

# **HIA IN PROPOSED DAM DEVELOPMENTS: MALAYSIAN METHODOLOGICAL PERSPECTIVE**

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# *Presentation Outline*

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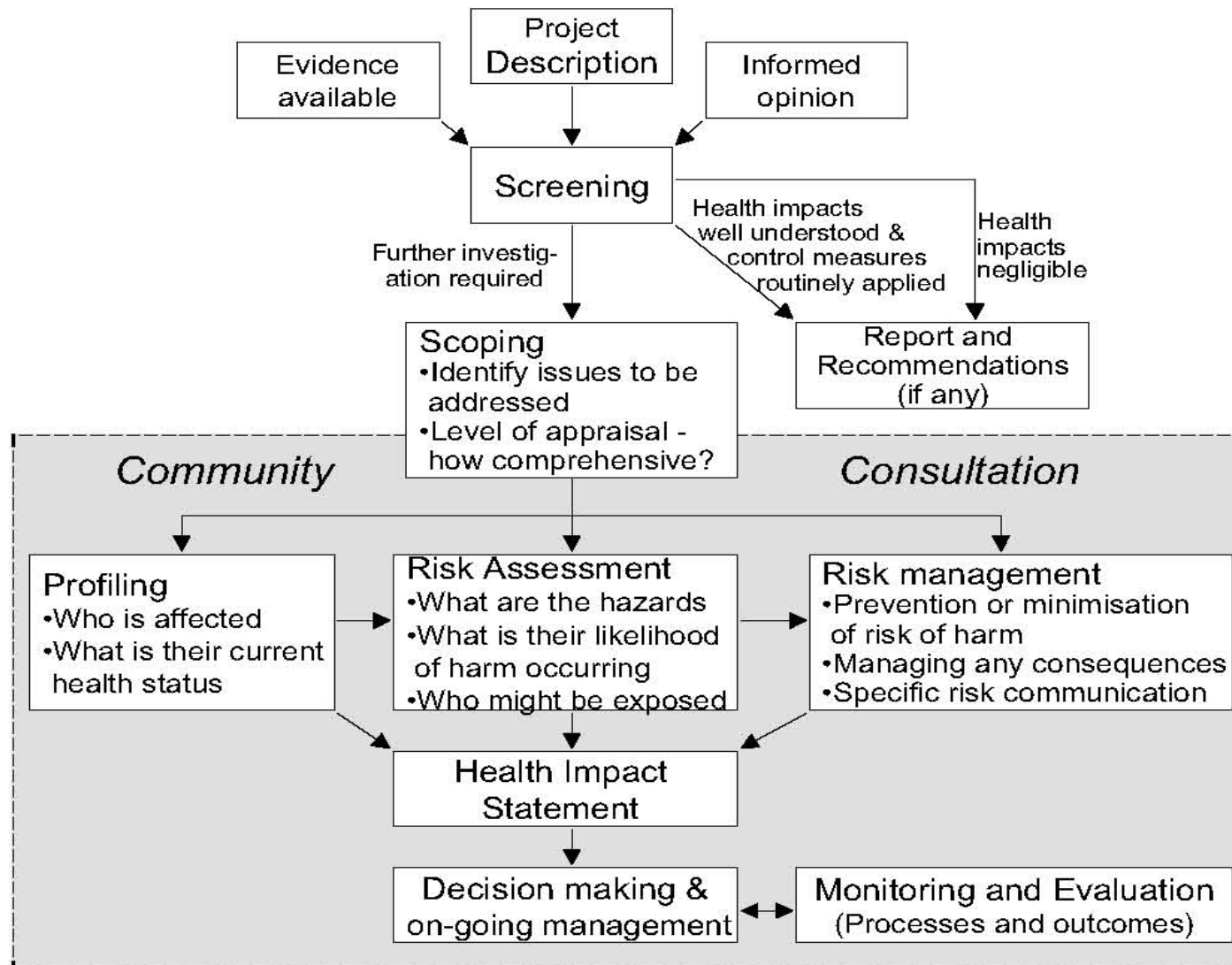
# Introduction

## EIA

- *Legal requirement under section 34A of Environmental Quality Act, 1974- Environment Quality (Prescribed Activities) (Environmental Impact Assessment ) Order 1986.*
  
- construction of dams or water resource development
  - **Water supply/ irrigation**
  - **Hydroelectric for power generation**
  
- since 14th January 1999, DEIA legally required



# EHIA Procedures



# EHIA

- The potential health impacts from water resource development such as the hydro-electric project are mainly on water-related diseases (WHO, 1998).
- These water-related diseases can be classified into four major groups;
  - *water-borne disease* – caused by highly infective organisms transmitted by contamination of water supplies.
  - *water-based diseases*- infections by worms- depend on aquatic crustacean hosts
  - *vector-borne diseases* transmitted by insect vectors that breed in or around water and
  - *water-washed diseases*- transmission when personal hygiene is poor due to lack of adequate water supplies

# Methodology of HIA of the proposed dam

Aim: To evaluate the potential impacts of the proposed dam development to the health of the local population.

- The local population were defined as the residents in the settlements in vicinity to the proposed dam.
- Public Health Impact Assessment
  - Community Health
  - Parasitology
    - Intestinal Parasites, Schistosomiasis
    - Zoonotic Diseases
  - Entomology- vectorborne diseases
  - Health Risk Assessment: HRA Methodology for water consumption and irrigation



# ***Methodology***

## **1. Existing Environment:**

### ***a. Cross-sectional survey:***

- ***Community survey:*** current community health status
- ***Entomological survey:*** update the distribution and species of mosquitoes and determine the risk of vector-borne diseases
- ***Parasitological survey:*** prevalence of intestinal parasite infections among children, schistosomiasis and zoonotic diseases to the local population

### **b. Retrospective review:**

- Review of the health surveillance records from the nearest health facilities.



## *2. Impact Prediction*

- Qualitative
  - Water-related diseases (vectorborne diseases), zoonotic diseases and other communicable diseases eg. Tbc, HIV, STDs etc
- Quantitative: EHRA
  - Chemical health risk assessment
  - EHRA based on US EPA methodology:
    - Steps: hazard identification, dose-response relationship, exposure assessment and risk characterisation

# Sampling Location & Population

## 1. Community Health

1. *Survey: villages in vicinity to the proposed dam*
2. *Review of surveillance data: waterborne, vectorborne and other communicable diseases from the nearest district health office*

## 2. Water-related diseases

1. *Intestinal Parasitic infections: among children of the affected population targeted coverage >50%*

### 2. *Schistosomiasis:*

***search for snails in all accessible streams.***

- ***Submerged root masses of trees growing at the edge of streams, rock surfaces, banks of stream, and rock pools were searched thoroughly at all possible sites for snails.***

### 3. *Water quality assessment:*

- *physico-chemical & micro-biological parameter*
- *Samples from the affected rivers & the reticulation systems of the drinking water supply*

## 4. Vectorborne diseases

1. *Mosquito survey: coverage 70% of the affected villages*

1. *Bare Leg Catch: anthropophilic mosquitoes*

2. *Light trap: trap any mosquito: anthropophilic and zoophilic*

2. *Larva survey: any pond/ container which hold water*

*Field samples will be brought back for rearing and identification of species*

*Takes ~5-10days for rearing and >1 week for identification*

## 5. Zoonotic diseases

1. *Rodent trapping:*

– *cage traps were set in the jungle fringe surrounding the villages.*

– *All trapped rodents will be killed and their physical measurements will be taken. They will be combed for any ectoparasites. Then dissected for endoparasites identification*

# *Findings/Existing Environment*

## 1. Community Health

### 1. Survey

- Response Rate:
- Socio-demography characteristics: ethnic groups, education levels, literacy rate, economic status.
- Basic amenities
  - Water supply: piped water supply, GFS and/or river water
  - Sanitation: minor improvements
- Self reported health status: *acute and chronic diseases among respondents*

### 2. Secondary data:

- Trend of diseases:
  - Water and vector-borne diseases
  - Other communicable diseases



# ***Vectorborne Diseases***

- Mosquito survey :
  - BLC & Light trap:
  - Looking for 4 specific genus, namely
    - *Anopheles: malaria*
    - *Mansonia: filariasis*
    - *Aedes: dengue and DHF*
    - *Culex: Japanese Encephalitis*
  
- Larval survey:
  - *50% will be reared up to the stage that could be identified*
  - *Another 50% will be killed and mounted.*



*Table 4.3.2. Bare Leg Catch collection during survey*

<b>Kg Tiat</b>	<b>No</b>	<b>Kg Teji</b>	<b>No</b>
<i>Armigeres (Leicesteria) longipalpis</i>	1	<i>Armigeres (Leicesteria) longipalpis</i>	1
<i>Armigeres (Leicesteria) flavus</i>	1	<i>Armigeres (Leicesteria) flavus</i>	4
<i>Armigeres (Armigeres)</i>	1	<i>Armigeres (Armigeres)</i>	1
<i>Aedes (Finlaya) 'niveus'</i>	3	<i>Aedes (Stegomyia) pseudoalbopictus</i>	1
<i>Aedes (Stegomyia) pseudoalbopictus</i>	1		
<i>Aedes (Steg.) gardnerii imitator</i>	1		
<b>Kg Renglas</b>		<b>Kg Kuala Boh</b>	
<i>Armigeres (Leicesteria) flavus</i>	2	<i>Armigeres (Leicesteria) magnus</i>	1
<i>Aedes albopictus</i>	1	<i>Armigeres (Leicesteria) flavus</i>	1
<i>Aedes (Finlaya) 'niveus'</i>	1	<i>Armigeres longipalpis</i>	1
<i>Aedes (Stegomyia) pseudoalbopictus</i>	1	<i>Aedes (Finlaya) 'niveus'</i>	2
<i>Culex (Cx.) quinquefasciatus</i>	1	<i>Aedes (Stegomyia) pseudoalbopictus</i>	5

# Results of the mosquito survey

## Adult survey :

Bare leg collections (BLC) 20 species belonging to 6 genera were collected from 4 villages

The predominant species : *Anopheles kochi* , *Aedes caecus*, *Culex mimulus* and *Culex gelidus*

*An. maculatus*, which is a vector of principal for malaria, was scarcely found,

*Aedes albopictus* was commonly found

CDC light trap collections : 3 villages: 12 species belonging to 4 genera

Predominant species: *Culex* spp

## Larval survey:

nine species of larvae belonging to 4 genera

Predominant species: *Culex* spp.

# ***WATER BORNE DISEASES***

- **PARASITOLOGICAL SURVEY**
  - among children
  - overall response rate: 84.4%(270 samples received from 320 distributed ).
  - 49% positive intestinal parasites
  
  - **Intestinal Protozoan Infections**
    - *commonest protozoa detected :Blastocystis hominis (BH) (24.4%), Entamoeba histolytica (15.6%), Giardia duodenalis (6.7%) and Iodamoeba butschlii (6.3%).*
    - *BH and IB: pathogenic for immuno-compromised person*
    - *EH and GD: diarrhoea, malnutrition, flatulence, amebiasias*
    - *transmission route: faecal – oral*
  
  - **Intestinal Helminthic Infections**
    - *commonest helminth: Ascaris lumbricoides (3.7%) followed by Trichuris trichiura (1.8%) and Enterobius vermicularis (0.7%)*
    - *Lower prevalance than the 2003 and 1999 surveys*
    - *Medical importance: stunting, wasting, malnutrition and unfit physically*
-

# Zoonotic Diseases

## Example of the data reported:

A total of 8 small mammals were trapped during the survey

### Total number and species of animals trapped at Cameron Highlands

Number	Species	Total Number	Helminth +ve	Ectoparasites
1	<i>Rattus tiomanicus</i>	4	1	4
2	<i>Rattus whiteheadi</i>	1	0	1
3	<i>Rattus cremoriventer</i>	3	2	3
	Total	8	3	8

### Summary of helminthes recovered from the trapped animals.

Number	Host Species	Nematodes	Cestodes	Trematodes
1	<i>Rattus tiomanicus</i>	<i>Angiostrongylus Malaysiensis</i>	-	-
2	<i>Rattus tiomanicus</i>	-	<i>Taenia taeniformis</i>	-
4	<i>Rattus tiomanicus</i>	-	<i>Taenia taeniformis</i>	-
6	<i>Rattus cremoriventer</i>	-	<i>Raillietina sp.</i>	-

# Impact Prediction

- *The nematodes, Angiostrongylus and the cestodes can be of medical importance.*
- *T. taeniaformis and Hymenolepis sp have the potentials to be transmitted to man directly.*
- *All small mammals were found in close proximity to human habitat thus transmission of these parasites to man and the risk to zoonotic disease are possible.*

## **Implications**

- *Risk for zoonotic diseases especially during the construction time.*

## **Mitigation**

- *Education.*
- *Reduce contamination/personal hygiene*
- *Rodent control*
- *Avoid swimming in or drinking from potentially contaminated water.*

# *Health Impact Assessment*

## **1. VECTORBORNE DISEASES**

The primary vectors found in the area during the survey will formed the basis for the impact prediction

Eg. *Japanese encephalitis (Culex gelidus) and filariasis (Mansonia dives)* and vectors for dengue (*Aedes albopictus*) if present in this proposed area.

- *Potential impacts:*
  - Risk for dengue, malaria, Japanese encephalitis and filariasis

# *Impact Prediction*

## **VECTORBORNE DISEASES**

- Current survey (2006) found presence of *Aedes albopictus* (Dengue vector) and *Culex spp* (JE vector) in BLC and larval survey
- These species are associated with development – man-made reservoir (eg containers) and area accessibility
- This findings was not found in 2004 survey.
- **Implications**
  - *Risk for Dengue and Dengue Haemorrhagic Fever and JE*
  - *Filariasis poses minimum risk (first survey- only one mosquito caught)*
  - *Malaria do not pose risk in this area.*
- **Mitigation**
  - *Area immediately surrounding the dam with vegetations have to be maintained regularly because the vegetations provide the habitat and resting area for mansonia.*
  - *Knowledge on dengue breeding places and sanitation (clean water supply and waste managements) must be emphasized through health educations.*

# Impact Prediction

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- Current survey: *Giardia duodenalis* and *Ascaris lumbricoides* are the main parasitic infections
- In 2004 survey, *Trichuris trichuria* and *Blastocystis hominis* were the main parasites
- Possible source: contamination of water supply which were mainly from GFS (93%)

## Implications

- *G. duodenalis* and *A. lumbricoides* are more pathogenic- caused more complications.
- *G. duodenalis*- zoonotic (host otter) – dam reservoir is a possible area of habitat for otters
- Reliance on contaminated water supply from GFS and rivers poses higher risk to the parasitic diseases esp *A. lumbricoides*

# HRA based on the water quality assessments

Is the risk acceptable?

**Cancer risk**

**Systemic risk**

Cancer excess

Hazard Index

CSF

X

CDI

÷

RfD or RfC

Combine all route of  
exposure

NOEL

Uncertainty factor

Exposure Assessment

Hazard Identification

Dose-response  
Assessment

# Discussion

- **Community health:**
  - *Socioeconomic, health status and other health determinants provide the baseline for the existing health status of the local affected population*
- **Entomological survey:**
  - *Some changes in the distribution of mosquito species*
  - *Could be due to changes in mosquito habitat because of the current development activities*
  - *Higher risk to dengue, DHF due to antropogenic activities*
- **Parasitology:**
  - *Intestinal parasitic infection relies on personal hygiene & water supply*
  - *zoonotic disease*
  - *Schistosomiasis*

# Challenges

- *The HIA for the proposed dam is being developed*
  - *Capacity building are very important*
  - *Community / Stakeholder consultations are integrated in the process*
  - *Quantitative risk assessment for the water related diseases need to developed*
  - *Emerging and reemerging diseases need to be addressed*
  - *Need cooperation from the health authorities for the surveillance data*
  - *Costs and other implications need to be considered*
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