hazard index)			0.56		0.58		0.60		0.73

Table 5.1.3. Hazard quotient (HQ) calculation of Cumulative Ground Level Concentration for each air monitoring station during the operational phase of the project

Pollutant	Guideline ($\mu g/m^3$)	Air Monitoring Station							
		AN1		AN2		AN3		AN4	
		$\mu g/m^3$	HQ	$\mu g/m^3$	HQ	$\mu g/m^3$	HQ	$\mu g/m^3$	HQ
TSP	260	64.0	0.25	61.0	0.23	66.6	0.26	68.7	0.26
PM_{10}	150	31.0	0.21	32.1	0.21	34.1	0.23	35.1	0.23
NO_2	75	3.9	0.05	7.6	0.10	6.8	0.09	8.5	0.11
SO_2	105	5.5	0.05	2.5	0.02	2.6	0.02	11.3	0.11
VOC	1300	241.9	0.19	183.8	0.14	199.6	0.15	177.6	0.14
Cumulative (hazard index)			0.7		0.7		0.7		0.85

Discussion

As the results, all air monitoring stations have healthy hazard indexes of less than one, even with the present of the proposed project. The modelling showed the proposed project will only cause very minimal changes in hazard quotient, hazard index and API. No risk of carcinogen observed from the proposed project since VOC concentrations were very minor and far below the guideline limits.

5.3 Noise monitoring

For any industry, noise from its machineries and equipments has been identified as one of potential community nuisance in the future. It may add more noise to the other existing sources nearby to the proposed site. Noise from various human activities, fauna sound and traffic movement are capable of contributing to a high background noise.

In this study, four sites were chosen for the noise monitoring exercise. They were placed at Tanjung Piai Ramsar area (N1), Futsal Court area (N2), Sekolah Seri Sinaran Chokoh area (N3), and Kampung Sungai Cengkih area (N4). The sampling involved day time (0700H – 2200H) and night time (2200H – 0700H) periods (Table 5.1.4). All areas are considered as low density residential and institutional land use categories based on The Planning Guidelines For Environmental Noise Limits And Control, 2007 by DOE, Malaysia.

From the baseline monitoring, all locations were found to have a high ground noise condition for both day and night time (Table 5.1.5). Thus, the study areas were considered as a high ground noise area. This high background noise was found due to the sea breeze, road traffic, flora noise and human activities. In this situation, Schedule 2 Maximum Permissible Sound Level was calculated and used in this assessment (Table 5.1.6). The first noise station was found to be violating the Schedule 2, which is the Ramsar site at Tanjung Piai. This is most probably due to natural noise by creatures like birds and other bigger animals.

Table 5.1.4. Recommended Maximum Permisiable Sound Limit (L_{Aeq}) for each receptor

Station for Noise	Location	*Land Use Category	*Day time (0700H – 2200H)	*Night time (2200H – 0700H)
N1	Tg. Piai Ramsar Site	Low density residential	50 dBA	40 dBA
N2	Futsal Court	Low density residential	50 dBA	40 dBA
N3	Sekolah Seri Sinaran Chokoh	Low density residential and institutional	50 dBA	40 dBA
N4	Kg. Sg. Cengkeh	Low density residential	50 dBA	40 dBA

*The Planning Guidelines For Environmental Noise Limits And Control, 2007 (DOE, Malaysia)

Table 5.1.5. Recommended Residential Noise level compared with the monitored level of sensitive receptors

Station Reference	L_{Aeq} (dBA)	
	Day time	Night time
Guideline	50.0	40.0
N1	**69.7**	**66.3**
N2	**51.3**	**55.3**
N3	**54.1**	**53.1**
N4	**59.1**	**61.8**

Table 5.1.6. Maximum Permissible Sound Level in Existing High Background Noise for each receptor

Station Reference	Permissible Sound Level (dBA)					
	Day time			Night time		
	L_{90}	L_{90}+ 10	L_{Aeq}	L_{90}	(L_{90}+ 5)	L_{Aeq}
N1	59.9	69.9	**69.7**	59.9	64.9	**66.3**
N2	59.9	69.9	**51.3**	59.9	64.9	**55.3**
N3	59.9	69.9	**54.1**	59.9	64.9	**53.1**
N4	59.9	69.9	**59.1**	59.9	64.9	**61.8**

Communities staying near to the Station N1 was postulated to be exposed to excessive noise exposure, particularly at night time. This is not good for health, especially mental health due to stress and unable to rest at night. However, they're not much present of neither housing area, nor institution like school in that area. Hence, the high noise is there, but very limited people will be debunked, especially those taken in conserving the area or tourist who simply came for a short of time. Thus, the excessive noise in that area is not a hazard to the communities in the survey zone.

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