CHAPTER V

CONCLUSIONS AND RECOMENDATION

5.1 Conclusions

The study of cadmium distribution and relationship between cadmium and zinc in soil from the Mae Ku floodplain can be concluded as follows.

5.1.1 Total Cadmium (Cd) and Zinc (Zn) Concentrations

Cadmium: total Cd concentration in the study soils (99 samples) ranged between 0.42 to 101.69 mg/kg (SD=12.89 mg/kg). The distribution of Cd concentration analyzed by histogram shows that the background level of the Mae Ku area is at 3 mg/kg. However, to consider for environmental concerns to the distribution of Cd concentration is divided into 3 categories; 1) the level of Cd in soils was elevated up to 3 mg/kg which is defined as non-contaminated or very low contaminated area. At this level is the majority of the study area, more than 75% of soil samples fall in this category. 2) the level of total Cd concentration from more than 3 mg/kg to 37 mg/kg which is defined in this study as medium contaminated area which is found more than 20% of soil samples fall in this category; and 3) the high contaminated area where the total Cd concentration found to be higher than 37 mg/kg. However, if compared to "Thai Background Level" reported by Pongsakul and Attajarusit (1999), which are in the range 0.0 1to 0.141 mg/kg, more than 90% of soil samples from Mae Ku area should be defined as cadmium contaminated soil.

Zinc: total Zn concentration in studied soils (99 samples) ranged between 29.34 to 2,347.74 mg/kg with a mean value of 209.94 mg /kg (SD = 337.92 mg/kg). As compared to the study result of total Zn concentration in soils with "Thai Background Level" soil zinc concentrations range of < 0.01 to 237 mg/kg (Pongsakul and Attajarusit, 1999), it found that more than 79 % of soil samples did not exceed this background.

From comparing the study result with the study of Mae Tao area studied by NRC-EHWM (2005), it is found that the contamination level of Mae Ku area is lower than Mae Tao area. This can be explained by the reason that Mae Ku area is not directly receiving the runoff from zinc mine, only if there is a heavy rain which may generate a flooding and overflow to convey sediment from waste tailing to lower Mae Ku area.

5.1.2 Bioavailability Fractions of Cd and Zn

The SM&T sequential extraction was the method used in this study. Only the BCR1 was conducted in order to determine the concentrations of potential bioavailability fraction of Cd and Zn in soils. The ranges and means of concentrations of bioavailability fractions of Cd and Zn values of soils in Mae Ku floodplain were 0.03-63.78 and 2.04-1,033.92 mg/kg with mean values of 2.48 and 55.46 mg/kg, respectively.

The relationship between bioavailability fraction and total concentration of these metals in soils, both BCR1 fraction and total the concentration of Cd show significantly linear relationship. From this study, the result shows that bioavailability fraction is 0.6 time of total Cd concentration in soils.

Similarly, a significant linear relationship was found between BCR1 and total concentration of Zn in soil samples. The ratio of bioavailability fraction (BCR1) to total Zn concentration in soil samples was found to be 0.02 time of total Zn concentration. As compared the ratio of BCR1 to total cadmium of Mae Ku area from this study to the one from Mae Toa which reported by NRC-EHWM (2005), the ratio of both areas is insignificantly different. However, it is much different from the ratio of sediment samples studied also by NRC-EHWM (2005). This may indicate that the evolution from other from of sediment to be on "exchangeable form" or BCR1 fraction after the sediment resettle in the paddy field may not take very long time. Thus, the sediment deposit in Mae Toa which has been more than 30 years as compared to Mae Ku which came from overflow due to heavy rain within about 5 years are insignificant result.

From the result in this study, it was found that the bioavailability fraction of Cd in the study soils was increased to 36 % of total concentrations. These can be assumed that Mae Ku area might be contaminated by Cd, particularly in the east part of the study area.

5.2 Recommendations

(1) The "Soil quality standard for habitat and agriculture" of Thailand which has been notified by the Notification of the National Environment Board of National Environmental Quality No. 25 Act. B.E. 2547 (2004), allows cadmium and compounds in this soil type not exceed 37 mg/kg. As compared to the present study results, the area may considered non-contaminated since there were only 2 anomalies found from our soil samples. However, if compared the same results with the standard of the other countries which allow cadmium in similar purpose soil type, for example the "Soil Standards for Agricultural or other property use" of Ontario, Canada which allows cadmium concentrations in this soil type not more than 3 mg/kg (where soil pH is 5.0 to 9.0) (http://www.ene.gov.on.ca/envision/gp/4696e.htm) and " The Soil Guideline Values for cadmium for residential with plant uptake" of Environment Agency of United Kingdom which allows cadmium concentrations in soil with pH 7 not more than 2 mg/kg (http://www.environment-agency.gov.uk), the concentration of total cadmium the study area need to be concerned and prepared for measures.

(2) Most of study area was in the low cadmium contaminated level; therefore, Phytoremediation may be appropriate in solving the cadmium contaminated in this area.

(3) Two sampling points which have very high cadmium concentration should be reinvestigated in more detail. If it confirms that the cadmium in those points is very high concentration, it should be excavated to dispose or prohibit land use in this area.