IJSBAR
International Journal of Sciences: Basic and Applied Research

International Journal of Sciences: Basic and Applied Research

Waste Management Practices of Science Laboratories among Higher Education Institutions in Davao City: Basis for a City-Wide Waste Management Enhancement Program in Science Laboratories

By Mitchelle Sarabillo Perez

Volume 10, 2014
ISSN (Print & Online): 2307-4531

© IJSBAR THESIS PUBLICATION
www.gssrr.org

Published by:
GSSRR
Global Society of Scientific Research and Researchers

Visit: www.gssrr.org

ISSN 2307-4531 (Print & Online)

IJSBAR research papers proceedings are currently indexed by:

© IJSBAR THESIS PUBLICATION
www.gssrr.org

Waste Management Practices of Science Laboratories among Higher Education Institutions in Davao City: Basis for a City-Wide Waste Management Enhancement Program in Science Laboratories

Copyright © 2014 by By Mitchelle Sarabillo Perez

All rights reserved. No part of this thesis may be produced or transmitted in any form or by any means without written permission of the author.

ISSN(online & Print) 2307-4531

The IJSBAR is published and hosted by the Global Society of Scientific Research and Researchers (GSSRR). Address: Khllda - Wasfi Al Tall Street, P.O.Box : 2245 Amman 11953, info@gssrr.org, Amman, Hashemite Kingdom of Jordan

WASTE MANAGEMENT PRACTICES OF SCIENCE LABORATORIES AMONG HIGHER EDUCATION INSTITUTIONS IN DAVAO CITY: BASIS FOR A CITY-WIDE WASTE MANAGEMENT ENHANCEMENT PROGRAM IN SCIENCE LABORATORIES

A Thesis
Presented to the
Faculty of the Graduate School
University of Mindanao
Davao City

In Partial Fulfillment
of the Requirements for the Degree of
Master in Environmental Planning

MITCHELLE S. PEREZ
March 2008

APPROVAL SHEET

This thesis entitled **"Waste Management Practices of Science Laboratories Among Higher Education Institutions in Davao City: Basis for A City-Wide Waste Management Enhancement Program In Science Laboratories"** prepared and submitted by **Mitchelle S. Perez** in partial fulfillment of the requirements for the degree of **Master in Environmental Planning,** has been examined and is hereby endorsed for approval and acceptance.

ROGELIO C. MONTERO, MSF
Adviser

PANEL OF EXAMINERS

APPROVED by the Committee on oral Examination with a grade of **Passed.**

RAMON M. BARBON, MEP
Chairperson

EUGENIO S. GUHAO, JR. D. M.
Member

MARCIANO B. MELCHOR, Ed.D.
Member

GLORIA P. GEMPES, Ed.D.
Member

Accepted in partial fulfillment of the requirements for the degree of **Master in Environmental Planning.**

Comprehensive Examination : PASSED

ROGELIO C. MONTERO, MSF
Program Head
Environmental Planning

ACKNOWLEDGMENT

This thesis was made possible through the help and support of several people during the conduct of the study. The researcher conveys her deep appreciation and gratitude to them.

Prof. Rogelio C. Montero, the research adviser, for his guidance and encouragement to finish this study

The Thesis Committee, chaired by Engr. Ramon M. Barbon and members, Dr. Eugenio S. Guhao Jr., Dr. Marciano B. Melchor and Dr. Gloria P. Gempes for their valuable comments, suggestions and knowledge for the improvement of this study. A special appreciation also goes to Dr. Consolacion G. Garcia for her enthusiasm and commitment for editing this thesis paper.

The school heads, deans, department chairs and teachers who helped the researcher in the distribution and retrieval of survey questionnaire.

My Husband, Fritz, for his love and inspiration and my family members, for their prayers and moral support; my friends, for their immeasurable help in the preparation of this manuscript

Above all, To **God Almighty**, for the strength and blessings He has showered upon the researcher throughout the conduct of this study.

M. S. P.

DEDICATION

This book is lovingly dedicated to my husband, Fritz B. Perez,
My beloved father and mother and to the rest of my family members,
My university professors and to the graduate school mentors,
My friends in school and work and
Above all to the Almighty God for His sustaining grace.
I dedicate this work.

M. S. P.

TABLE OF CONTENTS

		Page
TITLE PAGE		i
APPROVAL SHEET		ii
ACKNOWLEDGMENT		iii
DEDICATION		v
TABLE OF CONTENTS		vi
LIST OF TABLES		ix
LIST OF FIGURES		x
Chapter		
1	THE PROBLEM AND ITS SETTING	
	Background of the Study	1
	Statement of the Problem	3
	Hypothesis	4
	Review of Related Literature	4
	Theoretical and Conceptual Framework	18
	Significance of the Study	19
	Definition of Terms	21
2	METHOD	
	Research Design	23
	Research Subjects	23
	Research Instrument	26

	Data Gathering Procedure	28
	Statistical Treatment of Data	29
3	PRESENTATION AND INTERPRETATION OF FINDINGS	
	Profile of Wastes Being Generated in Science Laboratories	30
	Level of Waste Management Practices	33
	Significance of Differences in the Level of Waste Management Practices	56
	Proposed Intervention Scheme	59
4	SUMMARY, CONCLUSIONS AND RECOMMENDATIONS	
	Summary	66
	Conclusions	68
	Recommendations	69
REFERENCES		74
APPENDICES		77
A	Requests Letter to Heads of HEIs for Permission to Conduct the Study	75
B	Letter to the Respondents	78
C	Questionnaire	80
D	Letter to Validators	82
E	Accomplished Sheets	93
F	Summary of Results of Validation	99
G	Table of Equivalent	101
CURRICULUM VITAE		103

LIST OF TABLES

		Page
1	Distribution of Respondents of the study	25
2	Profile of Wastes Being Generated in Science Laboratories	31
3	Level of Waste Management Practices of Science Laboratories in Handling at source	34
4	Level of Waste Management Practices of Science Laboratories in Storage of waste	40
5	Level of Waste Management Practices of Science Laboratories in collection of waste	44
6	Level of Waste Management Practices of Science Laboratories in Final disposal of waste	50
7	Summary on the Level of Waste Management Practices in Science laboratories	55
8	Significance Differences in the Extent of Waste Management Practices between Biology and Chemistry Laboratories	57
9	Matrix of the Propose Activities	64

Figure		Page
1	Conceptual Framework of the Study	20

Chapter 1

THE PROBLEM AND ITS SETTING

Background of the Study

Academic schools and universities are one of the contributors of waste in the sectors especially those who engage in the science laboratory activities. Trends in teaching science today were veering towards the use of more specimens and chemical reagents that are considered to be wasteful and hazardous. The Kansas Department Health and Environment (2001) stated that many schools from across the world have already been gone to any kind of school accidents or situations that can cause serious threats to human health and to the environment. One of the reasons is that their school laboratory contains a wide variety of dangerous chemicals that are obsolete, unknown, toxic, reactive and even explosive. Chemicals that are often purchased in large amount were stored incorrectly and disposed improperly. These practices are placing the students, the teachers, personnel and staffs and even the environment at risk.

School laboratories in the Philippines have actually gone through toxic incidents. Based from the Inquirer editorial article (2006), the toxic accident happened in San Isidro High School in Makati City, when a wall-mounted cabinet of chemicals collapsed and worsed, it was smothered by the fumes coming from the dangerous chemicals. Several personnel as

well as people who lived nearby fell ill and were hospitalized. Moreover, the Barangay Prenza in Marilao, Bulacan where half of the 3,000 residents had to evacuate because of toxic asphyxiation because of the stench of chemicals were dumped nearby in the irrigation canal. Both of these incidents reveal weak management and show reckless disregard for safety in the handling of the chemicals. The incident was an eye-opener on the condition of laboratories in public science education. The educational and environmental authorities seem oblivious to the hazard of chemical experimentation in schools.

Implementation of the Davao City Government`s Waste Management Program has indications that some Dabawenyos are still not complying with the mandated waste segregation scheme. According to Oledan (2006) in his article in Sunstar Davao that waste recycling and segregation are relatively new things and an increase in waste generation is inevitable for an urbanized city like Davao. The response to the current effort to segregate and recycle waste would be an interesting venue, and an opportunity for further studies to look into waste patterns and behaviors in our locality. This would send out a message that waste avoidance and volume reduction through source reduction measures is aimed towards the protection of public health and the environment.

Sound waste management practices in science laboratories of schools can serve not only as a showcase but also a fine training ground for consciousness in the protection and conservation of the environment,

been conducted on waste management practices in science laboratories of schools in Davao City. It is in this context that the researcher conducted that study in addressing the problem of waste management in the science laboratories of Higher Education Institutions in Davao City.

Statement of the Problem

The primary aim of the study was to determine the waste management practices of science laboratories of Higher Education Institutions in Davao City. Specifically, the study sought answers to the following questions:

1. What is the profile of wastes being generated by science laboratories of Higher Education Institutions in Davao City in terms of :

    1.1 Biodegradable wastes

    1.2 Non-biodegradable wastes

    1.3 Residual wastes?

2. What is the level of waste management practices of science laboratories of Higher Education Institutions in Davao City in terms of:

    2.1 Handling of laboratory wastes at source

2.2 Storage of laboratory wastes

2.3 Collection of laboratory wastes

2.4 Final Disposal of laboratory wastes?

3. Is there a significant difference in the level of waste management practices when analyzed by type of laboratory?

4. On the basis of the results of the study, what intervention scheme can be designed to enhance the waste management practices of science laboratories of Higher Education Institutions in Davao City?

Hypothesis

This study tested the null hypothesis that there is no significant difference in the level of waste management practices when analyzed by the type of laboratory.

Review of Related Literature

This chapter presents a comprehensive review of books, related studies, official government issuances and other related literature, both from the international scene and from the national and local scenes. This review of related literature is for the purpose of building a comprehensive background of the study and to discover gaps that need to be filled in the study if there were already similar studies conducted earlier.

Waste Management

The Primer on Solid Waste (2007) stated that waste management are various activities involving in wastes such as identification of sources and types of solid waste, examination of the physical and chemical composition of solid waste, determination of solid waste generation rates and the influencing factors involved. This information serves as the basis for the conceptualization and operationalization of a solid waste management system.

Accordingly, sources of waste maybe classified based on land use and or predominant human activities such as infectious waste where waste materials is made up of discarded that may contain infectious or pathogenic agents, culture, blood products, needles and other materials that may cause disease in human. Infectious waste is sometimes referred to as regulated medical waste, biomedical waste, bio hazardous waste and hazardous waste where waste that posess a potential hazard to humans or to other living organism as they contain toxic substances that are non-degradable and persistent in nature. According to the inofrmation from The Environmental Protection Agency (2001) labs that work with microorganism, recombinant DNA technologies, lab animals, human body fluids (blood, urine, feces, tissues, and etc.) or blood borne pathogens are harmful and often require special work environments. These Laboratories must be managed so as to reduce the potential for personnel exposure

produce chemical waste. Typically all laboratories generated small quantities of a wide variety of waste. This characteristic requires careful attention in dealing with laboratory on compliance and on pollution prevention issues In fact, because of this characteristic, a typical method of waste handling was describe such "Lab pack" that was coined years ago by hazardous waste firms in which a number of small containers (i.e. jugs and bottles) of hazardous waste are individually package in a traditional fifty five (55) gallon drum. However, the handling method appears inefficient compared to combining all materials and to encourage mixing different laboratory waste in a single container that makes unwise reasons for safety and legal reasons. Some laboratories according to the Environmental Protection Agency (2001) who handled biologically active substances should consult the standard and guidelines identified above in order to establish an effective biosafety program. An effective biological waste program not only protects workers and the environment, thus it can also lead to cost savings from waste reduction or prevention. Laboratory staff and management should pursue opportunities to use materials with a

lower biohazard level or alternative procedures to reduce the material handling and disposal requirements of the program.

Storing. Stated in the General Laboratory Safety Guide of the University of Western Australia, (2007) that some example of common school laboratory chemical wastes includes mercury, arsenic, various acids (including nitric acid and picric acid) and bases (such as sodium hydroxide and bleach).

The study of Foster et al. (1998) in Chemical Disposal have shown that certain of these chemicals are toxic and can therefore cause health problems if they are not handled and stored properly. Additionally, there are a number of other chemicals whose inherent characteristic make them a reactive hazard or pose similar dangers. In response to increase awareness of the toxic and hazardous properties of certain chemicals, properties that make them less desirable for teaching use and school curricula changed to utilize others, and more acceptable materials. This resulted in an accumulation of unused quantities, of less desirable chemicals on school stockroom shelves. Schools often do not have adequate financial resources to properly dispose of these hazardous chemicals. Many sit on the shelf, becoming more dangerous as they age, or lose their labels, making their ultimate disposal more difficult and costly.

Collecting. Laboratory workers generate waste chemicals and increasingly during the past fifteen years and still been recognized that the ideal solution to the disposal of such wastes is to eliminate their generation at source. Armour (1999) also stated that the school system in general may generate chemical waste from their science laboratories. The hands-on experience with these chemicals has always been and will continue to be a very interesting tool in the teaching of the science subjects but said to be a place of danger because of experience and knowledge that may contribute to a safety and health incident. He also added that most colleges and universities generate hazardous waste and therefore are regulated as hazardous waste generators. Chemicals use in laboratories results in the need for disposal of mixed solvents, reagents, reaction products, and excess chemicals of all types. In addition, a number of other fairly common activities at colleges and universities may result in the generation of hazardous waste.

Waddell (2006) defined hazardous waste as solid, liquid or gas that could pose danger to human health or environment and this hazardous waste is considered as a dangerous waste and it is primarily regulated by the Department of Ecology.

The Republic Act 6969 also known as the Toxic Substances and Hazardous and Nuclear Waste Control Act of 1990 define hazardous waste as substances that are without any safe commercial, industrial,

agricultural or economic usage and are shipped, transported or brought from the country of origin for dumping or disposal into or in transit through any part of the territory of the Philippines. It is also clearly defined that hazardous waste shall also be referred to as by products, side-products, process residues, spent reaction media, contaminated plant or equipment or other substances from manufacturing operations and as consumer discards of manufactured products which present unreasonable risk and or injury to health and safety to environment. Hazardous wastes have potential to affect the environmental quality of all subsets of our environment.

According to the University of Pennsylvania (1995), These hazardous wastes are produced from a wide variety of research, commercial and industrial activities. Hazardous waste are also generated by science research laboratories, undergraduate and graduate science laboratories, medical teaching and research laboratories which have potential to severely affect the environment and human health and can be reduced through waste minimization practices. The total amount of hazardous waste generated in 1995 was 112,400 lbs. and the level of hazardous waste had been basically constant over the last five years. The disposal cost had escalated by about 20% since 1990.

Final Disposal. Benoit (2002) also stated that the school districts of California disposed a large amount of waste; approximately 763,817 tons per year. Accordingly, these school wastes represent a significant loss of natural resources and school districts funds as well as a potential threat to their health and the environment. Teachers, students and administrators are sometimes unaware that chemicals purchased and used as part of daily use in laboratory activities are hazardous waste when discarded and some school laboratories do not even have or maintaining laboratory chemical inventories and often unaware of all the chemicals found in the storage.

Improper management and disposal of these waste can injure the school community including the sanitation workers and can damage septic and sewage systems, which can contaminated soil and ground water supplies, which lead to contaminated drinking water and increase the hazardous air emissions or cause fires and explosion (Waddell, 2006).

The Department of Environment Protection in the State of Connecticut (2006) spelled out that most schools in the states are generators of hazardous waste and are classified either as Conditionally Exempt Small Quantity Generators, or Small Quantity Generators, although over-accumulation of waste can trigger Large Quantity Generators. The differences among these three generation categories are the percentage or weight of hazardous waste that generate per calendar

month. It must be noted that the disposal of any toxic or hazardous material must be in accord with current federal, provincial or state, and local regulations. Disposal on-site may require licensing as a treatment center unless the procedures can be considered as part of the reaction being performed at the bench.

PK Group Standard Operating Protocol in 1999 added some environmental issues occur in the lab such conditions that are dangerous than in any other room. In many labs, though, hazards are present. Laboratory hazards are as varied as the subjects of study in laboratories, and might include poisons; infectious agents; flammable, explosive, or radioactive materials; moving machinery; extreme temperatures; or high voltage. In laboratories where dangerous conditions might exist, safety precautions are important. Rules exist to minimize the individual's risk, and safety equipment is used to protect the lab user from injury or to assist in responding to an emergency

Moreover, to help protect workers from the diversity of chemical hazards in the laboratory, The Occupational Safety and Health Administration known as (OSHA) established the "Laboratory Standard" in 1990. OSHA estimated there are about 35,000 of laboratories in the United States. Given this number, it is probably safe to assume that most states have hundreds of laboratories. Some clinical labs in a hospital were using sharp containers for disposal of most of their biohazardous material. This

was not required by the state. By changing its disposable container, the labs reduced costs in disposing such wastes and the elimination of the unnecessary plastic sharp containers also helped reduce air pollution loading for the on-site incinerator.

Like many other businesses, the laboratory has environmental challenges and opportunities, associated with air quality management, wastewater management and hazardous and waste management. Some examples follow: States like California and Washington and some local municipalities have special lab-based regulations or assistance programs that may also occur elsewhere but these programs are not well publicized however, they often regulate wastewater discharge and may also regulate laboratory fume hood exhaust through a permitting system. The uneven natural patchwork of regulations requires each laboratory situation to be carefully evaluated. Many laboratories perform "sink disposal" of waste materials. Although it is legal in many cases, but this practice is still not necessarily the best environmental management choice. There are two important factors included in the spill and waste disposal procedures. First procedures are listed for individual chemicals in such a way for possible to detail precise conditions and exact quantities of reagent for each chemical to be destroyed. Second, the majority of the procedures were tested in the laboratory for safety to the operator as well as for its reliability, and to check that they met the desired criteria for conversion of the hazardous

material to non-hazardous products. Laboratories may resist also in using recycled materials, especially solvents, in analyses due to concerns about compromising test result quality. Because the results of testing are used to make decisions that often have severe financial or legal consequences for their customers, most labs are typically focused exclusively on quality and may be resistant to material or process changes. Laboratories must always follow standard test methods and therefore cannot easily deviate in procedure or materials. The stockpile samples in the laboratories which may be are hazardous and aged chemicals, until there is no longer sufficient storage space .When this happens, labs may have a "Spring Cleaning" which could temporarily catapult them into generator class and cause unnecessary disposal costs.

Moreover, there are a number of additional concerns about laboratories that people should be aware of. Among the most important are unique health and safety concerns associated with site visits. Visitors should be especially cautious during a lab site visit because special training is often needed to work within a laboratory. Consider, for example, that laboratory workers have the second highest rate of HIV/AIDS infection from occupational exposure among all professions after nurses and the laboratory workers tend to be highly educated compared to other business type of industries. This it would not be unusual to provide assistance to workers with advanced college degrees which some of whom may have

uniquely advanced knowledge of chemicals and reactions. Academic or teaching laboratories provide a special opportunity to provide training. In these labs, students are learning, for the first time, how to deal with chemicals. It is important that they also learn, at the same time, how to handle these materials in a way that does not cause pollution. Environmentally responsible work habits should be learned in an academic laboratory.

Case studies from the Colleges and Universities in New England (2003) cited some of the best management practices of waste management like for example; they have adopted the theme of "Reduce, Re-use and Recycle" in order to improve their environmental impact in their communities. Other institution have also added "prevention and conservation" to their programs by reducing the amount of any hazardous substance used or generated through process change, product substitution, micro scale chemistry, or other means possible. They encouraged new purchases that favor affordably priced local and renewable products. They also reduced their waste in public landfills by using all reasonable efforts to purchase reusable and recyclable products when available, collecting usable materials for donation and yard sales, raising students awareness on their consumption habits, and providing students with reusable items in the fall to set up their dorm rooms. Other waste management practices adopted were increasing efficiency in the

use of raw materials, energy, water, or other resources and protecting natural resources through conservation

Moreover, many school districts have already been successful in improving their economic and environmental performance through the implementation of waste reduction initiatives. In 1998, the Department of Ecology in their article" How to Make Waste Reduction and Recycling Happen in your School" published in July 2006, which stated that school districts and individual schools have developed policies for implementation of waste reduction and recycling program. Incorporating waste reduction as part of the school districts over all way of doing business can provide a number of important benefits such as reduced disposal costs, improved worker safety and reduced long-term liability. Increasing efficiency of school operations, decreases associated purchasing cost. The reduction program also fostered student achievement by transforming the school environment into a laboratory for learning and providing numerous opportunities for investigation through environment-base education. Everyone associated with the science laboratory share a legal and moral responsibility to minimize the amount of waste produce and to dispose of chemical waste in a way that has the least impact on the environment. It also noted that some waste must be professionally incinerated depending on what is contained in the waste or may it deposited in the designated

landfills, while other waste can be neutralized or discharge in normal streams.

Howe and Disinger (1995) pointed out that a school environmental program should have waste disposal policies that consider conservation, waste reduction and pollution control. A school can provide an excellent model for families by developing procedures to reduce waste and to recycle or compost as such material as possible. Common materials used in school that can be recycled include paper products, glass, plastic materials and aluminum and mixed metallic cans. Materials that can be composted include yard waste and food waste.

Policies should also be established for disposal of materials that can not be composted or recycled. Chemicals, paints, solvent, oil, batteries and other items containing hazardous materials should be removed by approved methods. If a community does not have a program for handling hazardous wastes, a good school activity is to work with community officials to establish a program. Yard waste and other materials can be used for composting. As a standard practice, the school undertakes garbage segregation.

The campus should provide separate bins for biodegradable materials and non biodegradable items with the necessary information relayed to all members of the school community (Soriano, 1995). Recycling of waste is one of the easiest environmental initiatives to

implement but most schools do not have a program in place. Schools can generate a large amount of waste because of their numerous activities and large populations. The combinations of lots of activities generate a greater quantity and variety of pollutants and wastes that, if mismanaged, can be potentially harmful to human health and the environment.

The Alabama Department of Environment Management (2002) added some suggested practices to reduce the risks associated with school laboratories, these are: Inventory the school laboratory and storage areas, Disposal of all unlabelled, outdated and high-hazard chemicals, Eliminate the use of high-hazard chemicals, Include a line item in the school budget for hazardous waste disposal and Investigate curricula that emphasize micro scale techniques.

All these literatures point to a common imperative that Science Laboratories in schools generate considerable amount of wastes. Thus, the need to set up a sustainable waste management system to address this concern in order to protect the health of their users and preserve the quality of the environment. This research study provides information for the bench workers to properly dispose of their laboratory waste and surplus chemicals charged with the responsibility of sound waste management. Not only that this should make it easier for a school community to comply with both legal and moral obligations in managing their waste, it also allow them to develop a plan of action for emergencies in the school laboratory.

As a staff in a science laboratory herself, the researcher shares the burden and the imperative to act. She feels that the time to act is NOW.

Theoretical and Conceptual Framework

This study is anchored on the theory of Pongràcz et al. (2004) which states that "Waste Management is to prevent waste causing harm to human health and the environment and application of waste management leads to conservation of resources by combining waste minimization and optimization measures to ensure that resources are effectively circulated within the ecosystem". This is also supported by the Agenda 21 of the Rio de Janeiro Declaration on Environmental Development which states that "environmentally sound waste management must go beyond the mere safe disposal or recovery of waste that are generated and seek to address the root cause of the problem by attempting to change unsustainable patterns of production and consumption".

The results in this study served as basis in the formulation of the intervention scheme in the different science laboratories as a precautionary approach to the current waste management practices. This will also ensure actions and ultimately bring about change after knowing the present state or the extent of the environment protection program of a certain entity or organization. The intervention scheme of waste management practices will provide feedback to the school management on

management practices as the input of the independent variable of the

study which has four components namely; Handling which refers to handling the waste in the science laboratory, Storage, this indicator refers to the way the science laboratory operations is storing its waste. For collection, this indicator refers to the waste collection process in the science laboratories; and Final disposal, refers to the ways and means in over-all disposal of the laboratory waste in the science laboratories. The four components of the waste management practices are the basis for formulating the intervention scheme which is the output of the study. The moderating variables are the type of school laboratories. They are Biology Laboratory and Chemistry Laboratory.

Significance of the Study

The results of the study could be beneficial to the following:

DENR Personnel. Findings of This study could serve as basis for the DENR officials to look into how the academic laboratory waste are disposed by the different schools and universities in the city and would see to it that any manner of disposing such waste adopted by the school may have harmful effects to the environment.

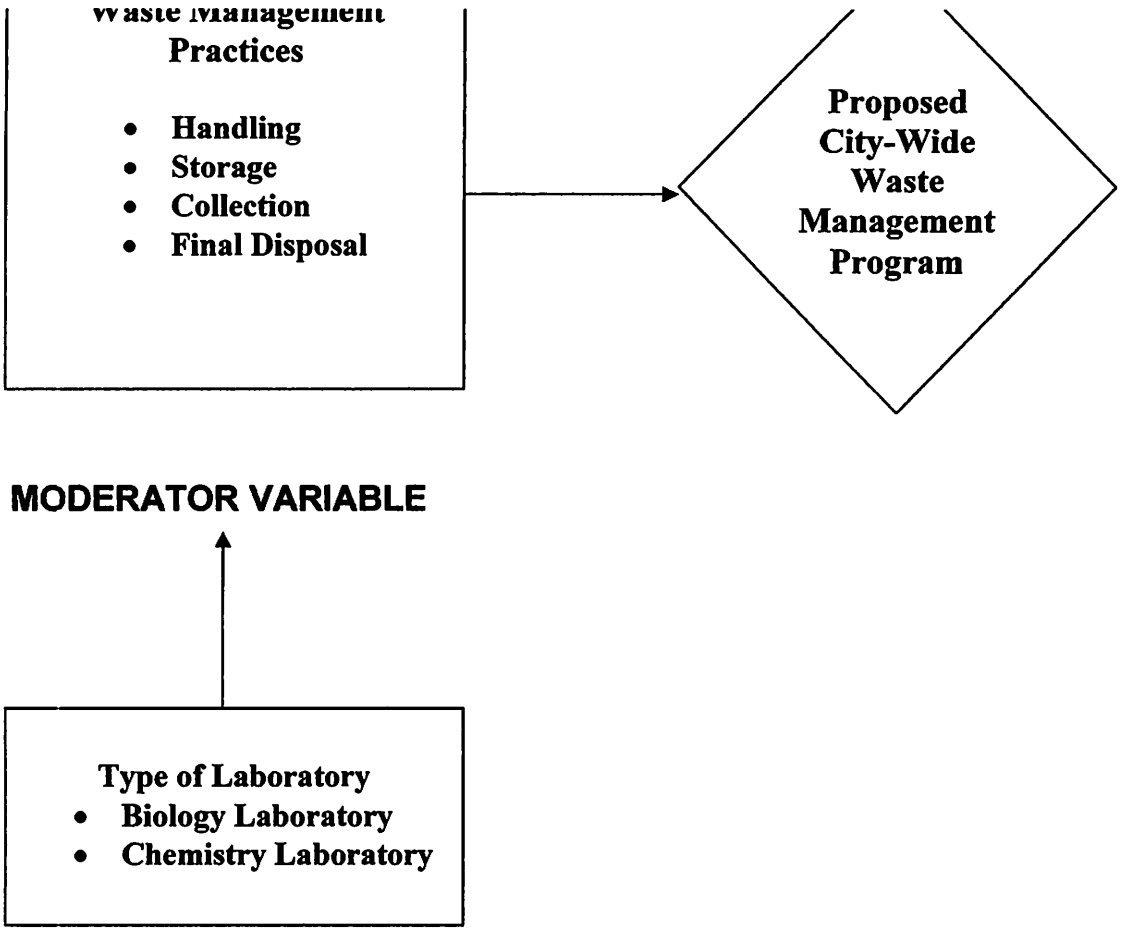

Figure 1. Conceptual Framework of the Study

School Administrators. The results of the study could be as an eye-opener for them and share the responsibility of addressing the problem on waste management in their science laboratories.

Science/Chemistry Teachers and Laboratory Staff. The results of this study could generate consciousness on their part on the importance of taking care of their laboratory wastes and create in their minds a desire for the implementation of a waste management system that will create a safe and environment-friendly science laboratory in their school.

Students. This study could be beneficial for them through the safety measures and effective management of chemicals stored for use in laboratory classes.

Definition of Terms

To have a common frame of reference, the key terms used in the study are operationally defined as follows:

Waste Management Practices. This refers to the discipline associated with control of generation, storage, collection, transfer and transport, processing, and disposal of wastes in a manner that is in accordance with the best principles of public health, economics, engineering, conservation, aesthetics, and other environmental consideration, and that is also responsive to public attitudes.

refers also to a place to be surveyed, having 2 main types: Biology Laboratory and Chemistry Laboratory

Higher Education Institutions. This refers to the post secondary schooling, which is higher education leading to a degree in a specific profession or discipline.

Enhancement Program. This refers to a list of activities set to be undertaken in order to improve a current situation. As used in this study, it refers to a list of proposed activities designed to improve or raise the level of waste management practices of science laboratories in Higher Education Institutions in Davao City.

research instrument, data gathering procedure, and statistical treatment of the data.

Research Design

This study used the descriptive method of research. Walpole. (1999) stated that this type of research "involves processes or techniques that are concerned with the collection, organization, presentation, computation, and interpretation of data thereby giving information, or describing the sample under study". This method was deemed appropriate for the study because the research aimed to determine the existing waste management practices in science laboratories of Higher Education Institutions (HEIs) in Davao City. Moreover, the appropriateness of this method for the study is supported by Aquino (1999) who states that "the descriptive method attempts to "describe systematically a situation or area of interest factually and accurately".

Research Subjects

The respondents of the study were senior college students who were enrolled in laboratory courses. Out of the estimated 3,000 senior

students currently enrolled in laboratory courses in HEIs in Davao City, a sample of 300 were randomly selected from 18 HEIs in Davao City. The distribution of the respondent students is presented in Table 1.

Quota sampling was used in apportioning the respondents by school. A total of 15 respondents was allotted for each HEI. However, St. Augustine College, which is a relatively small school, returned only 10 accomplished questionnaires. This was then compensated by increasing the allotment in the bigger HEIs like UP-Mindanao, University of Mindanao and Brokenshire College.

The study intended to cover all of the HEIs Davao City. Some schools, however, did not fully cooperate and the questionnaires that were distributed were not returned.

The study was conducted during the period November-December 2007.

Table 1

Distribution of Respondents of the Study

Name of Higher Education Institution	Number of Respondents
1. Ateneo de Davao University	15
2. Assumption College	15
3. Brokenshire College	30
4. Davao Doctors College	15
5. Davao Medical School Foundation	15
6. Davao Merchant Marine Academy	15
7. Holy Child College	15
8. Holy Cross of Davao College	15
9. John Paul College	15
10. Mindanao Medical School Foundation	15
11. Philippine Women's College	15
12. Rizal Memorial Colleges	15
13. St. Augustine College	10
1.4 San Pedro College	15
15. University of the Immaculate Conception	15
16. University of Mindanao	20
17. University of the Philippines – Mindanao	30
18. University of Southeastern Philippines	15
TOTAL	300

Research Instrument

A validated questionnaire was used in the gathering of data. The questionnaire was patterned from the Rhode Island University-Assessment Questionnaire which was used in assessing the status of waste management practices in science laboratories in that State. The questionnaire was submitted first to the adviser for comments and suggestions for refinement. Then a group of experts were asked to validate the questionnaire namely: Dr. Eugenio S. Guhao, Senior Vice-President for Academic Affairs and Dean of Graduate School, Professor Ramon M. Barbon, University Professor I of the Graduate School, University of Mindanao, Dr. Marciano B. Melchor, Dean of College of Arts and Sciences of the University of Mindanao, Dr. Gloria P. Gempes, University Professor II of the University of Mindanao, and Mr. Martin T. Obrero, MPA, Supervising Environment Management Specialist II, City Environment and Natural Office, Davao City. The comments and suggestions of the cited experts were incorporated in the revised questionnaire. The consolidated results from the experts validators an average weighted mean of 4.24 which has a descriptive rating of Very Good. This shown in Appendix F. The Survey Questionnaire is structured into two parts: Part I deals with the profile of wastes being generated in the science laboratories and Part II

deals with the level of waste management practices measured in terms of handling, storage, collection and final disposal.

The scoring guide in the analysis of the Profile of waste being generated are as follows:

1 – Less than 1 kilogram per week
2 – Between 1-2 kilograms per week
3 – Between 2-3 kilograms per week
4 – Between 3-4 kilograms per week
5 – More than 4 kilograms per week

In Evaluating the Level of Waste Management Practices, The following scale was used.

Scorces	**Level**	**Interpretation**
4.50 – 5.00	Very High Level	This indicates that the waste management practices is done almost all the time.
3.50 – 4.49	High	This indicates that the waste management practices is done most all the time.
2.50 – 3.49	Moderate Level	This indicates that the waste management practices is done sometimes..
1.50 – 2.59	Low Level	This indicates that the waste management practices is done occasionally.
1.00 – 1.49	Very Low Level	This indicates that the waste management practices is rarely done.

Data Gathering Procedure

The researcher observed the following steps in the gathering of data:

1. **Asking permission to conduct the study**. The researcher sent a letter seeking permission from the school heads of the selected HEI`s in Davao City to conduct the study in their respective laboratories using some of their science students as respondents.

2. **Hired two research aides.** This was done because the researcher is working and she could not leave her job to gather data for her research. The two hired aides were then oriented on the conduct of the study and how to administer and retrieve the questionnaire.

3. **Administration and Retrieval of the Questionnaire.** The researcher handed over the copies of the questionnaire to the hired aides and sent them to the HEIs which were pre-listed for their respective assignments. They were specifically instructed on the distribution of questionnaire and oriented the respondent students on how to accomplish the Questionnaire and then make arrangements as to when they could come back to retrieve them. The second trip of the aides was to retrieve the accomplished Questionnaires.

4. Analysis and Interpretation. The gathered data through the questionnaire were scored, recorded and classified with the guidance of

the statistician. The results were analyzed and interpreted based on the purpose of the study.

Statistical Treatment of the Data

The following statistical tools were used in the computation of data testing the hypothesis at a = 0.05 level of significance.

Mean. This was used to determine the level of waste management practices in answer to sub-problem 1.

For the profile of wastes being generated by the subject science laboratories, the obtained mean scores were converted to their respective equivalent in kilograms per week using a Table of Equivalent (Appendix G)

T-test. This was used to determine the significant difference in the level of waste management practices when analyzed by the type of school laboratory, the biology and chemistry laboratory.

Chapter 3

PRESENTATION AND ANALYSIS OF FINDINGS

This chapter presents the data gathered for the study, the statistical analyses made and the corresponding interpretations of the results. The discussions proceed in the order of the statement of the sub-problems.

Profile of Wastes Being Generated by Science Laboratories of Higher Education Institutions in Davao City

The results of the survey on the profile of wastes generated by science laboratories of Higher Education Institutions (HEIs) in Davao City are presented in Table 2. As shown, science laboratories of HEIs in Davao City generate an average total of 63.8 kilograms of laboratory wastes per week. Of this total, 32.8 kilograms come from the biology laboratory and 31.0 kilograms from the chemistry laboratory.

As to type of wastes being generated, *Biodegradable wastes* account for 21.9 kilograms per week, with 12.0 kilograms coming from the biology laboratory and 9.9 kilograms from the chemistry laboratory. This quantity is further broken down into: 5.0 kilograms of waste papers; 4.1 kilograms of animal specimens; 4.2 kilograms of plant part specimens; 4.5 kilograms of unsoiled tissue papers; and 4.1 kilograms of other miscellaneous wastes.

Table 2

Profile of Wastes Generated by Science Laboratories of Higher Education Institutions in Davao City

Type of Wastes Generated	Biology Laboratory	Chemistry Laboratory	TOTAL
	Kg/week	Kg/week	**Kg/wk**
A. Biodegradable Wastes			
1. Waste papers	2.6	2.4	**5.0**
2. Animal specimens	2.4	1.7	**4.1**
3. Plant part specimens	2.4	1.8	**4.2**
4. Unsoiled tissue papers	2.3	2.2	**4.5**
5. Other miscellaneous wastes	2.3	1.8	**4.1**
Sub-Total	**12.0**	**9.9**	**21.9**
B. Non-Biodegradable Wastes			
1. Broken glasses (all kinds)	2.2	2.4	**4.6**
2. Microscopic slides & cover slips	2.4	2.2	**4.6**
3. Disposable gloves, Masks, etc.	2.5	2.8	**5.3**
4. All kinds of sharp objects	2.5	2.2	**4.7**
5. Plastics (all kinds)	1.8	1.8	**3.6**
Sub-Total	**11.4**	**11.4**	**22.8**
C. Residual Wastes			
1. Aerosol cans, gas cylinders, etc.	1.8	2.0	**3.8**
2. Discarded batteries	1.6	1.8	**3.4**
3. Hazardous & flammable Materials	1.9	2.1	**4.0**
4. Microbiological wastes (i. e. culture media, broth cultures, etc)	2.1	1.7	**3.8**
5. Liquid wastes classified as non-hazardous Materials (i. e. water soluble indicators, etc.)	2.0	2.1	**4.1**
Sub-Total	**9.4**	**9.7**	**19.1**
TOTAL	**32.8**	**31.0**	**63.8**

On the other hand, *Non-biodegradable wastes* account for 22.8 kilograms per week, split equally at 11.4 kilograms per week each from the biology and chemistry laboratories. The wastes being generated under this waste category are: broken glasses of all kinds – 4.6 kilograms per week; microscopic slides and cover slips – 4.6 kilograms per week; disposable gloves, masks, etc. – 5.3 kilograms per week; all kinds of sharp objects – 4.7 kilograms per week; and all kinds of plastics – 3.6 kilograms per week.

Finally, *Residual wastes* are generated at the rate of 19.1 kilograms per week, with biology laboratory contributing 9.4 kilograms per week and chemistry laboratory contributing 9.7 kilograms per week. The wastes being generated under this category are: aerosol cans, gas cylinders, etc. – 3.8 kilograms per week; discarded batteries – 3.4 kilograms per week; hazardous and flammable materials – 4.0 kilograms per week; microbiological wastes, such as culture media, broth cultures, etc. – 3.8 kilograms per week; and liquid wastes classified as non-hazardous materials, such as water soluble indicators, oil-base re-agents, etc. – 4.1 kilograms per week.

Translating the total figure to annual basis, the result would show that the science laboratory of an HEI in Davao City generates an average of 3,317.6 kilograms or about 3.32 tons of laboratory wastes per annum, with biology laboratory accounting for 1.71 tons per annum and chemistry

laboratory accounting for 1.61 tons per annum. This means a lot of wastes that need to be taken cared of. This implies that HEIs in Davao City need good waste management to cope with the amount of wastes generated by their science laboratories.

Level of Waste Management Practices in Science Laboratories

This section presents and discusses the results of analyses of data on the level of waste management practices of science laboratories of Higher Education Institutions (HEIs) in Davao City. The discussions focus on the four indicators of waste management, namely handling, collection, storage and final disposal.

Handling of Laboratory Wastes at Source. The level of waste management practices in science laboratories of HEIs in Davao City in terms of Handling of Laboratory Wastes at Source is presented in Table 3. The results of analysis show that the overall mean for handling of laboratory wastes at source is 3.41, with a descriptive equivalent of *Moderate level*. This means that the practice of handling of laboratory wastes at source is only done sometimes. This implies that proper handling of wastes in science laboratories is not regularly observed. Analyzing data by type of laboratory, results show that Biology Laboratory obtained an overall mean rating of 3.45, described as moderate. This means that the practice of handling of wastes in biology laboratories is only

Table 3

Level of Waste Management Practices in Science Laboratories in Terms of Handling Laboratory Wastes at Source

Item	Biology Laboratory		Chemistry Laboratory		Overall	
	Mean	DE	Mean	DE	Mean	DE
1. Waste removal at source	3.52	H	3.51	H	**3.52**	**H**
2. Waste segregation at source	3.55	H	3.41	M	**3.48**	**M**
3. Segregated wastes are place in color-coded containers	3.46	M	3.24	M	**3.35**	**M**
4.Waste handlers are properly trained for handling laboratory wastes	3.33	M	3.38	M	**3.36**	**M**
5. Waste handlers use proper protective equipment	3.39	M	3.32	M	**3.36**	**M**
Overall	**3.45**	**M**	**3.37**	**M**	**3.41**	**M**

DE – Descriptive Equivalent

done sometimes. This implies that proper handling of wastes is not regularly observed in biology laboratories. Data also show that Chemistry Laboratory obtained an overall mean rating of 3.37, with a descriptive equivalent of moderate.This means that the practice of handling of wastes in chemistry laboratories is done only sometimes. This implies that proper handling of wastes is not regularly observed in the chemistry laboratories. This further implies that the chemistry laboratory could have been messy at times.

Narrowing down the analysis to specific items on handling of laboratory wastes at source, it can be gleaned that waste removal at source obtained an overall mean rating of 3.52, or High. This means that the practice of removal oflaboratory wastes at source is done most of the time. This implies that science laboratories are regularly cleaned of wastes after using them. By type of laboratory, data show that Biology Laboratory obtained a mean of 3.52, with a descriptive equivalent of high level. This means that the practice of waste removal in biology laboratories is done most of the time. This implies that biology laboratories are regularly cleaned of wastes after using them. On the other hand, Chemistry Laboratory obtained a mean rating of 3.51, describe as High. This means that the practice of waste removal in chemistry laboratories is also done most of the time. This implies that chemistry laboratories are also regularly cleaned of wastes after using them.

On the item of waste segregation at source, the overall mean is 3.48 with a equivalent descriptive of moderate. This means that the practice of segregation of waste at source in the laboratories is only done sometimes. This implies that proper segregation of wastes is not regularly observed in these laboratories. By type of laboratory, the results of analysis show that Biology Laboratory obtained a mean of 3.55, with a descriptive equivalent of high. This means that the practice of waste segregation in biology laboratories is done most of the time. This implies that laboratory wastes in biology laboratories are regularly segregated properly before placing them in the storage facility. In the case of the Chemistry Laboratory the mean obtained is 3.41, rated *Moderate level*. This means that the practice of waste segregation in chemistry laboratories is only done sometimes. This implies that wastes in chemistry laboratories are not regularly segregated properly before storing them in storage facilities.

Moving on to the item on placing of segregated wastes in color-coded containers, data show that the overall mean is 3.35, with a descriptive equivalent of moderate. This means that the practice of placing segregated wastes in color-coded containers in the laboratories is only done sometimes. This implies that the use of color-coded containers for segregated wastes is not regularly observed in these laboratories. By type of laboratory, the results of analysis show that Biology Laboratory obtained a mean rating of 3.46 with a descriptive equivalent moderate

level. This means that the practice of placing segregated wastes in color-coded containers in the biology laboratories is only done sometimes. This implies that the use of color-coded containers for segregated wastes is not regularly observed in the biology laboratories. For the Chemistry Laboratory, the mean rating obtained is 3.24 or moderate. This means that the practice of placing segregated wastes in color-coded containers in the chemistry laboratories is only done sometimes. This implies that the use of color-coded containers for segregated wastes is not regularly observed in the chemistry laboratories.

Moving further to the item on waste handlers' training for handling wastes, results of analyses show that the overall mean rating is 3.36, or moderate. This means that the training of waste handlers for handling wastes was only done sometimes. This implies that the training of waste handlers was not regularly observed in these laboratories. By type of laboratory, the results of analysis show that Biology Laboratory obtained a mean rating of 3.33, with a descriptive equivalent of moderate. This means that the training of waste handlers for handling wastes was only done sometimes. This implies that the training of waste handlers was not regularly observed in the biology laboratories. Chemistry Laboratory, on the other hand, obtained a mean rating 3.36, or moderate. This means that the training of waste handlers for handling wastes was only done

sometimes. This implies that the training of waste handlers was not regularly observed in the chemistry laboratories.

Lastly, on the item of waste handlers' use of proper protective equipment, the overall mean rating is 3.36, or moderate. This means that waste handlers use protective equipment only sometimes. This implies that proper use of protective equipment was not regularly observed in these laboratories. By type of laboratory, the results show that Biology Laboratory obtained a mean rating of 3.39, or moderate. This means that waste handlers in the biology laboratories use protective equipment only sometimes while handling laboratory wastes. This implies that the proper use of protective equipment was not regularly observed in the biology laboratories. On the other hand, Chemistry Laboratory obtained a mean rating of 3.32, or moderate. This means that waste handlers in chemistry laboratories use protective equipment only sometimes. This implies that the proper use of protective equipment was not regularly observed in the chemistry laboratories.

Storage of Laboratory Wastes. In terms of storage of laboratory wastes, the results of analyses are presented in Table 4. As shown, the overall mean for storage of laboratory wastes is 3.36, with a descriptive equivalent of moderate. This means that the practice of proper storage of laboratory wastes is only done sometimes. This implies that proper storage of wastes is not regularly observed in the science laboratories.

Analyzing data by type of laboratory, results show that Biology Laboratory obtained an overall mean of 3.37, describe as moderate. This means that the practice of proper storage of laboratory wastes is only done sometimes. This implies that proper storage of wastes is not regularly observed in the biology laboratories. In the case of the Chemistry Laboratory, the obtained mean is 3.34, or moderate. This means that the practice of proper storage of laboratory wastes is only done sometimes. This implies that proper storage of wastes is not regularly observed in the chemistry laboratories.

Going deeper in the analysis of data, results show that on the item of pre-treatment of smelly or obnoxious wastes before storage, the obtained mean is 3.33, with a descriptive equivalent of moderate. This means that the practice of pre-treatment of smelly or obnoxious before storage is only done sometimes. This implies that pre-treatment of smelly or obnoxious before storage is not regularly observed in these laboratories. By type of laboratory, the results of analysis show that Biology Laboratory obtained a mean rating of 3.33 with a descriptive equivalent of high. This means that the practice of pre-treatment of smelly or obnoxious wastes before storage is done only sometimes. This implies that laboratory wastes in biology laboratories are not regularly pre-treated properly before placing them in the storage facility.

Table 4

Level of Waste Management Practices in Science Laboratories in Terms of Storage of Laboratory Wastes

Item	Biology Laboratory		Chemistry Laboratory		Overall	
	Mean	DE	Mean	DE	Mean	DE
1. Smelly or obnoxious wastes are pre-treated prior to storage	3.33	M	3.33	M	**3.33**	**M**
2. Pre-treated wastes are placed in sealed containers	3.42	M	3.33	M	**3.38**	**M**
3. waste containers are stored in a secured room	3.40	M	3.31	M	**3.36**	**M**
4. Storage room area has adequate space	3.32	M	3.40	M	**3.36**	**M**
5. Storage area has adequate security provisions	3.39	M	3.32	M	**3.36**	**M**
Overall	**3.37**	**M**	**3.34**	**M**	**3.36**	**M**

For the Chemistry Laboratory the mean rating obtained is also 3.33, or moderate. This means that the practice of pre-treatment of smelly or obnoxious waste before storage is done only sometimes. This implies that laboratory wastes in chemistry laboratories are not regularly pre-treated properly before placing them in the storage facility.

With regards to the item on placing pre-treated wastes in sealed containers, data show that the overall mean is 3.38, rated as moderate. This means that the practice of placing pre-treated wastes in sealed containers is only done sometimes. This implies that placing pre-treated wastes in sealed containers is not regularly observed in these laboratories. By type of laboratory, the results of analysis show that Biology Laboratory obtained a mean of 3.42, with a descriptive equivalent of moderate. This means that the practice of placing pre-treated wastes in sealed containers is only done sometimes. This implies that placing pre-treated wastes in sealed containers is not regularly observed in the biology laboratories. As far as the Chemistry Laboratory is concerned, the mean rating obtained is 3.33, or moderate. This means that the practice of placing pre-treated wastes in sealed containers is only done sometimes. This implies that placing pre-treated wastes in sealed containers is not regularly observed in the chemistry laboratories. Moving over to the item on storage of waste containers in a secured room, results of analyses show that the overall mean is 3.38, rated moderate. This means that the practice of storing

waste containers in a secured room is only done sometimes. This implies that storing waste containers in a secured room is not regularly observed in these laboratories. By type of laboratory, the results show that Biology Laboratory obtained a mean rating of 3.40, with a descriptive equivalent of moderate. This means that the practice of storing waste containers in a secured room is only done sometimes. This implies that storing waste containers in a secured room is not regularly observed in the biology laboratories. As for the Chemistry Laboratory, the mean rating obtained is 3.31, or moderate. This means that the practice of storing waste containers in a secured room is only done sometimes. This implies that storing waste containers in a secured room is not regularly observed in the chemistry laboratories.

For the item on adequacy of space of storage room area, the overall mean rating is 3.36, or moderate. This means that the practice of having adequate space for storage room area is only done sometimes. This implies that the storage space for wastes in the laboratories is just barely adequate. By type of laboratory, the results of analysis show that Biology Laboratory obtained a mean of 3.32, with a descriptive equivalent of moderate. This means that the practice of having adequate space for storage room area is only done sometimes. This implies that the storage space for wastes in the biology laboratories is just barely adequate. Chemistry Laboratory, on the other hand, obtained a mean 3.40, rated as

moderate. This means that the practice of having adequate space for storage room area is only done sometimes. This implies that the storage space for wastes in the chemistry laboratories is just barely adequate.

Finally, on the item of adequate security provisions for the storage area, the overall mean rating is 3.36 describe as moderate. This means that the practice of providing adequate security provisions for the waste storage area is only done sometimes. This implies that the provision of security for the waste storage area in the laboratories is just barely adequate. By type of laboratory, the results of analysis show that Biology Laboratory obtained a mean of 3.39, with a descriptive equivalent of moderate. This means that the practice of providing adequate security provisions for the waste storage area is only done sometimes. This implies that the provision of security for the waste storage area in the biology laboratories is just barely adequate. In the case of the Chemistry Laboratory, the obtained mean is 3.32, rated as moderate. This means that the practice of providing adequate security provisions for the waste storage area is only done sometimes. This implies that the provision of security for the waste storage area in the chemistry laboratories is just barely adequate.

Collection of Laboratory Wastes. In terms of Handling of Collection of Laboratory Wastes, the results of data analyses are presented in Table 5. The results of analysis show that the overall mean

Table 5

Level of Waste Management Practices in Science Laboratories in Terms of Collection of Laboratory Wastes

Item	Biology Laboratory		Chemistry Laboratory		Overall	
	Mean	DE	Mean	DE	Mean	DE
1. Collection of wastes at source uses proper equipment	3.18	M	3.09	M	**3.14**	**M**
2. Collection of wastes at source observes prescribed proper procedure	3.30	M	3.17	M	**3.24**	**M**
3. Transport vehicle to final disposal is provided with protective cover	3.18	M	3.06	M	**3.12**	**M**
4. Waste storage area is accessible to transport vehicle	3.16	M	3.18	M	**3.17**	**M**
5. Collection of wastes for final disposal is properly coordinated with CENRO	3.24	M	3.18	M	**3.21**	**M**
Overall	**3.21**	**M**	**3.14**	**M**	**3.18**	**M**

for handling of laboratory wastes at source is 3.18, with a descriptive equivalent of moderate. This means that the practice of collection of laboratory wastes is only done sometimes. This implies that proper collection of wastes in science laboratories is not regularly observed.

Analyzing data by type of laboratory, results show that Biology Laboratory obtained an overall mean of 3.21 or moderate. This means that the practice of proper collection of wastes in biology laboratories is only done sometimes. This implies that proper collection of wastes is not regularly observed in biology laboratories. Data also show that Chemistry Laboratory obtained an overall mean of 3.21, with a descriptive equivalent of moderate. This means that the practice of proper collection of wastes in chemistry laboratories is only done sometimes. This implies that proper collection of wastes is not regularly observed in chemistry laboratories.

Narrowing down the analysis to specific items on collection of laboratory wastes, data show that the use of proper equipment in the collection of wastes at source obtained an overall mean of 3.14, described as rated moderate. This means that the practice of using proper equipment in the collection of laboratory wastes is only done sometimes. This implies that the use of proper equipment is not regularly observed in the science laboratories. By type of laboratory, data show that biology Laboratory got a mean rating of 3.18, with a descriptive equivalent of moderate. This means that the practice of using proper equipment in the collection of laboratory

wastes is only done sometimes. This implies that the use of proper equipment is not regularly observed in the biology laboratories. For the Chemistry Laboratory, the obtained mean is 3.09, or moderate. This means that the practice of using proper equipment in the collection of laboratory wastes is only done sometimes. This implies that the use of proper equipment is also not regularly observed in the chemistry laboratories.

On the item on the use of proper procedure in the collection of laboratory wastes at source, the overall mean obtained is 3.24, rated moderate. This means that the practice of using proper procedure in the collection of laboratory wastes at source is only done sometimes. This implies that science laboratories do not regularly use proper procedure in the collection of laboratory wastes. Analyzing the data by type of laboratory, the results show that Biology Laboratory obtained a mean of 3.30, with a descriptive equivalent of moderate. This means that the practice of using proper procedure in the collection of laboratory wastes at source is done most of the time. This implies that biology laboratories do not regularly use proper procedure in the collection of laboratory wastes. Moving over to the Chemistry Laboratory, the obtained mean is 3.17, rated as moderate. This means that the practice of using proper procedure in the collection of laboratory wastes at source is done most of the time. This

implies that chemistry laboratories also do not regularly use proper procedure in the collection of laboratory wastes.

As regards to the item on provision of protective cover for the transport vehicle of wastes towards final disposal, the overall mean rating is 3.12, or moderate. This means that the practice of providing protective cover to the vehicle transporting wastes to final disposal is only done sometimes. This implies that science laboratories do not regularly provide protective cover to the vehicle transporting wastes to final disposal. Analyzing the results by type of laboratory, biology Laboratory got a mean of 3.18, with a descriptive equivalent of moderate. This means that the practice of providing protective cover to the vehicle transporting wastes to final disposal is only done sometimes. This implies that biology laboratories do not regularly provide protective cover to the vehicle transporting wastes to final disposal. In the case of the Chemistry Laboratory, the obtained mean is 3.51, described as moderate. This means that the practice of providing protective cover to the vehicle transporting wastes to final disposal is only done sometimes. This implies that chemistry laboratories also do not regularly provide protective cover to the vehicle transporting wastes to final disposal.

On the item of accessibility of waste storage to transport vehicle, the overall mean is 3.17, with a descriptive equivalent of moderate. This means that the practice of making the waste storage area accessible to

transport vehicle is only done sometimes. This implies that the science laboratories do not regularly make the storage area of laboratory wastes accessible to transport vehicle.

By type of laboratory, the results show that Biology Laboratory obtained a mean rating of 3.16, or moderate. This means that the practice of making the waste storage area accessible to transport vehicle is only done sometimes. This implies that the biology laboratories do not regularly make the storage area of laboratory wastes accessible to transport vehicle. For the Chemistry Laboratory, the mean rating is 3.17, or moderate. This means that the practice of making the waste storage area accessible to transport vehicle is only done sometimes. This implies that the chemistry laboratories also do not regularly make the storage area of laboratory wastes accessible to transport vehicle.

Lastly, on the item of proper coordination with CENRO in the collection of wastes for final disposal, the overall mean is 3.21, with a descriptive equivalent of moderate. This means that the practice of proper coordination with CENRO in the collection of wastes for final disposal is only done sometimes. This implies that the science laboratories do not regularly coordinate with CENRO in the collection of wastes for final disposal. By type of laboratory, the results show that Biology Laboratory obtained a mean of 3.24, or moderate. This means that the practice of proper coordination with CENRO in the collection of wastes for final

disposal is only done sometimes. This implies that the biology laboratories do not regularly coordinate with CENRO in the collection of wastes for final disposal In the case of the Chemistry Laboratory, the mean obtained is 3.17, or moderate. This means that the practice of proper coordination with CENRO in the collection of wastes for final disposal is only done sometimes. This implies that the chemistry laboratories also do not regularly coordinate with CENRO in the collection of wastes for final disposal.

Final Disposal of Laboratory Wastes. In terms of storage of final disposal of laboratory wastes, the results of analyses are presented in Table 6. As shown, the overall mean for the practice of final disposal of laboratory wastes is 2.64, with a descriptive equivalent of moderate. This means that the practice of final disposal of laboratory wastes is only done sometimes. This implies that the storage area of wastes in the science laboratories is not regularly emptied of stored laboratory wastes. Analyzing data by type of laboratory, results show that Biology Laboratory obtained an overall mean of 2.65, or moderate. This means that the practice of final disposal of laboratory wastes is only done sometimes. This implies that the storage area of wastes in the biology laboratories is not regularly emptied of stored laboratory wastes. For the Chemistry Laboratory, the obtained mean is 2.62, described as moderate. This means that the practice of final disposal of laboratory wastes is only done sometimes.

Table 6

Level of Waste Management Practices in Science Laboratories in Terms of Final Disposal of Laboratory Wastes

Item	Biology Laboratory		Chemistry Laboratory		Overall	
	Mean	DE	Mean	DE	Mean	DE
1. Through septic vault	2.93	M	2.84	M	**2.88**	**M**
2. Through an incineration facility	2.44	M	2.38	M	**2.41**	**M**
3. Through open burning	2.51	M	2.51	M	**2.51**	**M**
4.Through burying/composting	2.69	M	2.69	M	**2.69**	**M**
5. Through other means other than the above	2.69	M	2.69	M	**2.69**	**M**
Overall	**2.65**	**M**	**2.62**	**M**	**2.64**	**M**

This implies that the storage area of wastes in the chemistry laboratories is also not regularly emptied of stored laboratory wastes.

Results of analyses of data by item show that the practice of disposing laboratory wastes through septic vault got a mean of 2.88, or moderate. This implies that the science laboratories have some other means of disposal of their laboratory wastes. Analyzing by type of laboratory, Biology Laboratory obtained an overall mean of 2.93, described as moderate. This means that the practice of disposing laboratory wastes by septic vault in the biology laboratories is only done sometimes. This implies that the biology laboratories have some other forms of disposal of their laboratory wastes. In the case of the Chemistry Laboratory the overall mean obtained is 2.84, or moderate. This means that the practice of disposing laboratory wastes by septic vault in the chemistry laboratories is only done sometimes. This implies that the chemistry laboratories have some other forms of disposal of their laboratory wastes.

Moving on to the item on disposal through an incineration facility, the overall mean obtained is 2.41, described as moderate. This means that the practice of disposing laboratory wastes through an incineration facility is only done sometimes. This implies that the science laboratories have some other forms of disposal of their laboratory wastes. By type of laboratory, Biology Laboratory obtained a mean of 2.44, or moderate. This means that the practice of disposing laboratory wastes through an

incineration facility is only done sometimes. This implies that the biology laboratories have some other forms of disposal of their laboratory wastes. In the case of the Chemistry Laboratory, the mean rating is 2.38, or moderate. This means that the practice of disposing laboratory wastes through an incineration facility in the chemistry laboratories is only done sometimes. This implies that the chemistry laboratories have some other forms of disposal of their laboratory wastes.

As far as the item on waste disposal through open burning is concerned, the overall mean obtained is 2.51, with a descriptive equivalent of moderate. This means that the practice of disposing laboratory wastes through open burning is done sometimes. This implies that the science laboratories have sometimes resorted to this malpractice in waste disposal. By type of laboratory, Biology Laboratory obtained a mean of 2.51, or moderate. This means that the practice of disposing laboratory wastes through open burning is done sometimes. This implies that the biology laboratories have resorted to this malpractice from time to time. In the case of the Chemistry Laboratory, the mean obtained is 2.51, or moderate. This means that the practice of disposing laboratory wastes through open burning in the chemistry laboratories is done sometimes. This implies that the chemistry laboratories have also resorted to this malpractice from time to time. For the item on disposal of wastes through burying/composting, the overall mean is 2.69, described as moderate.

This means that disposal of wastes in the science laboratories through burying or composting is only done sometimes. This implies that some types of wastes are buried through other means. By type of laboratories, Biology Laboratory obtained a mean of 2.69, or moderate. This means that disposal of wastes in the biology laboratories through burying or composting is only done sometimes. This implies that some types of wastes are buried through other means. On the other hand, Chemistry Laboratory obtained a mean of 2.69, or moderate. This means that disposal of wastes in the chemistry laboratories through burying or composting is only done sometimes. This implies that some types of wastes are buried through other means.

Finally, on the item on disposal of wastes through other means other than those already enumerated above, the overall mean is 2.69, described as moderate. This means that disposal of wastes in the science laboratories through other means is only done sometimes. This implies that most of the laboratory wastes are disposed through the means earlier enumerated. Analyzing by type of laboratory, Biology Laboratory got a mean of 2.69, or moderate. This means that disposal of wastes in the biology laboratories through other means is only done sometimes. This implies that most of the laboratory wastes are disposed through the means earlier enumerated. In the case of the Chemistry Laboratory, the mean rating is 2.69, or moderate. This means that disposal of wastes in the

chemistry laboratories through other means is only done sometimes. This implies that most of the laboratory wastes are disposed through the means earlier enumerated.

Summary. Reflected in Table 7 is the summary on the level of waste management practices among science laboratories. The overall mean is 3.15, with a descriptive equivalent of moderate. This means that waste management practices in science laboratories of HEIs in Davao City is only done sometimes. This implies that wastes being generated by science laboratories of HEIs in Davao City are not regularly taken cared of properly. This further implies that science laboratories of subject HEIs could be messy at times because wastes being generated are not effectively managed regularly. This implies furthermore that HEIs in Davao City are not strictly implementing the provisions of the Ecological Solid Waste Management Law (R. A. 9003) and the Toxic and Hazardous Wastes Law (R. A. 6969).

Analyzing the results by type of laboratory, it can be gleaned that the mean obtained by biology laboratory is 3.17, with a descriptive of moderate. This means that waste management practices in biology laboratories of HEIs in Davao City is only done sometimes. This implies that wastes being generated by biology laboratories of HEIs in Davao City

Table 7

Summary on the Level of Waste Management Practices in Science Laboratories

Indicator	Biology Laboratory		Chemistry Laboratory		Overall	
	Mean	DE	Mean	DE	Mean	DE
1 Handling of Laboratory Waste at Source	3.45	M	3.37	M	**3.41**	**M**
2. Storage of Laboratory Wastes	3.37	M	3.34	M	**3.36**	**M**
3. Collection of Laboratory Wastes	3.21	M	3.14	M	**3.18**	**M**
4. Final Disposal of Laboratory Wastes	2.65	M	2.62	M	**2.64**	**M**
Overall Mean	**3.17**	**M**	**3.12**	**M**	**3.15**	**M**

are not regularly taken cared of properly. This further implies that subject biology laboratories could be messy due to wastes being generated.

A similar picture appears in the case of Chemistry laboratories. The results show that the mean score obtained is 3.12, with a descriptive equivalent of moderate. The same implications for Biology laboratory apply for Chemistry laboratory. Analyzing the results further, data show that all the indicators for waste management practices obtained the same rating of moderate, with mean scores of 3.41, 3.36, 3.18 and 2.64 respectively for Handling Wastes at Source. The same implications for Biology laboratory apply for Chemistry laboratory.

Analyzing the results further, data show that all the indicators for waste management practices obtained the same rating of moderate, with mean scores of 3.41, 3.36, 3.18 and 2.64 respectively for Handling Wastes at Source, Storage, Collection and Final Disposal. Once again, all of the above implications apply in all these cases.

Significant Difference in the Level of Waste Management Practices when analyzed by Biology and Chemical Laboratories

Table 8 presents the t-test for paired samples to compare the overall level of waste management practices between biology laboratory and chemistry laboratory. The results show that the level of waste management practices between the two laboratories differ significantly. With a computed t-value of 3.091 and a probability value of .002, which is higher than .05, the

Table 8

Significant Different in the Level of Waste Management Practices when analyzed by Biology and Chemical Laboratories

Indicator	Means		Comp. t-value	Probab. Value (2-tailed)	Decision On H_o
	Chem. Lab.	Bio. Lab			
Handling	3.45	3.37	2.69	.008*	Reject
Storage	3.37	3.34	1.18	.238	Accept
Collection	3.21	3.14	2.75	.006*	Reject
Final Disposal	2.65	2.62	2.63	.009*	Reject
Overall	**3.17**	**3.12**	**3.09**	**.002***	**Reject**

difference is found to be significant. Therefore, the null hypothesis has to be rejected. This means, that both laboratories obtained the same rating of moderate level in their waste management practices, biology laboratory has a higher level of waste management practice. This implies that biology laboratory takes care of its wastes more properly compared to chemistry laboratory.

Moreover, the results of the comparison between the levels of practice by indicators show that the two laboratories differ significantly in Handling of Wastes at Source, Collection of Wastes and Final Disposal of Wastes. The respective computed t-values for these indicators are 2.68 for Handling, 2.75 for Collection and 2.62 for Final Disposal, with the corresponding probability values of 0.008, 0.006, and 0.002, respectively. Since these probability values are all lower than the 0.05 level of significance, the null hypotheses have to be rejected. This means that in the case of these indicators, level of waste management practice of biology laboratory is higher than that of chemistry laboratory, although both laboratories obtained the same rating of moderate level. All of the implications cited above also apply in these cases. However, in the case of the indicator of Storage of Wastes, the two laboratories do not differ significantly in their level of waste management practice. Data show that the computed t-value is only 1.182, with the corresponding probability value of 0.238. This means that although the obtained mean score of

biology laboratory of 3.37 is higher the obtained mean score of chemistry laboratory of 3.34, the difference is not big enough to be considered statistically significant. This implies that both laboratories have more or less the same level of waste management practices. This implies further that in this particular indicator, both laboratories have exerted more or less the same efforts in taking care of their wastes and in the same manner the findings of this study is conform to the theory of waste management by Pongràcz et al. and to the Agenda 21 theory.

PROPOSED CITY-WIDE PROGRAM FOR THE ENHANCEMENT OF WASTE MANAGEMENT PRACTICES IN SCIENCE LABORATORIES OF HIGHER EDUCATION INSTITUTIONS IN DAVAO CITY

Introduction

Waste management requires implementation of a well-coordinated and organized set of actions: proper handling at source, proper storage, proper collection system and proper and proper final disposal. The overriding objective of all these actions is two-fold: a) To ensure protection of public health by removing discarded materials in a timely manner to prevent the spread of disease, minimize likelihood of fires, and reduce aesthetic eye-sores; and b) To ensure the protection of the environment by disposing solid waste in a manner that is environmentally acceptable.

The need for proper waste management in science laboratories of schools does not need further underscoring. Being one of the most

important centers of activity for learning, science laboratories teem with students and teachers undertaking various laboratory activities. As such, they are potential generators of wastes that can pose a threat to public health or to the environment. It is therefore imperative that science laboratories of schools should have an effective and efficient waste management system to address this potential threat.

This herein proposed Program is designed to enhance the waste management practices in science laboratories of Higher Education Institutions (HEIs) in Davao City. The Program is planned for implementation in the First Semester, AY 2008-09, for a duration of three months.

Situational Analysis

The results of the survey of waste generation show that science laboratories of HEIs in Davao City generates considerable amount of wastes. This means that there is real need to enhance waste management practices in these laboratories. The survey on waste management practices show that all indicators of waste management practices obtained a mean rating in the moderate level. This implies that there is still much to be desired in the practice of waste management in the science laboratories. Another obvious implication is that waste management practices of the science laboratories still offers a lot of room for improvement.

Vision

The proposed Program envisions environment-friendly science laboratories of HEIs in Davao City.

Mission

To formulate and implement an effective and efficient waste management system in science laboratories of HEIs in Davao City.

Objectives

The primary objective of this Program is to raise the overall level of waste management practices in the science laboratories of Higher Education Institutions in Davao City.

Specifically, the scheme aims to:

1. Raise the level of awareness of both teachers and students in the sciences on the importance of proper waste management based on the provisions of existing waste management laws;
2. Raise the level of waste management practices in science laboratories of Higher Education Institutions in Davao City, especially on final disposal of laboratory wastes; and
3. Enhance the coordination and collaboration between the Department of Environment and Natural Resources, the Environmental Management Bureau and the Commission on

Higher Education on the matter of waste management in science laboratories of Higher Education Institutions.

Specific Targets

The proposed Program expects to realize the following specific targets:

1. A massive city-wide Information and Education Campaign on waste management in science laboratories shall have been conducted in all HEIs in Davao City;

2. Heightened awareness on the part of Administrators of HEIs, persons in-charge of science laboratories, science teachers and students on the importance of proper waste management in science laboratories shall have been generated;

3. A seminar-workshop on waste management in science laboratories, duly attended by representatives of HEIs in Davao City, shall have been conducted;

4. A Framework Plan for waste management in science laboratories, which could be commonly adopted by HEIs in Davao City, shall have been formulated;

5. A sustained implementation of a waste management plan shall have been set in place in science laboratories of HEIs in Davao City; and

6. A Memorandum of Agreement (MOA) between DENR-CHED providing for the sustained implementation and monitoring of waste management practices in science laboratories of HEIs in Davao City shall have been signed.

Strategies

To attain the objectives and specific targets of the Program, the researcher recommends the adoption of the following strategies:

1. Forge collaboration between DENR and CHED to address the concern of waste management in science laboratories of HEIs;
2. Enjoin the Administration of the University of Mindanao to take up the lead role in the whole intervention process;
3. Secure the active support of the tri-media in the IEC on waste management in science laboratories of schools; and
4. Coordinate with the Administrations of all HEIs in Davao City on the matter of waste management in science laboratories.

Proposed Activities

The activities envisaged in the Program are presented in Table 9. As can be gleaned, the matrix outlines a process towards evolving a realistic and practical framework plan for waste management that can be readily adopted and implemented by science laboratories of HEIs.

Table 9

Matrix of Proposed Activities

Activity	Objective	Description	Schedule (Duration)	Cost Estimate	Key Actors/ Participants
1) Presentation of the Proposed Intervention Scheme to the UM graduate School, with the request that the UM take cognizance of it and take up the lead role in implementing the Scheme.	To secure decision of the UM Administration to pursue the Intervention Scheme and take up lead role in implementing it.	Letter of transmittal and submission of copy of the Proposed Intervention Scheme	One week after the start of regular classes, 1st Sem., SY 2008-09 (One hour)	P – 0 –	Researcher
2) Decision by UM to pursue the Intervention Scheme and Designation of a Coordinator for the Project.	To provide legal basis for implementing the Project	Official action	One week after presentation of the Proposed Intervention Scheme	P - 0 -	UM Top Management
3) Presentation of the Project to DENR and CHED and enjoin them to collaborate with UM on the matter	-To secure the support and cooperation of the two agencies - To forge MOA for the endeavor	Consultation/Dialogue	Soon after the designation of Project Coordinator. (Half-day)	P - 0 -	Project Coordinator and representatives of DENR and CHED

Table 9 (Continued)

Matrix of Proposed Activities

4) Planning for the Conduct of Seminar Workshop on waste management in science laboratories of HEIs	To design the Seminar-Workshop, including the preparation of its Program	Brainstorming sessions	Early part of the 2nd month, 1st Semester, AY 2008-09 (One day)	P1,000.00	Project Coordinator and represent-tatives of DENR and CHED
5. Presentation of the Seminar-Workshop design to UM Administration for approval	To secure official approval for the conduct of the Seminar-Workshop	Presentation/ Briefing	Soon after the completion of the Seminar-Workshop design	P - 0 -	Project Coordinator
6. Decision by UM Administration to authorize and proceed with the conduct of the Seminar-Workshop	To provide legal basis for the holding of the Seminar-Workshop	Official action	Few days after receipt of the subject Seminar-Workshop design	P - 0 -	UM Top Management

Table 9 (Continued)

Matrix of Proposed Activities

7. Conduct of information dissemin-ation of the planned Seminar-Workshop in all HEIs in Davao City	To create awareness and enjoin them to send representatives as participants	Written communications/ briefings	Balance of the 2nd month up to 1st week of 3rd month, 1st Sem., AY 2008-09 (Twoweeks)	P5,000.00	Project Coordinator, assisted by some UM Faculty members
8. Conduct of the Seminar-Workshop	-To heighten awareness on the importance of waste management in science laboratories - To formulate a framework Plan for waste management in science laboratories	Lecture/ Workshop/ Brainstorming/ Formulation of Framework Plan	2nd week of 3rd month, 1st Semester, AY 2008-09 (Two days)	P20.000.00	Project Coordinator, with representatives from DENR and CHED
9. Production of IEC materials	To have materials for the conduct of IEC	Electronic production/ Printing	3rd week of 3rd month, 1st Semester, AY 2008-09 (One week)	P5,000.00	Project Coordinator, with support of UM Computer Laboratory/ UM Printing Office

Table 9 (Continued)

Matrix of Proposed Activities

10. Distribution of IEC materials to tri-media outlets	To disseminate information through the tri-media channels	Print ads/ radio spots/ TV public service spots	4th week of 3rd month, 1st Semester, AY 2008-09 (One day)	P1,000.00	Project Coordinator, with the aid of some staff
11. Conduct of School-wide IEC in respective HEIs	To create awareness among their constituents	Meetings/ Briefings/ distribution of printed information	4th week of 3rd month, 1st Semester, AY 2008-09 (One week)	P10,000.00	Respective Project Coordinators of HEIs
12. Conduct of respective Seminar-Workshop in all HEIs	To create awareness among their constituents To flesh-out the framework plan	Lecture/ Workshop/ Brainstorming/ Fleshing out the Framework Plan	4th week of 3rd month, 1st Semester, AY 2008-09 (One day)	P ? (Depending on HEI's budgetary allocation)	Respective Project Coordinators of HEIs with the aid of DENR/CHED

Table 9 (Continued)

Matrix of Proposed Activities

13. Decision by respective administrations of HEIs on the adoption of the fleshed-out waste management plan for their science laboratories	To provide legal basis for the implement-tation of waste management plan in HEI's science laboratories	Official action	Soon after the conduct of Seminar-Workshop in the HEI	P - 0 -	Top HEI Management
14. Implementation of waste manage-ment plan in science laboratories of HEIs in Davao City	To raise the level of waste management practices in science labs	Carry out the activities provided under the waste management plan	Start of 2nd Sem., AY 2008-09 - onwards	P ? (Depending on HEI's budgetary allocation)	Respective Project Coordinators of HEIs
15. Monitoring of waste management in science laboratories of HEIs in Davao City	To ensure the implementation of the waste management plan	Random actual observations during laboratory hours	Start of 2nd Sem., AY 2008-09 - onwards	P ? (Depending on provisions in MOA)	Joint DENR-CHED Monitoring Team

Monitoring and Evaluation

For implementation of the waste management plan to be more effective, it should be complimented with sustained monitoring and evaluation. As envisioned in this Intervention Scheme, this task is to be undertaken by a joint DENR-CHED monitoring team.

Chapter 4

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

This chapter presents the summary and findings of the study, highlighting the answers to the sub-problems, the conclusions drawn and the recommendations of the researcher.

Summary

The primary aim of the study was to determine the waste management practices of science laboratories of Higher Education Institutions in Davao City. Specifically, the study sought answers to the following questions:

1. What is the profile of wastes being generated by science laboratories of Higher Education Institutions in Davao City in terms of :

    1.1 Biodegradable wastes

    1.2 Non-biodegradable wastes

    1.3 Residual wastes?

2. What is the level of waste management practices of science laboratories of Higher Education Institutions in Davao City in terms of:

    2.1 Handling of laboratory wastes at source

    2.2 Storage of laboratory wastes

    2.3 Collection of laboratory wastes

    2.4 Final Disposal of laboratory wastes?

3. Is there a significant difference in the level of waste management practices when analyzed by type of laboratory?

4. On the basis of the results of the study, what intervention scheme can be designed to enhance the waste management practices of science laboratories of Higher Education Institutions in Davao City?

The researcher used a descriptive method of research employing a validated questionnaire as data gathering instrument. This study was conducted among 300 senior college students enrolled in their laboratory subjects during the school year 2007-2008. Quota sampling was used in the selection of the respondents. The statistical tools used were mean and T-test.

The following were the findings of the study :

1. Science laboratories of HEIs in Davao City generate 63.8 kilograms of wastes per week, or the equivalent of 3.2 tons of wastes per annum, with biology laboratory contributing 32.8 kilograms per week or 1.71 tons per annum and chemistry laboratory contributing 31.0 kilograms per week or 1.61 tons per annum. On the type of wastes being generated, biodegradable wastes contribute 21.9 kilograms per week, non-biodegradable wastes 22.8 kilograms per week and residual wastes 19.1 kilograms per week.

2. The overall mean rating for level of waste management practices in science laboratories of HEIs in Davao City was 3.15 or moderate. The

mean rating by laboratory is 3.17 for biology laboratory and 3.12 for chemistry laboratory. On the indicators of waste management practices, the mean scores were 3.41 for handling of laboratory wastes at source; 3.36 for storage of laboratory wastes; 3.18 for collection of laboratory wastes and 2.64 for final disposal of laboratory wastes.

3. Based on the mean rating of waste management practices when analyzed in terms of biology laboratory and chemistry laboratory showed that the overall computed t-value was 3.091 with the corresponding probability value of 0.002 at a = 0.05 level of significance. Therefore, the null hypothesis for sub-problem 3 was rejected.

Conclusions

Based on the foregoing findings, the following conclusions are drawn:

1. Science laboratories of Higher Education Institutions in Davao City generate a moderate amount of wastes annually.

2. The level of waste management practices of the subject science laboratories is considered *moderate.*

3. There is significant difference in the waste management practices of biology and chemistry science laboratories.

Recommendations

In view of the foregoing findings and conclusions, the researcher hereby recommends the following:

1. That the Department of Environment and Natural Resources, in coordination with the Commission on Higher Education, enjoin the Higher Education Institutions in Davao City to enhance the waste management practices in their science laboratories to effectively cope with the considerable amount of laboratory wastes being generated by these laboratories.

2. That Higher Education Institutions encourage those in charge of chemistry laboratories to enhance and raise to higher levels their waste management practices to keep them at least at par with or even higher than their counterparts in the biology laboratories.

3. That the herein Proposed Intervention Scheme which is the city-wide program for the enhancement of waste management practices in science laboratories be adopted by Higher Education Institutions in Davao City to enhance the level of waste management practices in their science laboratories.

4. That similar studies be conducted in the other elementary and secondary levels of educational institutions to affirm or validate the findings of this study and to have a more comprehensive approach to waste management in school laboratories.

University of Western Australia, School of Human and Exercise Science. General laboratory safety. Retrieved July 31, 2007. Web site: http://www.uwa.edu./safety/laboratory.html

Waddell, D., (2006). Laboratory waste management guide. local hazardous waste management program in king country. Retrieved Aug. 01,2007. web site : http://www.govlink.org/hazwaste/publications/lab guidelines_os.pdf.

Waste (2000 September). Solid waste. Retrieved July 25,2007. web site: http:// www.cf.ac.uk/bio si/staff/kille/methods/General Waste.html

Kansas Department Health and Environment.(2001). Waste chemical disposal guidance for schools. Retrieved Aug. 01,2007 from website: http://www.kdheks.gov/waste/download/school_chemical_guidance_books_1001.pdf.

Occupational Health and Safety Administration (OHSA). Case studies :chemical risk prevention in school laboratories. Retrieved July 31 ,2007 from Web site:http://www.osha.europa.eu/good/practice/sector/education.

Oledan, R., (2006, June 09). Cost Efficiency. Sunstar Davao..http://www.sunstar .com.ph .

Pongràcz, Z., Phillips, P.S., and Keiski, R.L. (2004). Evolving the theory of waste management- implications to waste minimization. Published Article, Oulu University Press, Finland, 61-67. Retrieved July 01,2007., From website: http://www.herkules.oulu.fi/isbn9514268210/.

PK Group Standard Operating Protocol. (1999, July). Waste disposal guide. Retrieved from webite http:/www.mdk.org/instruction/Curriculum/ science/ safety /chemicals.html.

Teacher Guide, Primer on solid waste management, A guide to the integration of solid waste management into school curriculum. Retrieved Aug.3,2007 web site: http://www.edugreen.teri.res.in/explore/solwaste/what.html.

University of Illinois at Urbana Champaign (2006 July). Division of Research Safety. Chemical waste management guide. Retrieved Aug. 15,2007. web site. http://www.chemwaste.mgt_guide.mht.

Univesity and College in New England (2003 May). The best management practices: waste management case studies. Retrieved Aug.3,2007. website: http//www.epa.gov/assistance/univ/bmpcasestudies_waste.html

University of Pennsylvania, Laboratory sharp waste management procedure. (2006 November) Retrieved June 31,2007. http://www.ehrs.upenn .edu/resources/waste/bio/usedsharps.html

University of Pennsylvania, The campus environmental audit: hazardous waste. (1995) Retrieved June 31,2007.http://www.dolphin.upenn.edu/ pennenv/audit/.

University of Pennsylvania, University`s biological safety manual, veterinary school and infectious waste disposal guide.(2007 April) Retrieved June 31,2007. web site: http://www.ehrs.upenn/resources/waste/bio/vet_ guide.html

REFERENCES

Armour, M.A., Hazardous laboratory chemical disposal guide.2nd Edition New York: Lewis Publisher Inc. 1999

Department of Environment and Natural Resources, Solid Waste Management For Local Government`s, Quezon City, 1998

Soriano, Sr. Luz Emmanuel, R.A., Save mother earth-what schools can do, Phoenix Publishing House, Inc., Quezon City, 1995

Walpole, R., Introduction to Statistic. 3rd Edition. New York: Macmillan Publishing Co., Inc. 2006

Alabama Department of Environmental Management (2002, January). Hazardous waste disposal: management of school laboratory waste, website:http://www.adem.state.al.us/land division/ Guidance/School Chemwaste/

Benoit, T., (2002). School science laboratory chemical and mercury clean-out project. Vermont Department of Environmental Conservation`s Assistance Division, website :http://www.mercut.org/pdf/finalreport.pdf.

Department of Ecology, Washington State, Hinkley Center for solid and hazardous waste management (2006, July). Hazardous waste and toxic reduction program, web site http://www.ecy.wa.gov.html.

Environmental Protection Agency. U.S. Environmental Protection Agency. Environmental management guide for small laboratories. Retrieved July 31,2007 from Web site : http://www.epa.gov/cgi-bin/epaprintonly.html

Environmental Protection Agency. (2004, December). Hazardous waste management for school laboratories and classroom. Retrieved July 31 2007 from web site: http://www.epa.gov/region/human health/children/ management tool kit.pdf.

Howe, R. and Disinger, J., Teaching desirable environmental ethics and action though school activities. ERIC/SMEAC Environmental Educational-Digest No. 1 http:/www.ericdigest.org/pre-9217 /ethics.html .1995

Inquirer. (2006, December 01). Editorial: Toxic Incidents.Retrieved July 24,2007. Inquirer website :http:// www. inquirer.net

APPENDICES

Appendix A

Letter-Requests to Heads of HEI's for Permission to Conduct the Study

_____ 2007

To: The Head of School

_____

_____

S I R/ MADAM:

This is to request your good office to allow the undersigned, a graduate student of the University of Mindanao, Davao City, to conduct a study entitled " **Waste Management Practices of School Science Laboratories among Higher Education Institutions: Basis for an Intervention Scheme".**

This research is being conducted in partial fulfillment of the requirements for the Degree of Master in Environmental Planning at the University of Mindanao, Bolton St., Davao City.

In view thereof, allow me to conduct a survey for at least twenty (20) students in your institution through a given form of questionnaires to be fill-up by them with corresponding rating which will consume for two (2) to three (3) minutes only.

Hoping for your favorable consideration on this matter.

Very truly yours,

Mitchelle S. Perez
Researcher
(MEP Student, Batch 2007)

Appendix B

Letter for the Respondent

Dear Respondent:

This Questionnaire is for the purpose of gathering data for the undersigned's research entitled **"Waste Management Practices of Science Laboratories among Higher Education Institutions: Basis for an Intervention Scheme"**, a partial requirement for the Degree of Master in Environmental Planning at the Graduate School which she is currently pursuing at the University of Mindanao, Davao City.

Please answer all the items in the Questionnaire as honestly as possible. Rest assured that the information you supply through this Questionnaire will be treated with outmost confidentiality.

Thank you for your kind cooperation.

MITCHELLE S. PEREZ
Researcher

Appendix C

Questionnaire

QUESTIONNAIRE

General Information:

Name: (Optional)_____

Name of School/College/University: _____

Part I. Profile of Wastes Being Generated

Please assess the rate of waste generation in your science laboratory by checking the appropriate using the following Rating Scale as your guide:

Rating Scale

1 – Less than 1 kilogram per week
2 – Between 1-2 kilograms per week
3 – Between 2-3 kilograms per week
4 – Between 3-4 kilograms per week
5 – More than 4 kilograms per week

A. Biodegradable Wastes	Biology Laboratory					Chemistry Laboratory				
	1	**2**	**3**	**4**	**5**	**1**	**2**	**3**	**4**	**5**
1. Waste papers										
2. Animal specimens										
3. Plant part specimens										
4. Unsoiled tissue papers										
5. Other miscellaneous wastes										
B. Non-biodegradable Wastes										
1. Broken glasses (all kinds)										
2. Microscopic slides & cover slips										
3. Disposable gloves & masks										
4. All kinds of sharp objects)										
5. Plastics (all kinds)										

C. Residual Wastes	Biology Laboratory					Chemistry Laboratory				
	1	2	3	4	5	1	2	3	4	5
1. Aerosol cans, gas cylinders, etc.										
2. Discarded batteries										
3. Hazardous & flammable materials										
4. Microbiological wastes (i. e. culture media, broth cultures, etc)										
5. Liquid wastes classified as non-hazardous materials (i. e. water soluble indicators, etc.)										

Part II. Level of Waste Management Practices

Please assess the level of waste management practices in your science laboratory by checking the appropriate using the following Rating Scale as your guide:

Rating Scale

Numerical Score	Descriptive Equivalent	Verbal Description
5	Very High Level	This indicates that the waste management practice cited in the item is *done almost all the time.*
4	High	This indicates that the waste management practice cited in the item is *done most of the time.*
3	Moderate Level	This indicates that the waste management practice cited in the item is *only done sometimes.*
2	Low Level	This indicates that the waste management practice cited in the item is *done only occasionally.*
1	Very Low Level	This indicates that the waste management practice cited in the item is *rarely done.*

A. Handling of Laboratory Wastes at Source	Biology Laboratory					Chemistry Laboratory				
	1	2	3	4	5	1	2	3	4	5
1. Waste removal at source										
2. Waste segregation at source										
3. Segregated wastes are place in color-coded containers										
4. Waste handlers are properly trained for handling laboratory Wastes										
5. Waste handlers use proper protective equipment										

B. Storage of Laboratory Wastes	Biology Laboratory					Chemistry Laboratory				
	1	2	3	4	5	1	2	3	4	5
1. Smelly or obnoxious wastes are pre-treated prior to storage										
2. Pre-treated wastes are placed in sealed containers										
3. waste containers are stored in a secured room										
4. Storage room area has adequate space										
5. Storage area has adequate security provisions										
C. Collection of Laboratory Wastes										
1. Collection of wastes at source uses proper equipment										
2. Collection of wastes at source observes prescribed proper Procedure										
3. Transport vehicle to final disposal is provided with protective cover										
4. Waste storage area is accessible to transport vehicle										
5. Collection of wastes for final disposal is properly coordinated with CENRO										

D. Final Disposal of Laboratory Wastes										
1. Through septic vault										
2. Through an incineration facility										
3. Through open burning										
4.Through burying/composting										
5. Through other means other than the above										

END

Thanks!

Appendix D

Letter to Validators

September 08, 2007

Dr. Eugenio S. Guhao, Jr.
Dean of Graduate School
University of Mindanao
Davao City

Dear Dr. Guhao:

Pursuant to the standard practice of the University of Mindanao Graduate School to let the members of the Thesis Committee validate the data-gathering instrument of the researcher, May I respectfully request you to please validate the herein **Questionnaire.**

This research instrument is intended to gather data for the undersigned`s masteral thesis entitled " **Waste Management Practices of Science Laboratories among Higher Education Institutions in Davao City: Basis for an Intervention Scheme ",** a partial requirement for the degree of Master in Environmental Planning.

For your ready reference, attached is a copy of my research problem as well as the validation sheet to guide you in your validation of my questionnaire.

Thank you for your kind support.

Very respectfully yours,

MITCHELLE S. PEREZ
(MEP Student, Batch 2007)
Researcher

September 08, 2007

Prof. Ramon M. Barbon, MEP
University Professor I
University of Mindanao
Davao City

Dear Prof. Barbon:

Pursuant to the standard practice of the University of Mindanao Graduate School to let the members of the Thesis Committee validate the data-gathering instrument of the researcher, May I respectfully request you to please validate the herein **Questionnaire.**

This research instrument is intended to gather data for the undersigned's masteral thesis entitled " **Waste Management Practices of Science Laboratories among Higher Education Institutions in Davao City : Basis for an Intervention Scheme ",** a partial requirement for the degree of Master in Environmental Planning.

For your ready reference, attached is a copy of my research problem as well as the validation sheet to guide you in your validation of my questionnaire.

Thank you for your kind support.

Very respectfully yours,

MITCHELLE S. PEREZ
(MEP Student, Batch 2007)
Researcher

September 08, 2007

Dr. Marciano B. Melchor
University Professor II
University of Mindanao
Davao City

Dear Dr. Melchor:

Pursuant to the standard practice of the University of Mindanao Graduate School to let the members of the Thesis Committee validate the data-gathering instrument of the researcher, May I respectfully request you to please validate the herein **Questionnaire.**

This research instrument is intended to gather data for the undersigned`s masteral thesis entitled " **Waste Management Practices of Science Laboratories among Higher Education Institutions in Davao City : Basis for an Intervention Scheme ",** a partial requirement for the degree of Master in Environmental Planning.

For your ready reference, attached is a copy of my research problem as well as the validation sheet to guide you in your validation of my questionnaire.

Thank you for your kind support.

Very respectfully yours,

MITCHELLE S. PEREZ
(MEP Student, Batch 2007)
Researcher

September 08, 2007

Dr. Gloria P. Gempes
University Professor II
University of Mindanao
Davao City

Dear Dr. Gempes:

Pursuant to the standard practice of the University of Mindanao Graduate School to let the members of the Thesis Committee validate the data-gathering instrument of the researcher, May I respectfully request you to please validate the herein **Questionnaire.**

This research instrument is intended to gather data for the undersigned`s masteral thesis entitled " **Waste Management Practices of Science Laboratories among Higher Education Institutions in Davao City : Basis for an Intervention Scheme ",** a partial requirement for the degree of Master in Environmental Planning.

For your ready reference, attached is a copy of my research problem as well as the validation sheet to guide you in your validation of my questionnaire.

Thank you for your kind support.

Very respectfully yours,

MITCHELLE S. PEREZ
(MEP Student, Batch 2007)
Researcher

September 08, 2007

For: Martin T. Obrero, MPA
Supervising Environment Management
Specialist II, City Environment and
Natural Resources Office, Davao City

Dear Sir:

Pursuant to the standard practice of the University of Mindanao Graduate School to let the expert of specialization to validate the data-gathering instrument of the researcher, May I respectfully request you to please validate the herein **Questionnaire.**

This research instrument is intended to gather data for the undersigned's masteral thesis entitled " **Waste Management Practices of Science Laboratories among Higher Education Institutions in Davao City : Basis for an Intervention Scheme ",** a partial requirement for the degree of Master in Environmental Planning.

For your ready reference, attached is a copy of my research problem as well as the validation sheet to guide you in your validation of my questionnaire.

Thank you for your kind support.

Very respectfully yours,

MITCHELLE S. PEREZ
(MEP Student, Batch 2007)
Researcher

Appendix E

Accomplished Sheets

Validation Sheet for Questionnaire

Please check the most appropriate box according to your evaluation of the herein Questionnaire: (5 - Excellent; 4 - Very good; 3 - Good; 2 - Fair; 1 -Poor)

	5	4	3	2	1
1. Clarity of Test Directions and Items (the vocabulary level, language structure and conceptual level of questions suit to the level of respondents. The instructions and items are written in clear and understandable manner.)	☐	☑	☐	☐	☐
2. Presentation / Organization of Topics (The items are presented and organized in logical manner.)	☐	☐	☑	☐	☐
3. Suitability of Items (The items appropriately represent the substance of the research. The questions are designed to determine the conditions, knowledge, perceptions and attitudes that are supposed to be measured.)	☐	☑	☐	☐	☐
4. Adequateness of Content per Category (The items adequately represent the coverage of the research. The number of questions per area is representative enough of all the questions needed per category.)	☐	☐	☑	☐	☐
5. Attainment of Purpose (The instrument as a whole fulfills the objectives for which it was constructed.)	☐	☑	☐	☐	☐
6. Appropriateness of Rating Scale and Evaluation (The scale adopted is appropriate for the items.)	☐	☑	☐	☐	☐
7. Objectivity of Items (Each item question requires only one specific answer and no aspect of the questionnaire suggests bias on the part of the researcher.)	☐	☑	☐	☐	☐

Comments and suggestions: _____

_____

_____

_____

Signature: _____

ESGUERRA, JM

Validation Sheet for Questionnaire

Please check the most appropriate box according to your evaluation of the herein Questionnaire: (5 - Excellent; 4 - Very good; 3 - Good; 2 - Fair; 1 -Poor)

	5	4	3	2	1
1. Clarity of Test Directions and Items (the vocabulary level, language structure and conceptual level of questions suit to the level of respondents. The instructions and items are written in clear and understandable manner.)	☑	☐	☐	☐	☐
2. Presentation / Organization of Topics (The items are presented and organized in logical manner.)	☑	☐	☐	☐	☐
3. Suitability of Items (The items appropriately represent the substance of the research. The questions are designed to determine the conditions, knowledge, perceptions and attitudes that are supposed to be measured.)	☑	☐	☐	☐	☐
4. Adequateness of Content per Category (The items adequately represent the coverage of the research. The number of questions per area is representative enough of all the questions needed per category.)	☐	☑	☐	☐	☐
5. Attainment of Purpose (The instrument as a whole fulfills the objectives for which it was constructed.)	☐	☑	☐	☐	☐
6. Appropriateness of Rating Scale and Evaluation (The scale adopted is appropriate for the items.)	☑	☐	☐	☐	☐
7. Objectivity of Items (Each item question requires only one specific answer and no aspect of the questionnaire suggests bias on the part of the researcher.)	☑	☐	☐	☐	☐

Comments and suggestions: Revise items based on my comments/suggestions

Signature: Ramon M. Barron

Validation Sheet for Questionnaire

Please check the most appropriate box according to your evaluation of the herein Questionnaire: (5 - Excellent; 4 - Very good; 3 - Good; 2 - Fair; 1 -Poor)

	5	4	3	2	1
1. Clarity of Test Directions and Items (the vocabulary level, language structure and conceptual level of questions suit to the level of respondents. The instructions and items are written in clear and understandable manner.)	☑	☐	☐	☐	☐
2. Presentation / Organization of Topics (The items are presented and organized in logical manner.)	☑	☐	☐	☐	☐
3. Suitability of Items (The items appropriately represent the substance of the research. The questions are designed to determine the conditions, knowledge, perceptions and attitudes that are supposed to be measured.)	☑	☐	☐	☐	☐
4. Adequateness of Content per Category (The items adequately represent the coverage of the research. The number of questions per area is representative enough of all the questions needed per category.)	☐	☑	☐	☐	☐
5. Attainment of Purpose (The instrument as a whole fulfills the objectives for which it was constructed.)	☑	☐	☐	☐	☐
6. Appropriateness of Rating Scale and Evaluation (The scale adopted is appropriate for the items.)	☑	☐	☐	☐	☐
7. Objectivity of Items (Each item question requires only one specific answer and no aspect of the questionnaire suggests bias on the part of the researcher.)	☑	☐	☐	☐	☐

Comments and suggestions: _____

No further comments / suggestions

Signature: _____

Validation Sheet for Questionnaire

Please check the most appropriate box according to your evaluation of the herein Questionnaire: (5 - Excellent; 4 - Very good; 3 - Good; 2 - Fair; 1 -Poor)

	5	4	3	2	1
1. Clarity of Test Directions and Items (the vocabulary level, language structure and conceptual level of questions suit to the level of respondents. The instructions and items are written in clear and understandable manner.)	☐	☑	☐	☐	☐
2. Presentation / Organization of Topics (The items are presented and organized in logical manner.)	☐	☑	☐	☐	☐
3. Suitability of Items (The items appropriately represent the substance of the research. The questions are designed to determine the conditions, knowledge, perceptions and attitudes that are supposed to be measured.)	☐	☑	☐	☐	☐
4. Adequateness of Content per Category (The items adequately represent the coverage of the research. The number of questions per area is representative enough of all the questions needed per category.)	☐	☑	☐	☐	☐
5. Attainment of Purpose (The instrument as a whole fulfills the objectives for which it was constructed.)	☐	☑	☐	☐	☐
6. Appropriateness of Rating Scale and Evaluation (The scale adopted is appropriate for the items.)	☐	☑	☐	☐	☐
7. Objectivity of Items (Each item question requires only one specific answer and no aspect of the questionnaire suggests bias on the part of the researcher.)	☐	☑	☐	☐	☐

Comments and suggestions: _____

Signature: _____

GLORIA GEMPES, EdD, DM

Validation Sheet for Questionnaire

Please check the most appropriate box according to your evaluation of the herein Questionnaire: (5 - Excellent; 4 - Very good; 3 - Good; 2 - Fair; 1 -Poor)

	5	4	3	2	1
1. Clarity of Test Directions and Items (the vocabulary level, language structure and conceptual level of questions suit to the level of respondents. The instructions and items are written in clear and understandable manner.)	☐	☑	☐	☐	☐
2. Presentation / Organization of Topics (The items are presented and organized in logical manner.)	☐	☐	☑	☐	☐
3. Suitability of Items (The items appropriately represent the substance of the research. The questions are designed to determine the conditions, knowledge, perceptions and attitudes that are supposed to be measured.)	☑	☐	☐	☐	☐
4. Adequateness of Content per Category (The items adequately represent the coverage of the research. The number of questions per area is representative enough of all the questions needed per category.)	☐	☑	☐	☐	☐
5. Attainment of Purpose (The instrument as a whole fulfills the objectives for which it was constructed.)	☐	☑	☐	☐	☐
6. Appropriateness of Rating Scale and Evaluation (The scale adopted is appropriate for the items.)	☐	☐	☑	☐	☐
7. Objectivity of Items (Each item question requires only one specific answer and no aspect of the questionnaire suggests bias on the part of the researcher.)	☑	☐	☐	☐	☐

Comments and suggestions: 1. Pls consider provisions of R.A. 9003 in the major and detailed classification of waste
2. IEC is suggested to be the major description of item #5 under intervention schemes (iii) incorporating therein cap. e of item #4 under intervention scheme.
3. Numerical value of 1 (not at all) seems not appropriate as the verbal description which specify a "very rarely" waste management practices.

Signature: MARTIN T. OBRERO

Appendix F

Summary of Results of Evaluation

Computation of Validator`s Rating

INDICATORS	DR. E. S. GUHAO,JR.	PROF. R. BARBON	DR.M. B. MELCHOR	DR. G. P. GEMPES	FOR .M.T. OBRERO	MEAN
1. Clarity of Direction and Items The Vocabulary level language, structure and conceptual level of participants. The test directions and the items are written in a clear and understandable manner.	4	5	5	4	4	4.4
2. Presentation and organization of Items The items are presented and organized in a logical manner.	3	5	5	4	3	4.0
3. Suitability of Items The items appropriately represent the substance of the research. The questions are designed to determine the conditions, knowledge,perception and attitudes that are supposed to be measured.	4	5	5	4	5	4.6
4. Adequateness of items per category The items represent the coverage of the research adequately. The number of questions per area category is a representative enough of all the questions needed for the research	3	4	4	4	4	3.8
5. Attainment of Purpose The instrument as a whole fulfills the objective for which it was constructed	4	4	5	4	4	4.2
6. Objectivity Each item requires only one specific answer of measures only one behavior and no aspect of the questionnaire suggests on the part of the researcher	4	4	5	4	3	4.2
7. Scale and Evaluation Rating System The scale adopted is appropriate for the items.	4	5	5	4	5	4.6
AVERAGE RATING	3.7	4.7	4.8	4.0	4.0	4.24

Appendix G

Table of Equivalent

Table of Equivalent

Mean Score	1.0	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9	2.0
Equivalent Mean kg	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0

Mean Score	2.0	2.1	2.2	2.3	2.4	2.5	2.6	2.7	2.8	2.9	3.0
Equivalent Mean kg	1.0	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9	2.0

Mean Score	3.0	3.1	3.2	3.3	3.4	3.5	3.6	3.7	3.8	3.9	4.0
Equivalent Mean kg	2.0	2.1	2.2	2.3	2.4	2.5	2.6	2.7	2.8	2.9	3.0

Mean Score	4.0	4.1	4.2	4.3	4.4	4.5	4.6	4.7	4.8	4.9	5.0
Equivalent Mean kg	3.0	3.1	3.2	3.3	3.4	3.5	3.6	3.7	3.8	3.9	4.0

CURRICULUM VITAE

CURRICULUM VITAE

MITCHELLE SARABILLO PEREZ
"BING / Mitz"
Blk. 6 Lot 6 Pag-ibig Country Homes
Cat. Pequeno, Davao City
0916-543-9469

Date of Birth	:	September 28, 1978
Place of Birth	:	Davao City
Civil Status	:	Married
Spouse Name	:	Fritz B. Perez

Educational Background

Graduate Studies	:	Master of Environmental Planning University of Mindanao Ponciano Reyes St., Davao City	2008
College	:	Bachelor of Science in Biology Silliman University Dumaguete City	2000
High School	:	Assumption College of Davao J. P. Cabaguio Ave., Davao City	1994

Elementary	:	Kapt. Tomas Monteverde Sr. Central Elementary School Ponciano Reyes St., Davao City	1990

Eligibilities:

Professional Regulation Commission- Board Examination Passed
Licensure Examination for Teacher

Civil Service Professional Exam- Passed

Work Experience:

Science Research Asst.
Philippine Science High School Southern Mindanao Campus
Sto. Nino, Tugbok District, Davao City
2000-Present

Instructor I
University of Southeastern Philippines
B.O. Obrero St, Davao City
2000

Latest Trainings/Seminars Attended:

Seminar-Training on Rapid Microbiological Methods
Notre Dame of Marbel City
2002

Members of the Editorial Board

Editor in chief

Dr. Mohammad Othman Nassar, Faculty of Computer Science and Informatics, Amman Arab University for Graduate Studies,
Jordan, moanassar@aau.edu.jo , 00962788780593

Editorial Board

Prof. Dr. Felina Panas Espique, Dean at School of Teacher Education, Saint Louis University, Bonifacio St., Baguio City, Philippines.
Prof. Dr. Hye-Kyung Pang, Business Administration Department, Hallym University, Republic Of Korea.
Prof. Dr. Amer Abdulrahman Taqa, basic science Department, College of Dentistry, Mosul University, Iraq.
Prof. Dr. Abdul Haseeb Ansar, International Islamic University, Kuala Lumpur, Malaysia
Dr. kuldeep Narain Mathur, school of quantitative science, Universiti Utara, Malaysia
Dr. Zaira Wahab, Iqra University, Pakistan.
Dr. Daniela Roxana Andron, Lucian Blaga University of Sibiu, Romania.
Dr. Chandan Kumar Sarkar, IUBAT- International University of Business Agriculture and Technology, Bangladesh.
Dr. Azad Ali, Department of Zoology, B.N. College, Dhubri, India.
Dr. Narayan Ramappa Birasal, KLE Society's Gudleppa Hallikeri College Haveri (Permanently affiliated to Karnatak University Dharwad, Reaccredited by NAAC), India.
Dr. Rabindra Prasad Kayastha, Kathmandu University, Nepal.
Dr. Rasmeh Ali AlHuneiti, Brunel University, United Kingdom.
Dr. Florian Marcel Nuta, Faculty of Economics/Danubius University of Galati, Romania.
Dr. Suchismita Satapathy, School of Mechanical Engineering, KIIT University, India.
Dr. Juliana Ajdini, Department of Social Work and Social Policy, Faculty of Social Science, University of Tirana, Albania.
Dr. Arfan Yousaf, Department of Clinical Sciences, Faculty of Veterinary and Animal Sciences, PMAS-Arid Agriculture University Rawalpindi, Pakistan.
Dr. Rajamohan Natarajan, Chemical Engineering, Faculty of Engineering, Sohar university, Oman.
Dr. Tariq Javed, Lahore Pharmacy College (LMDC), University of Health Sciences, Lahore, Pakistan.
Dr. Rogers Andrew, Sokoine University of Agriculture, United Republic Of Tanzania
Dr Feras Fares, Amman Arab University for graduate studies, Jordan.

GSSRR
Global Society of Scientific Research and Researchers

IJSBAR
International Journal of Sciences: Basic and Applied Research

IJSBAR
International Journal of Sciences: Basic and Applied Research