Chapter 5
Conclusions

5.1 Conclusions

The assessment of the environmental impacts of the electronic products WWTP by the EPS method is an investigation on the weighting method in LCA. It can be obtained to a single environmental impact score and confirmed their results by a sensitivity analysis. It can be concluded as detail below;

5.1.1 The result of the weighing method showed that the total ELUs for the first evaluation is approximately 2,043 ELU based on one cubic meter of treated wastewater. The most important process generating the highest environmental burdens for an electronic products WWTP is raw material consumption for each treatment process. The exception is the rinse recycle process (T1) due to the result is effected to the energy consumption more than raw material consumption.

5.1.2 With consideration to the gold recovery process (T3) and batch treatment and neutralization process (T4), are modified to improve the environmental burdens and maximize the environmental benefits by waste minimization. The most significant contributions are come from the gold inlet of wastewater in T3 and chemical transportation; as well as, NaOH production and sludge generation in T4.

5.1.3 The modification to improve overall WWTP by using the opportunities of waste minimization is required to reduce ELU value and relieve the loading of environmental potentials. The improvement analysis is the need to reduce raw material consumption and increase their efficiency during operation of WWTP.

- The first modification is dealt to reduce and control the gold wastewater inlet to T3.
- The second modification is developed and modified the existing gold recovery process to establish high efficiency.

◆ The third modification is reduced the quantities of chemical usage in the batch treatment and neutralization process (T4) concerned to the reduction of chemical production, transportation and sludge generation. Otherwise, all treatment processes are considered by waste minimization to improve their operations and implement housekeeping practices.

5.1.4 The analysis result of modification showed that the recalculation of ELU to modified WWTP is around 19.78 ELU per cubic meter of treated wastewater, which is nearly reduced to 99%. The most serious major in this study is the gold inlet of wastewater. This is solved by applying the modification of chemical changes in the precipitation process for both T2 and T4 (which found a reduction of ELU only in T4). The high volume of collecting sludge and dry cake generation is still remained a major obstacle to this WWTP. However, with further study this problem will be rectified.

5.1.5 The result of this study showed the efficiency and potential to apply the analytical method of LCA in the electronic products wastewater treatment plant as an internal company tool. In Summary, this technique can be effectively applied for proposition as an internal manufacturing industry analytical tool to further sustainable development.

5.2 Recommendations

5.2.1 It is noted that the EPS methodology in this study is given reference to a model and data for the weighting and characterization phases of a default method (version 2000). The weighting factors are selected to perform in the environmental impact based on impact assessment as a global average, put valuations (weighting factors) in OECD countries. It should be adopted into the Thai condition by changing the weighting factors for further study and development.

5.2.2 Due to limitation of this study, some local informational data are not available. LCA studies in Thailand are lacking; especially, a domestic background

database. Therefore, many estimations and assumptions are used, and are need for future development.

5.2.3 With further study, the LCI will be fully completed from chemical production, maintenance materials and air emissions in WWTP. Moreover, to ensure the evaluation is corrected and believable, all main streams of the LCA, construction, operation and demolition phase, will be included in the investigation as the largest system boundary relevant to the study goal.

5.2.4 The results from the modifications of emissions to soil are significant in T2 and T4. It can be solved by incresing the filter press capacity (which prefers the new one with automatic plate shifting). From data calculations, the filter press will be expanded from 0.12 m^3/cycle to 0.5 m^3/cycle because the newly designed filter press can be operated 2 cycles/day to meet the actual operation, and to support more sludge in the future.

5.2.5 The study feasibility for recycling the filtered-cake sludge to reduce environmental impacts, as emissions to soil, can be referred to the sludge analytical data. The percentage solids is approximated 22%. Incresing the percentage solids is valuable and effects the recycling fee. Otherwise the study feasibility for the wastewater segregation is available to the chemical recovery processes (evaporation, RO, ion exchange, electrodialysis, ultra filtration) and the metal recovery process (electrolytic recovery). These expected results can reduce sludge generation and costs for disposal.