CHAPTER V
CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

The purpose of this work is to develop a methodology that take into account a new measure of environmental risk in uncertainty conditions to provide and develop design procedures for optimizing chemical process simultaneously based on economic aspect (maximizing net present worth; NPW), environmental aspect (minimizing environmental impact), minimizing financial and environmental risks using a multi-objective optimization approach and the two-stage stochastic model for planning under uncertainty. Realizing the uncertainty present in the process systems such as forecasted prices of raw materials and products, and equipment cost estimates is associated with risk.

As an example, the vinyl chloride production process is evaluated using the proposed methodology by using the process simulator ProII and GAMS program to create scenarios under uncertainty. The best solution should have a plant capacity of 400,000 ton/year, no heat integration, and no HCl recycle which obtains the expected net present worth of $334,532,151 \pm 220,223,579$, the expected environmental impact of 4.91 ± 0.54 EIU/ton of VCM, and risk of losing money which is 6.5%.

However, the design depending on the decision maker's preference to weigh each objective and specify the level of risks (environmental risk and financial risk) that can accept. The selection of the design done in this work is controlled to have all of the objectives equal to 1, and just shows the idea how to select the optimum solution.

5.2 Recommendations

For the further work, the accuracy of raw data, and more parameters should be included in order to obtain more realistic model and design because the main obstacle encountered is difficult to approach the real data, so the design is quite far from the real system.