CHAPTER 6

CONCLUSIONS AND SUGGESTIONS FOR FURTHER WORK

As mentioned in Chapter 1, various methods have been taken by the Federal and State Governments to ensure a constant supply of water for the people. Diversion, dammings, cloud seedings and groundwater studies have been directed by the governments to ensure the people gets adequate water supply and a clear environment without haze.

Groundwater has been the subject and interest of the many throughout the world (Arrate et al., 1997; Melloul and Azman, 1997, and Ang and Mohamad, 1998), thus reflecting the importance of the groundwater issue. In some parts of the world, groundwater has been used for drinking and other purposes.

6.1 Hypothesis of the present investigation

The five areas or sites chosen for the purpose of the present study are topographically different. At some sites e.g. Site 1 and Site 2 (Mukim Klang), industrial activities are quite extensive. The activities at Site 3 and Site 5 are more agricultural in nature although Site 5 also has light industrial activities. One of the study sites (Site 4) is a landfill site.

The hypothesis formulated in this study is as follows. It is widely known, in any human activity there will be some waste generated . These waste materials may be in the form of solids and liquids. Liquid waste may contain detergents, solvents and dissolved materials which may and can become contaminants in water and flow together into drains, rivers and eventually into the seas. Likewise solid waste can undergo decay, oxidation and corrosion which can lead to metal ion dissolution in interstitial water. Soils have corrosive power. When a metal product is disposed, it may be covered with soil after some time. When this happens, the structure of the metal may vary (Khare and Nahar, 1997), stress can be induced, soil moisture and composition may change and the degree of soil aeration may fluctuate. These variations result in the metal atoms, at certain points on the metal surface, passing more readily into solution than those at other places. Neutral metal atoms leave the metallic structure and become positively charged ions and the corrosion of metal ions in soil. The dissolved metal ion thus enters the soil. According to Bervoets, (1997) ,metal levels in organisms are positively related to the easily reducible and reducible metal fractions. Other metal ions such as Ca^{2+} from fertilisers can also find its way through the soil when it is trapped in water. These water molecules may join up with other water molecules and increase the contaminant level. When they reach the underground water table, they can pollute groundwater. Organotin compounds which have been used as antifouling paints since the 1960s can be continuously released from vessels into water and bring toxic effects to non target organisms (Harino et al., 1997). These are examples of methods how heavy metals can enter the environment.

Apart from waste materials, heavy metals are typically adsorbed onto finer grained sediments and spread across surrounding areas through floods and surface runoff water (Martin, 1997). Heavy metals are among the best known and most widely studied pollutants through the fluvial system. Heavy metals of the type described in this study have also been the subject of interest of other people. For example Ibrahim (1992), Ibrahim (1994) Ibrahim (1994a) and Ibrahim (1995) have studied heavy metal contents in mosquito coils, Langkawi black sand and in cockles (Anadara granosa) by neutron activation analysis.

The primary aim of the present study is to determine the safety of interstitial water for domestic use. The term "interstitial water" is used here so as to give a clearer picture of the water sample studied. Although "interstitial water" is used to define water in the pores between several soil grains, its properties can still reflect the properties of groundwater *per se*. This is because interstitial water may seep through the ground and find its way to the water table in an unconfined aquifer, and become groundwater *per se* and influence the properties of groundwater.

The results presented in Chapter 4 reveals that the interstitial waters in these areas need to be purified and treated before they can be used domestically (whether for drinking or washing). In the literature review, methods of treating polluted groundwater have been given. pH and moisture content do influence the distribution of some heavy metals although lateral seepage of heavy metals and recharge and discharge of water containing heavy metals can also influence the distribution. Chapter 5 is meant to suggest how one

can design and evaluate the performance of a lining system for landfill containment since the interstitial water at the landfill site is very high.

6.2 Suggestions for further work

It is thought worthwhile to further the work by taking more soil samples form bore holes dug at 5 m apart and for a fixed depth to study the lateral movement of heavy metals in interstitial water. In this way seepage rate can be determined for dry and wet conditions. This will also enable one to model heavy metal movement in the soil.