



An examination of pollution prevention in Montana secondary agricultural education laboratories  
by Thomas Martin Bass

A thesis submitted in partial fulfillment of the requirements for the degree of Master of Science in  
Agricultural Education  
Montana State University  
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**Abstract:**

The purpose of this study is to determine what practices, in the area of pollution prevention and waste management, are being applied by Montana agricultural educators in the classroom, laboratory and field settings. When certain defined practices are not applied, barriers to implementation will be examined. Data will also be collected and analyzed regarding Montana agricultural educators' perceptions and knowledge base-concerning pollution prevention, waste management and hazardous material management.

A survey titled "Pollution Prevention in Agricultural Education Laboratories and Field Areas" was administered to 73 Montana Agricultural Education Programs, which appeared on a statewide agricultural education program directory. This study was a census of the population of Montana Agricultural Education programs. .

Subject areas examined in this study are divided into ten sections: 1) Demographic data, 2) Program information, 3) Agricultural and power mechanics laboratory, 4) Green house and farm plot, 5) Wood laboratory, 6) Metals/welding laboratory , 7) Animal confinement area, 8) Curriculum and classroom management, 9) Perceptions, 10) Barriers to Pollution Prevention.

Results of the study found that deficiencies were identified with current practices in pollution prevention and waste management by Montana agricultural educators. Lack of knowledge, or need for further education was the primary barrier to practice and improvement of pollution prevention identified by survey respondents. Agricultural educators in Montana, had positive perceptions of pollution prevention. Most agreed that agriculturalists are responsible for their own actions concerning the environment and that the actions of few can have a wide effect. It was documented that Montana agricultural educators do have a basic knowledge or awareness of pollution prevention and proper waste management.

The participants in this study indicated a need for education in pollution prevention specific to agricultural teaching laboratories and field areas. Agricultural educators in Montana are interested in pursuing this issue. Data obtained through this study may also be pertinent in other areas of vocational education where similar teaching or research facilities are maintained. Such research can also contribute to that which has already been done in other areas such as chemistry and biology education.

It is recommended that a pollution prevention education or training program, specific for agricultural education, should be developed as soon as possible. It should focus on source reduction of waste, management of unavoidable waste and consideration to proper facilities planning and management. Agricultural educators themselves should be as involved as possible in the development of pollution prevention training and education. Such information should become part of a holistic pollution prevention resource for educational institutions including all traditional, academic and vocational (agriculture included) teaching areas.

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Master of Science

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Agricultural Education

Montana State University  
Bozeman, Montana

January, 2000

N378  
B2939

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This thesis has been read by each member of the thesis committee and has been found to be satisfactory regarding content, English usage, format, citations, bibliographic style, and consistency, and is ready for submission to the College of Graduate Studies.

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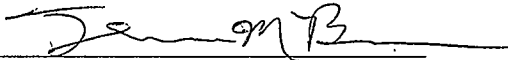
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## ACKNOWLEDGMENT

The author wishes to thank his graduate committee, Dr. Martin Frick, Chair, Dr. Van Shelhamer, and Dr. Mike Vogel. Their guidance, instruction and moral support were essential to the completion of this thesis and my entire graduate program. The author also wishes to thank the entire staff of the Montana State Extension Service Pollution Prevention Program for their technical assistance and patience throughout the development of this project. Very special thanks to Barb Planalp for all of her help on this project and her watchful eye throughout my time in this program.

The author also wishes to thank his entire family for their support in this venture and their continued encouragement over the distance. Final thanks to my friends and the people of Bozeman, who welcomed me to this community and made me feel right at home.

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## ABSTRACT

The purpose of this study is to determine what practices, in the area of pollution prevention and waste management, are being applied by Montana agricultural educators in the classroom, laboratory and field settings. When certain defined practices are not applied, barriers to implementation will be examined. Data will also be collected and analyzed regarding Montana agricultural educators' perceptions and knowledge base concerning pollution prevention, waste management and hazardous material management.

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Subject areas examined in this study are divided into ten sections: 1) Demographic data, 2) Program information, 3) Agricultural and power mechanics laboratory, 4) Green house and farm plot, 5) Wood laboratory, 6) Metals/welding laboratory, 7) Animal confinement area, 8) Curriculum and classroom management, 9) Perceptions, 10) Barriers to Pollution Prevention.

Results of the study found that deficiencies were identified with current practices in pollution prevention and waste management by Montana agricultural educators. Lack of knowledge, or need for further education was the primary barrier to practice and improvement of pollution prevention identified by survey respondents. Agricultural educators in Montana, had positive perceptions of pollution prevention. Most agreed that agriculturalists are responsible for their own actions concerning the environment and that the actions of few can have a wide effect. It was documented that Montana agricultural educators do have a basic knowledge or awareness of pollution prevention and proper waste management.

The participants in this study indicated a need for education in pollution prevention specific to agricultural teaching laboratories and field areas. Agricultural educators in Montana are interested in pursuing this issue. Data obtained through this study may also be pertinent in other areas of vocational education where similar teaching or research facilities are maintained. Such research can also contribute to that which has already been done in other areas such as chemistry and biology education.

It is recommended that a pollution prevention education or training program, specific for agricultural education, should be developed as soon as possible. It should focus on source reduction of waste, management of unavoidable waste and consideration to proper facilities planning and management. Agricultural educators themselves should be as involved as possible in the development of pollution prevention training and education. Such information should become part of a holistic pollution prevention resource for educational institutions including all traditional, academic and vocational (agriculture included) teaching areas.

## CHAPTER 1

### THE PROBLEM

#### Introduction

Environmental concern seems to be rising in our society. A quick scan of our media sources reveals that the environment is certainly a topic receiving much attention. New fields of study are dedicated to this area, and environmental issues are finding their way into our traditional subjects of study and research. All segments of society need to become more responsible in the way that they utilize resources and manage waste and potentially hazardous materials.

An important concept in the arena of environmental issues is pollution prevention, conceived in the early 1980's. This idea was born into national policy with the passing of the Pollution Prevention Act of 1990. The pure concept of pollution prevention (P2) deals with source reduction of waste, use of alternate (better for human health and the environment) products, methods and processes as well as conservation of resources. The passing of this act helped create resources for research, education, technical assistance and development of policy and legislation.

The movement to act more responsibly where issues of pollution are concerned continues. It is important that all segments of society and industry recognize their

responsibility in helping solve these problems. Through education and increased awareness, society can make pro-active decisions regarding these issues before regulatory agencies force change all at once. Williams recognized agriculture's involvement in this arena, when he stated, "Production agriculture and agribusiness industries face, as well as contribute to, environmental concerns" (1993, p. 5).

Institutions such as schools and colleges can potentially be incredible generators of waste and pollution. Many schools have begun to examine their practices and take action in acting more responsibly as a whole institution in the areas of waste reduction, waste management and hazardous material management. Educators in science, especially chemistry, are examining the way they teach and conduct laboratory experiments. They are taking steps towards decreasing health risk to students, instructors and the environment by more effective management of chemicals, potential hazards and waste.

As a part of a larger institution agricultural educators have a responsibility to do their part in improving the environmental management practices of their programs and in promoting practices that can have a great deal of influence on the very thing agriculture relies on: productive, safe, non-polluted land, water and air. Williams supported the integration of sound environmental practices and education with agricultural education in 1993 when he stated:

If agricultural educators recognize these {environmental} concerns and teach their students how to develop solutions to these problems through the application of scientific principles, then the students, the agricultural industry, and the profession of agricultural education will all benefit (p. 5).

Helping agricultural educators in Montana become better environmental stewards will first require an assessment of the perceptions about, and knowledge of pollution prevention, as well as current practices in dealing with waste and hazardous materials.

An examination of these points will allow for the development of educational programs to help agricultural educators make responsible decisions prior to regulatory government intervention, implement new waste and resource management tools, increase their personal safety and the safety of their students, pass on responsible behaviors to their students, and ultimately protect the resources upon which the entire agricultural industry is reliant. Bogo (1999), quoted former Tufts University dean, Anthony Cortese as saying, "If the students are learning in class about the environment and how to act responsibly, and the university through its buildings, its operations and investments is unsustainable, then they are sending a very subtle but effective message that says 'do what I say, not what I do', practicing what they preach is extremely important" (p. 39). This idea also holds true in the high school setting, especially for agricultural education.

#### Statement of Purpose

The purpose of this study was to determine what practices, in the area of pollution prevention, are being applied by Montana agricultural educators in the classroom, laboratory and field settings. When certain defined practices were not applied, barriers to implementation were examined. Data was collected and analyzed regarding Montana

agricultural educators' perceptions and knowledge base concerning pollution prevention, waste management and hazardous material management.

### Need for Study

The following statement, published by the United States Environmental Protection Agency (EPA, 1990), sums up the multifaceted importance of practicing and teaching pollution prevention in educational settings.

Reduction of pollutant emissions associated with research and educational activities is an important objective consistent with traditional environmental policy. More significantly, however, the adoption of waste minimization by the research and educational community carries with it a tremendous potential for designing pollution out of future industrial (or agricultural) processes right in the lab. Waste minimization awareness can also be instilled and propagated by educational institutions, so that today's students and tomorrow's professionals can apply pollution prevention in their endeavors. Hence the importance of instituting pollution prevention within research and educational organizations cannot be overstated (p. 1).

The previous quote gives reasons why implementation of these concepts are important, but does not convey the need for research. Research is needed.

Implementation or further development of practices cannot occur without an assessment of current practices, barriers to implementation and general knowledge about the subject.

The role of agricultural educators in the area of pollution prevention, waste management and hazardous material management has not been examined well at all. Of 853 articles published in the Journal of Agricultural Education and papers presented at the National Agricultural Education Research Meetings from 1986 to 1996, only 18 dealt

with what was categorized as “environmental” issues (Radhakrishna and Xu, 1997). That means only two percent of published research in these two venues were dedicated to environmental issues. Within this two percent, many papers dealt with sustainable agriculture and organic farming. Research on pollution prevention within the realm of agricultural education is non-existent. Radhakrishna and Xu described environmental and sustainable agriculture topics as “emerging topics” (1997). Researching issues in pollution prevention as it pertains to agricultural education and agricultural teaching laboratories will fill a current void. A baseline of pollution prevention information gathered from agricultural educators will provide a platform from which future research and education can be developed. An initial area of priority can be identified and efficient progress can be made toward improving the perceptions, level of knowledge and practices of pollution prevention by agricultural educators.

### Objectives

The following objectives are put forth, in order to fulfill the purpose of this study:

- (1) To determine Montana agricultural educators’ current practices in pollution prevention;
- (2) To identify barriers to implementation of practices in pollution prevention by Montana agricultural educators;
- (3) To determine Montana agricultural educators’ perceptions of pollution prevention;
- (4) To determine Montana agricultural educators’ level of knowledge of pollution prevention.

Definitions

Pollution Prevention (P2) - an activity that relies on source reduction of pollutants. P2

stands above recycling, treatment, and disposal in a waste management hierarchy.

P2 is not limited to, but may include the following concepts: waste reduction, reuse and in-house recycling of materials, water conservation, energy conservation and hazardous material substitution. Under P2 one waste stream cannot be turned into another (Peaks to Prairies P2 Information Center 1999). In the context of this study, pollution prevention is used as an umbrella term, including waste management and recycling. This was done for the sake of brevity in the survey instrument and to keep new terms and concepts as simple as possible for the study population. It should be realized that there is a distinct difference between pollution prevention, waste management, and issues regarding environmental compliance.

Waste - surplus, unusable or byproduct materials.

Waste Management - methods of recycling, treating or disposing of waste and surplus materials after they are generated or accrued.

Hazardous Materials - materials which may possess personal health or environmental hazards; material requiring special management to prevent danger to persons, animals or the environment.

### Assumptions

Pollution prevention is necessary to provide a safe learning environment and to sustain and protect natural resources involved in agriculture. The researcher's beliefs account for the following assumptions:

- 1) Waste and potential pollutants result from certain activities in agricultural education;
- 2) Increased awareness of concepts in pollution prevention by educators will contribute to increased awareness in students;
- 3) Proper management of waste and hazardous materials will provide a safer learning environment for educators and students;
- 4) Pollution prevention in the setting of agricultural education laboratories and other facilities can impact the environment outside of that setting;

### Limitations

› The following limitations exist for this study:

- 1) The survey population will be limited to agricultural educators in the state of Montana's Public School System employed during the 1999-2000 school year;
- 2) Pollution prevention was primarily examined in laboratory and field activity settings, curriculum only received brief attention;
- 3) The survey was administered in the month of October 1999.

## CHAPTER 2

### REVIEW OF LITERATURE

While there is little to no research on pollution prevention, waste management and hazardous material management related to agricultural education in secondary schools, there are resources from parallel fields that provide insight into how these topics are pertinent to agricultural education. Traditional science education, predominantly chemistry and biology, has begun to recognize the need to control wastes that result from the educational process of conducting laboratory experiments and demonstrations. On an industrial scale, the activities that make up most of agricultural education's laboratory and field projects have been studied in relation to their human health and environmental impacts.

Collins (1995) introduced the need for pollution prevention and waste management in the field of chemistry education and research when he stated that, "concern for the environment has become an important factor in developments in science and technology (p. 965)." The term "green chemistry" has been used for several years now. This term, or related terms such as "primary prevention" and "environmentally benign chemistry" deal with the idea that activities in chemistry education and research that are potentially harmful to the environment can be substituted with less polluting or

non-polluting alternatives (Collins, 1995). Collins stated that green chemistry is the most widely used, and offers the strongest description of the concepts involved (1995).

Comparisons can be made between the defense of green chemistry offered by Collins and the need for pollution prevention and waste management in agricultural education. Collins (1995) stated that:

The idea of green chemistry has an energy that properly belongs in university research laboratories and classrooms where it can be nurtured in the most positive way. It presents academic chemists with an opportunity to develop a new and optimistic way of looking at chemistry and planning to contribute to it's future (p. 965).

Integrating practices of pollution prevention into agricultural education allows educators and students alike to look at agriculture with a new perspective and contribute to its future.

One could argue that pollution prevention should be easier to integrate in agricultural education than other fields. Swan and Spiro (1995) stated that, "environmental issues and standard chemistry curriculum do not always map onto one another exactly" (p. 967). The authors describe difficulty experienced by chemistry educators in meshing the two topics. Agriculture and the environment are very integrated. Agricultural educators and students already have an idea of how the two are related. In a survey conducted on the impacts of sustainable agriculture, agricultural educators and students recognized that sustainable agricultural practices involved or contributed to the following: better conservation of soil, greater management requirements, reduced use of chemicals, protection of groundwater, safer food and

protection of wildlife and woodlands (Williams and Wise, 1997). Such realistic associations between agriculture and the environment by educators and students are a positive sign that barriers experienced in chemistry environmental education may not be as heavily encountered.

Disappointed by low awareness of agriculture and the food and fiber systems by elementary students, several entities in the state of Ohio developed AgVenture Magazine, a teaching tool for use in elementary education (primarily fourth grade) (Swortzel, 1997). The purpose of AgVenture Magazine was to provide a tool to be used across all subject matters that would increase the awareness of agriculture and the methods by which we get our food, clothes and many raw materials by elementary students. Swortzel examined how elementary teachers integrated this magazine into other subject areas; he found that while the most use of AgVenture Magazine was in social studies, the second most popular use of the magazine was in education on environmental issues (1997). The margin of environmental issues over third placing general science was 11%; social studies led environmental issues by 13% (Swortzel, 1997). When left to their own recognizance, non-ag elementary teachers recognized the important relation between agriculture and the environment.

Agricultural educators maintain a variety of teaching laboratories to help fulfill the objectives set forth in their curriculums. Some areas of study defined in the Montana Agricultural Education Curriculum that may contain laboratory sections include the following: animal husbandry, metallurgy, crop production, horticulture, internal combustion engines, hydraulics (transmission of power), material fabrication and repair,

equipment maintenance and management and agricultural construction (MSU-AgEd, 1994). The labs associated with the previously listed areas of study can produce the same wastes that their larger scale counterparts in industry and production agriculture. Along with many other subject areas, agricultural education has already been identified as producing hazardous waste through its teaching activities (EPA, 1990).

The United States EPA published a Pollution Prevention guide for research and educational institutions in 1990. Within this document waste streams from a variety of educational activities were identified. Subjects, which may commonly be included in an agricultural education curriculum, that were recognized as potentially producing waste or hazardous materials included the following: (broad) agriculture, horticulture/landscaping, woodworking, metalworking, welding, auto mechanics, masonry and machine shop (EPA, 1990). Although not an exhaustive list of potential problem materials, the following wastes were identified as coming from the previously mentioned subject activities: pesticides, fertilizers, stains, solvents, wood preservatives, paints, metal dust, metal waste, de-greasing solvents, oil, grease, batteries, acids, alkaline wastes, and stripping and cleaning solutions (EPA, 1990).

Many wastes pose an immediate personal health threat through poor handling before their disposal or spillage may cause an environmental one. Rein stated, "Perhaps more than any other occupational group, agricultural workers are exposed to a tremendous variety of environmental hazards that are potentially harmful to their health and well being" (1992, p. 1). The environment referred to here is the work environment; within this environment potential hazards include: respiratory hazards, noise, skin

disorders, cancers, chemical hazards and heat stress (Rein, 1992). Chemical and noise hazards in the work environment not only pose threats to human health, but to the greater environment as well. Respiratory hazards, skin disorders, cancers and chemical hazards can all be related to how waste and hazardous materials are managed, stored, handled and transported.

The most widely recommended method in dealing with pollutants, waste and hazardous materials is source reduction. This is a means of reducing the amount of waste and surplus material generated, limiting possession of hazardous materials to minimum amounts needed. In its plan for waste management in schools, the Massachusetts Department of Environmental Management (MDEM) recommended examining an institution's or program's purchasing strategies (MDEM, 1988). Amounts of material that are hazardous or may be difficult to dispose of should be purchased only as needed and gross surplus avoided. MDEM (1988) continued by also recommending the practice of maintaining detailed inventories of chemicals and stored waste, proper storage facilities that comply with regulation, and utilizing disposal or transportation methods that are most economical, such as "milk-run" shipments. A "milk-run" shipment utilizes small collections from several sources in an area, all of which share shipping costs. Also related, periodic community collections of certain materials may also prove to be cost effective. Continuous disposal and recycling options exist for many common wastes.

The automotive repair and maintenance industry and day to day machinery operation in agricultural production can generate a great deal waste. Engine fluid wastes such as engine oil, transmission fluid, gasoline, diesel, solvents and cleaners, brake fluid

and hydraulic oil can be generated. The importance of proper management of used engine fluids is supported by the following statements:

- 1) One gallon of used oil, the oil from a single oil change, can render 1 million gallons of water undrinkable;
- 2) Oil concentrations as small as 50 to 100 parts per million in a sewage treatment system can foul the treatment process;
- 3) Concentrations as low as 310 parts per million of oil can cause serious long term effects to freshwater fish species (EPA 1994, p. 4).

A great need exists for proper engine fluid management along the entire spectrum of waste generators, from the "do-it-your-selfer", to the mechanics teaching lab, and finally large agricultural operations and commercial auto repair businesses.

Many agricultural education programs maintain greenhouses and small farm plots. These teaching labs raise the same concerns one would find with their respective larger industries of horticulture and major crop production. Latimer et al. (1996) reported the nursery industry is the second greatest consumer of insecticides, and runoff water from greenhouses and nurseries has been the subject of discussion on new regulations. Two impediments to pollution prevention, with respect to conventional pesticide use in the horticulture industry, stated by Latimer, et. al. (1996) were "lack of sufficient educational or resource information for users on potential or available alternatives, and lack of funding for educating the users on the implementation of alternatives" (p.121-122).

Risse (1998) reported that "the most common environmental pollutants from crop production are sediment, nutrients and pesticides" (p. 37). These pollutants are produced

on incredible scales in production agriculture, but management in smaller scale operations, such as teaching labs, is just as important. The University of Florida has been involved in a study that assessed pesticide contamination at agricultural research universities (Thomas, 1994). In the study, 49 pesticide mixing and loading sites at research universities were tested for pesticide contamination. Thomas (1994) reported that, "seventy-eight percent of these sites were found to have soil or ground water pesticide levels which exceed one or more recommended action levels. Many also exceeded allowable levels under federal and or state hazardous waste regulations" (p. 203). In the case of agricultural chemical contamination, the problem has already been identified in the teaching/research arena.

The residential construction industry in America is making efforts to become more environmentally responsible with initiatives in waste reduction and resource management. McStain Enterprises, a Denver based construction firm promotes practices that reduce the impact on diminishing wood and other natural resources (Fanjoy, 1999). "Much of the program [McStain's Built Green Program] involves the use of recycled and engineered building products" (Fanjoy, 1999, p. 87). Concepts of wood resource conservation should also be understood in the agricultural and vocational wood/construction laboratory setting.

Pollution prevention is also needed wherever agricultural animals are maintained; large scale animal confinement operations undergo a great deal of scrutiny concerning environmental impact. Risse (1995) stated that, "Although problems associated with small scale, agricultural livestock production do not receive as much attention as larger

operations, small operations can have a substantial impact on rural environmental quality” (p. 1). Even maintaining a few animals in the teaching field area or laboratory carries with it responsibilities related to environmental concerns.

Agricultural teaching laboratories mimic different activities and components of the previously mentioned industrial and production agricultural situations. The same environmental concerns raised there, should also remain in the scaled down activities associated with agricultural and vocational education. It has already been shown that the chemistry and biology teaching laboratories are potential sources of hazardous waste and pollutants. All of this information may be used to facilitate environmental assessment of agricultural teaching laboratories and field areas.

## CHAPTER 3

### METHODOLOGY

The following methods were used to meet the objectives of this study. They are described within this chapter in four sections: 1) Population Description, 2) Instrument Design, 3) Data Collection Methods, and 4) Data Analysis Procedures.

This was a descriptive research study to determine the current practices in pollution prevention conducted by Montana agricultural educators in secondary schools, as well as to determine barriers preventing these educators from engaging in pollution prevention. Measurements related to perceptions and knowledge on the subject possessed by agricultural educators were also made.

#### Population Description

Potential individuals for the study population were identified through the Directory of Montana Agricultural Educators, maintained by the Agricultural Education Program at Montana State University. Seventy-three programs were listed in the roster updated fall of 1999. For programs with multiple teachers, all were included on the address. Potential participants were contacted by postcard prior to inclusion in the survey mailing. Every program on the roster was included in the mailing, therefore this was a census and all agricultural education programs at secondary schools in Montana could

participate. A study proposal was sent to the president of the Montana Vocational Agriculture Teachers Association. As a representative of many of the agricultural educators in Montana, this person was considered by the researcher to possess valid opinions concerning the proposed research population. Positive comments were received concerning the general project idea as well as the speculated acceptance by agricultural educators in Montana. The population included in the study was limited to individuals meeting the following criteria:

1. Those employed as agricultural educators in Montana secondary schools in the school year 1999-2000.
2. Those educators listed, by their program/school name on the Directory of Montana Agricultural Educators updated fall of 1999.

#### Instrument Design

The research instrument was a survey constructed with partial adherence to the Total Design Method (TDM) published by Dillman (1978). The survey instrument is a collection of questions which were developed from review of related literature, expert advice and prior use in other related surveys or audits. A brief demographic questionnaire, one question on curriculum and a single question related to the EcoStar award program sponsored by the Montana State University Extension Service made up a small portion of the survey. The remainder of the survey deals directly with this study's objectives. Other than demographic information, anonymity was protected. There were

no distinguishing features on the survey instruments which could lead to identification of participants upon return. Identification of participants by name was solely voluntary.

The survey was constructed with a combination of questions using three and five point Likert-type scales, nominal scale and open ended format. Question format was chosen on appropriateness for the type of answer desired and to maintain the highest instrument validity. Further comments were encouraged at the end of the survey on any related topic or issue. These comments are provided in Appendix D.

A pilot test of the survey was conducted. Twenty surveys were sent out to technology education instructors in Montana secondary schools. While this audience did not maintain all of the same teaching laboratories, many similarities did exist. This audience was encouraged to evaluate the survey for content and face validity. A survey draft was also administered to an expert panel, composed of a subject matter specialists, and two agricultural education professors (university level). Appropriate adjustments were made to the instrument in accordance with comments made by pilot audience and expert panel.

A Cronbach's Alpha-Reliability Analysis was conducted using all Likert-type scale questions in the survey instrument on the final data. "For research purposes, a useful rule of thumb is that reliability should be at least .70 and preferably higher" (Franken and Wallen, 1996 p. 163). The Cronbach's Alpha-Reliability coefficient rating for this instrument was .78, therefore the overall reliability of the survey was acceptable.

### Data Collection Methods

The data for this study was collected using a mailed survey instrument. Dillman's TDM was considered while designing the following mailing timetable:

- 1) October 12, 1999-pre-survey postcard sent (Appendix A);
- 2) October 15, 1999-1<sup>st</sup> cover letter and survey sent (Appendix B);
- 3) October 22, 1999- reminder announcement at Montana Vocational Agriculture Educators Conference made; and
- 4) November 2, 1999- reminder postcard sent and electronic reminder on Met-Net made (Appendix C).

As stated earlier, a total of 73 surveys were mailed to agricultural educators in Montana secondary schools. A cover letter accompanied the survey instrument (Appendix B). The survey was designed to be a self mailer for return. Postage was provided for the respondent. Data from returned surveys was manually entered into Microsoft® Excel®. Comments and answers to open ended questions were typed in Corel® Word Perfect® and are available in Appendix D. All spreadsheets were prepared for presentation in table form.

A final response rate of 56.2% was obtained, a full explanation of this data is available in Chapter 4 and also described in Table 1. Two additional surveys were received after data analysis was complete and narration was near final draft. They are not included in the data reported here. Dillman (1978) finds that, "there is almost no difference in response rates for various lengths below 12 pages, or about 125 items. However beyond that length, the response rates decline to an average of 65%" (p.27).

The length of this survey hovered around this barrier and it may or may not have been a factor in response rate. It is believed that surveys within special audiences should receive higher response rates (Dillman, 1978). However, other factors may contribute to reduced rate. It was the researcher's belief that sensitive subject matter and fear of self-incrimination was a contributing factor to a response rate less than that projected by Dillman. Time constraints upon the researcher, as well as financial limitations contributed to the need to modify Dillman's method and ability to do further follow-up.

#### Data Analysis Procedures

Data analysis was conducted using Microsoft® Excel® and SPSS® statistical software. Expert guidance was sought during statistical analysis of the data. Early and late respondents were examined for statistical difference by a t-test and Mann-Whitney U test. Gall, Borg, and Gall (1996) stated that, "If you are concerned about score distributions of your data, you should consider doing both a t-test and its non-parametric counterpart, either the Mann-Whitney U test or the Wilcoxon signed rank test" (p. 390). The hypothesis that there would be no difference between the two groups was accepted, as no significant differences were found at the .05 level. Late responders were combined with early responders for the remaining data analysis. Response frequencies for all survey questions were calculated in Excel® spreadsheets, tables and figures were prepared in Corel® Word Perfect®, and statistical analysis on early and late respondents was done in SPSS®.

## CHAPTER 4

### RESULTS OF THE STUDY

The study was designed to identify Montana agricultural educators' level of awareness and level of knowledge of pollution prevention, as well as to measure the frequency of certain practices in pollution prevention. The study hoped to also identify barriers to implementation of practices in pollution prevention and measure the perceptions of pollution prevention and the environment held by Montana agricultural educators. The results of this study are divided into ten sections: 1) Demographic data, 2) Program information, 3) Agricultural and power mechanics laboratory, 4) Green house and farm plot, 5) Wood laboratory, 6) Metals/welding laboratory, 7) Animal confinement area, 8) Curriculum and classroom management, 9) Perceptions, and 10) Barriers to Pollution Prevention.

Since not all total respondents answered each section of the survey, percentages throughout the results are representative only of the frequencies of a response to that single question alone. The total number of responses for each question is listed under "Frequency, Total" for that question in the table, or below the table when indicated by an asterisk. In Table 5, these responses to a question in a section exceed the frequency listed for that section; it is assumed that some teaching activities may take place although a full laboratory for such activities may not exist. Due to the sensitive nature of this survey,

and the perception by the population that some answers may be incriminating, anonymity was protected. This issue also may have led respondents to omit certain demographic data which they felt may lead to their identification. All respondents' answers to open ended questions are available in Appendix D.

### Demographic Data

Seventy-three surveys were mailed to agricultural education programs identified in Directory of Montana Agricultural Educators. All surveys were assumed to be delivered correctly; none were returned due to postal problems. Three requests were made to receive second copies because the original survey was lost by the potential respondent.

Table 1 represents the return rate of surveys over the study period. Eighteen surveys were returned within a week of the initial mailing, for a response rate of 24.7%. A verbal reminder was given at the MVATA meeting in Butte, Montana on October 22, 1999. Approximately 40 teachers were present at this meeting. The eight surveys returned between the MVATA meeting and the mailing of the reminder postcard on November 2, 1999, represent 10.9% of the total returned. Consideration was made in the return period for the occurrence of the National FFA Convention in Louisville, Kentucky October 25-31, 1999. A large majority of the survey population attended this event, therefore disrupting the survey period. On November 2, 1999 a reminder postcard was mailed to encourage those who had not returned their survey to do so. Four surveys were returned between the mailing of the postcard and the cut-off date of November 9, 1999.

They represent 5.5% of the total return. Eleven more surveys, representing 15.1% of the total were returned after November 9, 1999. Late responses were not found to be statistically different from the original responses, by a t-test and Mann Whitney U test, and all were grouped together for a final response rate of 56.2%.

Table 1. Survey responses over time.

	Date	n	Returned	Percent
After 1st mailing	10/15/99	73	18	24.7
After MVATA reminder	10/22/99	---	8	10.9
After reminder postcard	11/02/99	---	4	5.5
After late response date	11/09/99	---	11	15.1
Total			41	56.2

Data in Table 2, and Figure 1 depict the age and gender of survey respondents. Seven (17.1%) respondents were within the age range 21-25, 1 (2.4%) respondent 26-30, 5 (12.2%) in the range 31-35, 8 (19.5%) in 36-40, five (12.2%) in 41-45, 10 (24.4%) in 46-50, 4 (9.8%) indicated to be between 51 and 55, no respondents were above 55, and 1 (2.4%) respondent did not indicate his age or gender. Thirty-seven (90.2%) respondents indicated they were male, 3 (7.3%) indicated they were female, and 1 (2.5%) did not answer this question.

Table 2. Age group distribution of survey respondents.

Age group (years)	Frequency	Percent
21-25	7	17.1
26-30	1	2.4
31-35	5	12.2
36-40	8	19.5
41-45	5	12.2
46-50	10	24.4
51-55	4	9.8
56+	0	0.0
No response	1	2.4
Total	41	100.00

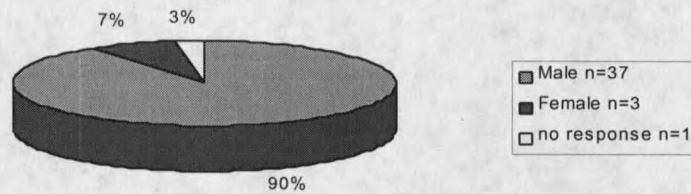


Figure 1.

Gender composition of survey respondents.

The level of education attained by survey respondents was collected and reported in Figure 2. Twenty (48.8%) respondents have acquired a bachelors degree. Eleven (26.8%) have completed some graduate work and 10 (24.4%), have completed studies to the masters level. No respondents (0.0%) have completed doctoral studies.

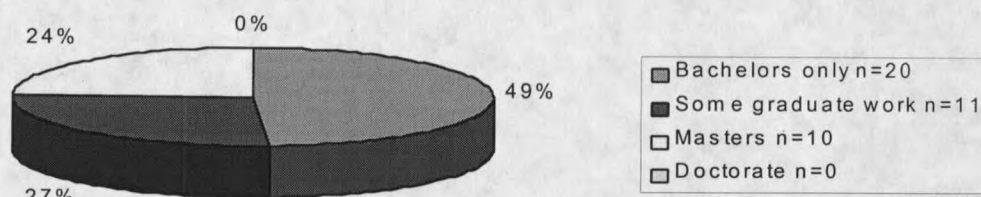


Figure 2. Level of education attained by survey respondents.

Table 3 data represents the occurrence of pollution prevention training during the career of survey respondents. Nine (21.9%) reported to have received some sort of pollution prevention training during college while 32 (78.1%) respondents did not receive any. Eleven (27.5%) respondents indicated they had received some sort of pollution prevention training during in-service training updates. Twenty-nine (72.5%) have never received pollution prevention training at in-service updates.

Table 3. Occurrence of Pollution Prevention training in college or in-service updates.

Training received	In college		At in-service updates	
	Frequency	Percent	Frequency	Percent
Yes	9	21.9	11	27.5
No	32	78.1	29	72.5
Total	41	100.00	40	100.00

Respondents were asked to indicate the number of years they had been teaching. Table 4 represents all responses to this question divided into groups. The actual mean number of years teaching is 13.3 based on each individual numerical response. Eleven

(26.8%) respondents had been teaching 5 or less years, 6 (14.6%) had 6-10 years experience, 6 (14.6%) more were found to have 11-15 years experience, 8 (19.5%) with 16-20, 7 (17.1%) with 21-25, 2 (5.0%) with 26-30, and 1 (2.4%) respondent with 31 or more years of teaching experience.

Table 4. Teaching experience of survey respondents in years, organized into categories.\*

Experience group (years)	Frequency	Percent
0-5	11	26.8
6-10	6	14.6
11-15	6	14.6
16-20	8	19.5
21-25	7	17.1
26-30	2	5.0
31+	1	2.4
Total	41	100.00

\* mean calculated by actual year responses = 13.3

#### Program Information

Information pertaining to the size and focus of the teaching programs of all respondents is included in this section. Tables 5 identifies the teaching laboratory areas maintained by survey respondents as well as the amount of usage each laboratory area receives. Thirty-nine (95.1%) mechanics laboratories were identified out of 41 responses. Thirty-seven (90.2%) respondents operated a metals/welding laboratory, 29 (70.1%) a wood laboratory, 22 (53.6%) respondents maintained greenhouses or farm/garden plots, 3 (7.3%) animal confinement areas and 2 (4.8%) indicated other areas were maintained (see

Appendix D for comments on other). A total of 132 teaching laboratory areas were maintained. The researcher assumed that some activities associated with certain laboratory areas may still be practiced even though that laboratory area is not officially maintained. Teachers were asked to identify which areas were used the most, the results are as follows, based on the number of times a laboratory area was ranked first (percentages are only of those who possess such a laboratory area): metals/welding laboratory ranked first 20 (54.1%) times, mechanics laboratory ranked first 12 (30.8%) times, wood laboratory and green house/farm plot were both ranked first 5 (17.2% and 22.7% respectively) times each, animal confinement area received 3 (100.0%) first place rankings and "other" received no (0.0%) first place rankings. For further explanation to the percentages listed above and in column five of Table 5 use this example, "54.1% of those respondents who maintain a metals lab use it the most."

Table 5. Frequency of occurrence and level of use of specific laboratory areas maintained by respondents.

Laboratory Area	Occurrence		Level of Use	
	Frequency	Percent*	Frequency	Percent*
Metals/welding	37	90.2	20	54.1
Ag/power mechanics	39	95.1	12	30.8
Wood	29	70.1	5	17.2
Green house/garden or farm plot	22	53.6	5	22.7
Animal confinement or pasture	3	7.3	3	100.00
Other	2	4.8	0	0.0
Total	132	N/A	N/A	N/A

\* Percentage based on 41 respondents to entire survey

\*\* Percentage based on number of times ranked first by those who maintain such an area

Table 6 describes the number of students in respondents' programs. Actual number of students was indicated on returned surveys, however data is grouped into categories. Four (10.5%) programs had 30 or less students, 10 (26.3%) had 31-50, 11 (28.9%) had 51-70, 6 (15.8%) had 71-90, 2 (5.3%) had 91-110 and 5 respondents (13.2%) had 111 or more students in their program. The actual mean number of students calculated from individual responses was 70.35.

Table 6. Size of programs by number of students.\*

Number of students in program	Frequency	Percent
1-30	4	10.5
31-50	10	26.3
51-70	11	28.9
71-90	6	15.8
91-110	2	5.3
111+	5	13.2
Total	38	100.00

\*mean calculated by actual number of students = 70.35

#### Agricultural or Power Mechanics Laboratory Area

Thirty-nine respondents answered questions in this section. They identified a variety of wastes generated through the activities of their agricultural or power mechanics laboratory. Four wastes were generated by over fifty percent of respondents; they are as follows: Oil frequency =35 (89.7%), Used oil filters frequency =33 (84.6%), Cleaning solvents frequency =27 (69.2%) and Antifreeze frequency =24 (61.5%). Waste diesel or gasoline was acquired by 18 (46.1%) respondents and waste transmission fluid was

acquired by 17 (43.5%) respondents. Wastes acquired by the smallest amount of respondents were: Batteries frequency =9 (23.0%), Brake fluid frequency =8 (20.5%), Tires frequency =5 (12.8%) and other waste frequency =2 (5.1%). Please see Appendix D for comments related to "Other". Table 7 also describes this data.

Table 7. Number of programs who acquire the following wastes through teaching activities in agricultural or power mechanics laboratories.\*

Type of waste	frequency	percent
Oil (O)	35	89.7
Used oil filters (OF)	33	84.6
Cleaning solvents (CS)	27	69.2
Anti-freeze (AF)	24	61.5
Diesel or gasoline (D or G)	18	46.1
Transmission Fluid (TF)	17	43.5
Batteries (B)	9	23.0
Brake fluid (BF)	8	20.5
Tires (T)	5	12.8
Other	2	5.1

\* Percentage of agricultural or power mechanics laboratories acquiring said waste based on 39 respondents to this portion of the survey.

Respondents of this section were asked to first indicate their level of awareness of recycling options and best disposal methods for the wastes identified in Table 7, and then to indicate how often those options and methods are utilized or practiced.. Table 8 indicates responses to these questions with wastes being divided into two categories. Oil, transmission fluid, anti-freeze, brake fluid, diesel or gas and cleaning solvents were grouped together as engine fluid wastes. Out of 35 respondents to this question, 5 (14.3%) indicated they were very aware of recycling and best disposal methods for these

wastes, 19 (54.3) said they were aware, and 11 (31.4%) were not aware. When asked if they practiced recycling or best disposal methods, 9 (25.7%) answered "Always", 17 (48.6%) answered "Mostly", 8 (22.9%) "Seldom", and only 1 (2.8%) never practiced recycling or best disposal methods.

Awareness of recycling options and best disposal methods were not high with solid waste associated with the mechanics laboratory (batteries, tires and oil filters, and other). Six (17.6%) respondents out of 34 indicated they were very aware, 16 (47.1%) aware, and 12 (35.3%) said they were not aware of recycling options or best disposal methods for such waste. Level of practice of recycling options and best disposal methods for these waste, also noted in Table 8, is as follows: 7 (20.5%) respondents answered that they always practiced said options and methods, 11 (32.4%) "Mostly", 11 (32.4%) "Seldom", and 5 (14.7%) indicated "Never".

Table 8. Level of awareness and practice of recycling options and best disposal methods for previously mentioned wastes in agricultural/power mechanics laboratories.

Level of awareness	Type of waste			
	O, TF, AF, BF, D or G, CS * (fluids)		B, T, OF, Other (solids)	
	Frequency	Percent	Frequency	Percent
very aware	5	14.3	6	17.6
aware	19	54.3	16	47.1
not aware	11	31.4	12	35.3
Total	35	100.00	34	100.00
Level of practice	Frequency	Percent	Frequency	Percent
always	9	25.7	7	20.5
mostly	17	48.6	11	32.4
seldom	8	22.9	11	32.4
never	1	2.8	5	14.7
Total	35	100.00	34	100.00

\* See Table 7 for explanation of abbreviations.

Where engine fluid wastes were concerned, respondents were asked to indicate whether they practiced safe storage techniques and utilized spill containment methods. The following data is also available in Table 9. Of 35 respondents to these questions, 32 (91.4%) indicated that they used sealed containers or spill prevention in storage areas. Three (8.6%) respondents indicated that they did not. Only 16 (45.7%) respondents indicated some sort of spill containment method was used in the work area, the remaining 19 (54.3%) indicated that no such methods were used.

Table 9. Practice of safe storage methods and spill containment for engine fluid wastes.

	Use of sealed containers and spill prevention in storage area		Use of spill prevention and spill containment in work area	
	Frequency	Percent	Frequency	Percent
Yes	32	91.4	16	45.7
No	3	8.6	19	54.3
Total	35	100.00	35	100.00

#### Green House and/or Farm Plot

Respondents answered a bank of questions related to storage methods and practices of pesticides and agricultural chemicals. Data related to these questions is presented in Table 10. Twelve of 21 (57.1%) respondents maintain an inventory of pesticides on school property, while the remaining 9 (42.9%) did not. Eighteen of 20 (90.0%) respondents maintain this inventory in a secure area, safe from water penetration, while 2 (10.0%) did not. Seventeen of 20 (85.0%) indicated that their pesticides were well labeled and identified, while three (15.0%) indicated otherwise. Of 16 respondents to the question concerning routine calibration of spraying equipment, 10 (62.5%) indicated that they regularly calibrated sprayers, while 6 (37.5%) indicated they did not engage in such activity.

Table 10. Occurrence of proper practices in pesticide storage, and handling in greenhouses and/or farm plots.

	Pesticide inventory maintained on property		Use secure storage area safe from water penetration		Pesticides well labeled and identified		Regular calibration of sprayers	
	Freq.	Percent	Freq.	Percent	Freq.	Percent	Freq.	Percent
Yes	12	57.1	18	90.0	17	85.0	10	62.5
No	9	42.9	2	10.0	3	15.0	6	37.5
Total	21	100.00	20	100.00	20	100.00	16	100.00

Further questioning into proper pesticide application and handling techniques revealed (also shown in Table 11) that out of 21 respondents, 8 (38.1%) always applied pesticides to deal with targeted organisms, 8 (38.1%) mostly followed this trend, while 4 (19.0%) seldom did and 1 (4.8%) never applied pesticides for target organisms only. Of 21 respondents, 13 (61.9%) indicated that they always followed recommended application rates, 8 (38.1%) indicated they mostly followed recommended application rates and no one answered seldom or never. When asked if pesticides were mixed on a pad that would contain spills and prevent contamination of soils or water resources, 5 out of 19 (26.3%) indicated they always used such an area for mixing, 6 (31.6%) mostly did, 6 (31.6%) more indicated they seldom use of such an area, and 2 (10.5%) never.

Table 11. Level of practice of proper pesticide application and handling techniques.

Level of practice	Apply for target organisms only		Follow recommended application rates		Use spill containment measures while mixing	
	Frequency	Percent	Frequency	Percent	Frequency	Percent
Always	8	38.1	13	61.9	5	26.3
Mostly	8	38.1	8	38.1	6	31.6
Seldom	4	19.0	0	0.0	6	31.6
Never	1	4.8	0	0.0	2	10.5
Total	21	100.00	21	100.00	19	100.00

Twenty-one persons responded to the question concerning the use of personnel safety measures, such as clothing, gloves, and eye wear. Table 12 describes this data. Of those 21 respondents, 12 (57.1%) always made use of such measures, 7 (33.3%) mostly did, 2 (9.6 %) seldom took such measures, and no one indicated never. Sixteen of 31 (51.6%) respondents always store chemicals in original containers, 14 (45.2%) answered mostly, no respondent indicated seldom, while 1 (3.2%) indicated chemicals were never stored in original containers. None of 21 respondents indicated that they always compost old plant material, 8 (38.1%) indicated they mostly did, 9 (42.9%) indicated they seldom did, and 4 (19.0%) never composted old plant material.

Table 12. Level of practice of recommended techniques related to agricultural chemical safety, storage and alternative techniques (compost).

Level of practice	Take recommended personal safety measures (clothing, gloves, eye wear)		Store chemicals in original containers		Use old plant material for compost	
	Freq.	Percent	Freq.	Percent	Freq.	Percent
always	12	57.1	16	51.6	0	0.0
mostly	7	33.3	14	45.2	8	38.1
seldom	2	9.6	0	0.0	9	42.9
never	0	0.0	1	3.2	4	19.0
Total	21	100.00	31	100.00	21	100.00

Two questions were asked concerning the awareness of water run-off from greenhouses or farm plots and the potential threat posed to water sources and those results are indicated in Table 13. Of 20 respondents, 14 indicated that they were aware of the run-off patterns from their green houses or plots, while 6 were not aware. Two of 20 (10%) respondents indicated that the run-off from their greenhouses or farm plots could immediately threaten water sources, while 18 (90%) were sure run-off could not threaten water sources.

Table 13. Awareness of basic water run-off patterns in the vicinity of green house and/or farm plots.

	Aware of water run-off pattern from greenhouse or farm plot		Run-off immediately threatens water source	
	Frequency	Percent	Frequency	Percent
Yes	14	70.0	2	10.0
No	6	30.0	18	90.0
Total	20	100.00	20	100.00

Twenty respondents answered the first question concerning awareness of recycling options and proper disposal methods for agricultural chemical containers (see Table 14). Three (15.0%) respondents indicated they very aware of such options and methods, 13 (65%) indicated they were just aware, and 4 (20%) were not aware. Three respondents of 21 (14.3%) indicated they always recycled or properly disposed of chemical containers, 10 (47.6%) mostly used such options or methods, 5 (23.8%) indicated seldom, and 3 (14.3%) indicated recycling options or proper disposal methods were never used.

Table 14. Level of awareness and practice of recycling and proper techniques in agricultural chemical and chemical container disposal.

Recycling options and proper disposal methods for agricultural chemicals and empty chemical containers		
Level of awareness	Frequency	Percent
very aware	3	15.0
aware	13	65.0
not aware	4	20.0
Total	20	100.00
Level of practice/use	Frequency	Percent
always	3	14.3
mostly	10	47.6
seldom	5	23.8
never	3	14.3
Total	21	100.00

Wood Laboratory

The following data is also available in Tables 15 and 16. All 30 (100.0%) respondents to the wood laboratories section of the survey indicated that they had surplus paint in their laboratories, 25 (83.3%) indicated that possessed surplus stains, 23 (76.6%) possessed surplus solvents and strippers, and 3 (10.0%) indicated that they also possessed other similar materials. Thirty-four responses were made for the question concerning storage of the previously mention wood finishing chemicals on site. Thirty-three respondents (97.0%) indicated that they did store such chemicals, while 1 (3.0%) indicated such chemicals were not stored on school property for more than a few days. Twenty-three of 33 respondents (69.7%) indicated that such chemicals were stored in a fire retardant cabinet, ten (30.3%) indicated such chemicals were not. Out of 29 respondents, 20 (69.0%) indicated that they were aware sawdust could be composted, the remaining 9 (31.0%) were not aware.

Table 15. Types of waste generated in wood laboratory.\*

Type of waste	Frequency	Percent
Paint (P)	30	100.0
Stain (ST)	25	83.3
Solvents/strippers (SO)	23	76.6
Other	3	10.0

\*Percentages based on 30 respondents who maintain wood laboratories in their program.

Table 16. Occurrence of proper storage technique of wood finishing chemicals and awareness of alternative disposal method (compost) for sawdust.

	Store P, ST, SO, or other waste on property		Paints and solvents stored in fire retardant cabinet		Aware clean sawdust can be composted	
	Frequency	Percent	Frequency	Percent	Frequency	Percent
Yes	33	97.0	23	69.7	20	69.0
No	1	3.0	10	30.3	9	31.0
Total	34	100.00	33	100.00	29	100.00

When asked if they were aware of proper disposal techniques for wood finishing chemicals, also as seen in Table 17, 3 (9.0%) of 34 total respondents indicated that they were very aware of proper methods, 16 (47.0%) indicated they were aware, and 15 (44.0%) answered not aware. Next, respondents indicated the level of practice of proper disposal for wood finishing chemicals. Thirty-three responses were made for this question. Four (12.5%) respondents always used proper methods, 6 (18.8%) mostly used proper technique, 14 (43.7%) seldom use proper methods, and 8 (25.0%) never use proper disposal methods for wood finishing chemicals.

Table 17. Level of awareness and practice of proper disposal techniques for wood finishing chemicals (paint, stain, solvents/strippers and other waste).

<u>Recycling options and proper disposal methods for paint, stain, solvents/strippers and other wood shop chemical waste</u>		
Level of Awareness	Frequency	Percent
very aware	3	9.0
aware	16	47.0
not aware	15	44.0
Total	34	100.00
Level of Practice	Frequency	Percent
always	4	12.5
mostly	6	18.8
seldom	14	43.7
never	8	25.0
Total	32	100.00

#### Metals/Welding Laboratory

The following data is also described in Tables 18 and 19. Thirteen (35.1%) respondents, out of 37 total for this question, indicated that they generate waste solvents, paint or waste water from the activities of their metals or welding laboratory area, while the remaining 24 (64.9%) did not generate such waste. Also out of 37 respondents, 31 (83.8%) indicated that they used some sort of hazardous gas for welding, while 6 (16.2%) did not. These 37 respondents also indicated the following: 29 (78.4%) always monitor gas tank and system for leaks and verify system is turned off, 6 (16.2%) mostly practice those activities, 2 (5.4%) seldom engage in such activities, while no one (0.0%) indicated that they never checked welding systems for gas leaks and verified such systems were

properly turned off. Concerning the use of safety clothing in the welding shop, 26 (70.3%) of 37 respondents indicated that such clothing was always used, 11 (29.7%) indicated such clothing was mostly used, while no responses (0.0%) were recorded for seldom use or never. Tables 18 and 19 reflect this information.

Table 18. Occurrence of waste generation from metals/welding laboratory and potentially hazardous gas use.

	Generate waste solvents, paint or rinse water in metal/welding laboratory		Utilize potentially hazardous gas for welding purposes	
	Frequency	Percent	Frequency	Percent
Yes	13	35.1	31	83.8
No	24	64.9	6	16.2
Total	37	100.00	37	100.00

Table 19. Level of practice of recommended safety techniques in metals/welding laboratory:

	Monitor gas tanks and system for leaks, verify system turned off		Use of safety clothing in metal shop area	
	Frequency	Percent	Frequency	Percent
always	29	78.4	26	70.3
mostly	6	16.2	11	29.7
seldom	2	5.4	0	0.0
never	0	0.0	0	0.0
Total	37	100.00	37	100.00

Table 20 data describes awareness and use of recycling options for scrap metal. When asked if they were aware of recycling options for scrap metal, 19 (51.3%) respondents out of 37 respondents indicated they were very aware of such options, 17 (46.0%) indicated they were just aware and 1 (2.7%) indicated they were not aware of

recycling options for scrap metal. Thirty-six responses were recorded concerning the level of use of recycling options for scrap metal. Twenty-two (61.1%) respondents always recycle, 12 (33.3%) mostly recycle, 1 (2.8%) seldom recycles, and 1 (2.8%) never recycles.

Table 20. Level of awareness and practice of recycling options for scrap metal.

Recycling options for scrap metal		
Level of awareness	Frequency	Percent
very aware	19	51.3
aware	17	46.0
not aware	1	2.7
Total	37	100.00
Level of practice	Frequency	Percent
always	22	61.1
mostly	12	33.3
seldom	1	2.8
never	1	2.8
Total	36	100.00

#### Animal Confinement Area

The least number of responses were recorded for this section and are described in Tables 21 and 22. The following information on animal species maintained is based on five respondents to this section. Two (40.0%) respondents maintain swine, 3 (60.0%) keep cattle, 2 (40.0%) keep sheep, 1 (20.0%) maintains poultry, while 3 (60.0%) indicated other species. Of four respondents, 2 (50%) indicated a waste management plan was in place for their animal confinement area, 2 (50%) indicated such a plan was not in place. Of five, 4 (80%) respondents were aware of the water run-off patterns of their

confinement area, and 1 (20%) was not aware. However, all five (100.0%) were certain run-off from their animal confinement areas did not threaten water sources.

Table 21. Animal species maintained by respondents.

Species kept	Frequency	Percentage*
Swine	2	40.0
Cattle	3	60.0
Sheep	2	40.0
Poultry	1	20.0
Other	3	60.0

\* Percentages based on a total of 5 respondents to the animal section of survey.

Table 22. Occurrence of waste management plan and awareness of water run-off patterns from animal confinement area.

	Waste management plan in place		Aware of water run-off from animal area		Run-off immediately threatens water source	
	Frequency	Percent	Frequency	Percent	Frequency	Percent
Yes	2	50.0	4	80.0	0	0.0
No	2	50.0	1	20.0	5	100.0
Total	4	100.00	5	100.00	5	100.00

As seen in Table 23, all five (100.0%) respondents indicated animal waste was removed from animal confinement areas. One (20.0%) indicated veterinary, medical or other bio-waste was generated, 4 (80.0%) indicated such waste was not generated.

Table 23. Occurrence of waste removal from animal confinement area and occurrence of generation of veterinary or biological (medical) waste.

	Removal of animal waste from confinement area is needed		Veterinary, medical and bio waste generated	
	Frequency	Percent	Frequency	Percent
Yes	5	100.0	1	20.0
No	0	0.0	4	80.0
Total	5	100.00	5	100.00

### Curriculum and Classroom Management

A measurement was also made on the occurrence of pollution prevention, or environmental topics in other curriculum areas, as well as recycling practices in the regular classroom. Table 24 describes this information. Of 36 respondents, 16 (44.4%) recycle classroom materials not covered in the previously mentioned portions of the survey, and 20 (55.6%) did not recycle in the classroom. Pollution prevention or general environmental topics were covered in curriculum used by 22 (59.5%) of 37 respondents to this question, while 15 (40.5%) indicated such topics were not covered in other curriculum areas.

Table 24. Occurrence of classroom material recycling other than laboratory waste previously mentioned and occurrence of inclusion of environmental topics in curriculum.

	Recycle classroom materials other than those previously mentioned		Curriculum includes some sort of environmental topics	
	Frequency	Percent	Frequency	Percent
Yes	16	44.4	22	59.5
No	20	55.6	15	40.5
Total	36	100.00	37	100.00

### Perceptions of Environmental Issues in Agriculture

A measurement was made on the level of agreement with seven statements concerning concepts of agriculture's relation to environmental responsibility and regulation, pollution prevention and waste management. Respondents answered using the following scale: Strongly agree (SA), Agree (A), Disagree (D), or Strongly disagree (SD). The following information is listed in Table 25.

When responding to the question, if "the behavior of one person, or small group of people can have a significant affect on larger environments", 19 (46.3%) respondents strongly agreed, 22 (53.7%) agreed and no responses (0.0%) were recorded under disagree or strongly disagree (Frequency total=41). Of 41 respondents, 27 (65.9%) strongly agreed, and 14 (34.1%) agreed that "agriculture is dependent on clean safe soil, air, and water". No respondent (0.0%) answered disagree or strongly disagree. Thirty-nine responses were recorded for the following statement, "agriculturalists are responsible for their own actions concerning the environment". Twenty (51.3%) respondents strongly agreed, 18 (46.2%) agreed, none (0.0%) disagreed and 1 (2.5%) strongly disagreed.

In reaction to the statement "monetary cost, time and labor are issues to be considered when making decisions which may affect the environment", 4 (9.8%), of 41 total responses, strongly agreed, 33 (80.5%) agreed, while 3 (7.3%) disagreed, and 1 (2.4%) strongly disagreed. Thirty-nine respondents recorded their reaction to this statement, "considering the previous issues (re: statement 4), it is still possible for agriculturalists to make environmentally responsible decisions in almost all situations."

Fourteen respondents (35.9%) strongly agreed, 24 (61.5%) agreed, 1 (2.6%) disagreed, and no responses (0.0%) were made for strongly disagree.

The last two statements dealt with the issue of compliance with preferred practices or rules. None (0.0%), of 39 respondents, strongly agreed that "agriculturalists are currently doing enough to protect the environment and sustain the industry". Eighteen (46.2%) respondents agreed with the statement, 21 (53.8%) disagreed and no respondents (0.0%) indicated strongly disagree. Respondents reactions to the statement, "agriculturalists are capable of policing themselves without intervention by government and regulatory agencies" are as follows: 5 (12.2%) strongly agreed, 20 (48.8%) agreed, 15 (36.6%) disagreed and 1 (2.4%) strongly disagreed (Frequency total= 41).

Table 25. Level of agreement with statements concerning perceptions of waste management and pollution prevention in a broad agricultural setting.

Question		SA	A	D	SD	Total
The behavior of one person or group can have a significant affect on larger environments.	Freq.	19	22	0	0	41
	Percent	46.3	53.7	0.0	0.0	100.00
Agriculture is dependent on clean safe soil, air and water.	Freq.	27	14	0	0	41
	Percent	65.9	34.1	0.0	0.0	100.00
Agriculturalists are responsible for their own actions concerning the environment.	Freq.	20	18	0	1	39
	Percent	51.3	46.2	0.0	2.5	100.00
Monetary cost, time and labor are issues to be considered when making decisions which may affect the environment.	Freq.	4	33	3	1	41
	Percent	9.8	80.5	7.3	2.4	100.00

Table 25. (Continued) Level of agreement with statements concerning perceptions of waste management and pollution prevention in a broad agricultural setting.

Question		SA	A	D	SD	Total
Considering the previous issues, it is still possible for agriculturalists to make environmentally responsible decisions in almost all situations	Freq.	14	24	1	0	39
	Percent	35.9	61.5	2.6	0.0	100.00
Agriculturalists are currently doing enough to protect the environment and sustain their industry.	Freq.	0	18	21	0	39
	Percent	0.0	46.2	53.8	0.0	100.00
Agriculturalists are capable of policing themselves without intervention by the government and regulatory agencies.	Freq.	5	20	15	1	41
	Percent	12.2	48.8	36.6	2.4	100.00

#### Barriers to Pollution Prevention

Barriers to practice, or improved practice, of pollution prevention were addressed at the end of the survey, and the data presented in Table 26. Thirty-nine responses were recorded for this section, more than one answer was accepted per respondent. Thirty-three (84.6%) respondents indicated that increased knowledge could improve their pollution prevention, 10 (25.6%) indicated increased administrative support could improve their practices, 23 (58.9%) indicated new funds would improve pollution prevention practices, 12 (30.7%) listed increased community support as a barrier reducing factor, 28 (71.8%) indicated more community resources could help improve pollution prevention, and 5 (12.8%) answered "other." Table 26 describes this data.

Table 26. Reduction in barriers to pollution prevention.

Reduction of barrier	Frequency	Percent*
Increased knowledge	33	84.6
Increased administrative support	10	25.6
New funds for implementation of more P2	23	58.9
Increased community support	12	30.7
More community resources**	28	71.8
Other	5	12.8

\*Percentages based on an Frequency of 39 respondents to this portion of the survey.

\*\* (recycling, special collections, outside assistance) These are waste management systems, not pollution prevention in the strict definition.

#### Interest in Eco-Star Educator Award Program

The following information is not related to the study objectives. Since this inquiry was made through the survey instrument, an explanation and data collected is included here. An award system for environmentally responsible educators was proposed by the Montana State University Extension Service. Interest in participating in this merit based award program by agricultural educators was measured. The question was posed at the very end of the survey instrument adjacent to the mailing instructions. This data is also indicated in Table 27. Ten (23.8%) respondents were interested in participating in the Montana Eco-Star Educators award program, 7 (16.7) indicated they were not interested, while 25 (59.5%) did not respond. The researcher is suspect that the placement of the Eco-Star inquiry at the back cover of the survey after a blank page may have contributed to the low response rate to this question.

Table 27. Number of respondents who expressed interest in participating in Montana Eco-Star Educator reward program for environmentally responsible educators.

Interested in award program	Frequency	Percent
Yes	10	23.8
No	7	16.7
Did not respond	25	59.5
Total	42	100

## CHAPTER 5

## CONCLUSIONS, IMPLICATIONS, AND RECOMMENDATIONS

The purpose of this study was to determine what practices, in the area of pollution prevention, were being applied by Montana agricultural educators in the classroom, laboratory and field settings. When certain defined practices were not applied, barriers to implementation were examined. Data were also collected and analyzed regarding Montana agricultural educators' perceptions and knowledge base concerning pollution prevention, waste management and hazardous material management.

To fulfill the purpose of this study, the following objectives were identified.

Agricultural educators were surveyed to:

1. Determine Montana agricultural educators' current practices in pollution prevention;
2. Identify barriers to implementation of practices in pollution prevention by Montana agricultural educators;
3. Determine Montana agricultural educators' perceptions of pollution prevention;
4. Determine Montana agricultural educators' level of knowledge of pollution prevention.

### Conclusions

Based on the analysis of quantitative data, and consideration for written comments by survey respondents, the following conclusions were drawn:

1. Deficiencies were identified with current practices in pollution prevention and waste management by Montana agricultural educators. The researcher believes the most eminent are in the mechanics laboratory, greenhouses and farm/field plots, and in the wood laboratory. Comments indicated in Appendix D show that substances are going to the land fill that could be re-used in house, recycled, or used outside the agricultural education program.

2. Barriers to practice and improvement of pollution prevention were identified. Lack of knowledge, or need for further education was the primary barrier identified by survey respondents.

3. Agricultural educators in Montana had positive perceptions of pollution prevention. Most agreed that agriculturalists are responsible for their own actions concerning the environment and that the actions of few can have a wide effect. Educators perceived that they still had room to improve based on answers to the section titled "Barriers to Pollution Prevention".

4. Montana agricultural educators do have a basic knowledge or awareness of pollution prevention and proper waste management. On all questions dealing with awareness, over 50% of respondents indicated they were aware or very aware of the topic and practices associated with that question. Tables 8, 14, 17, and 20 dealing with

awareness of recycling options and proper disposal techniques for mechanics laboratory waste, agricultural chemicals, wood finishing chemicals and scrap metal support this.

5. Agricultural educators surveyed appear willing to improve their practices in pollution prevention and waste management if they could receive more community support and have easier to use resources such as recycling and special waste collections.

6. Agricultural educators in Montana wish to improve their pollution prevention practices and are willing to participate in further education or training as noted by several written responses found in Appendix D.

### Implications

The data and written comments provided by this survey allowed the researcher to believe and make the following statements:

1. There is a need for education in pollution prevention specific to agricultural teaching laboratories and field areas.

2. Education on managing agricultural teaching laboratories in an environmentally responsible way should not only target instructors or educators. Students and administrators, while on opposite ends of the educational spectrum, are also integral components of successful pollution prevention initiatives being taken in the teaching laboratory.

3. Data obtained through this study may also be pertinent in other areas of vocational education where similar teaching or research facilities are maintained. Such

research can also contribute to that which has already been done in other areas such as chemistry and biology education.

4. A need for training and certification of technical support, and educators in pollution prevention for the research and educational community may exist. Agencies such as the EPA could offer such training and certification to individuals, who in turn would serve a region or area by assisting educators in becoming better environmental stewards.

5. A potential exists for agricultural educators to receive reprimands, should a regulatory agency scrutinize current practices in waste management and pollution prevention.

6. A responsibility exists for organizations, such as Extension, already performing pollution prevention training and education to extend efforts to this new audience, i.e.: agricultural and vocational educators.

### Recommendations

The entire research process, including review of literature, collection and analysis of data, and consideration of comments made by survey respondents, committee members and others led the researcher to make the following recommendations:

1. A pollution prevention education or training program, specific for agricultural education, should be developed as soon as possible. It should focus on source reduction of waste, management of unavoidable waste and consideration to proper facilities

planning and management. True pollution prevention should be the primary focus of such education, with recycling and best disposal options secondary and tertiary choices.

2. Agricultural educators themselves should be as involved as possible in the development of pollution prevention training and education.

3. Pollution prevention training should be made an integral part of college studies for those pursuing teaching degrees in agriculture. Pollution prevention should be part of career-long updates and re-certification programs for educators.

4. A holistic pollution prevention resource for educational institutions should be developed including all traditional, academic and vocational (agriculture included) teaching areas. Grounds and facilities maintenance could also be included.

#### Recommendations for further study

1. Similar research should be conducted in other vocational fields of education to determine if education in pollution prevention is needed.

2. Existing facilities in agricultural and vocational education should be examined. Ways to make existing facilities more environmentally friendly and considerations to be made in construction of new agricultural teaching laboratories should be examined.

3. A needs assessment or pollution prevention audit may be in order for post secondary institutions such as technical schools and vocational colleges. Universities should also be considered as other institutions with a similar educational need for pollution prevention training.

4. The data from this study could be used in the future to identify correlations such as, links between certain demographic traits and perceptions or practice of pollution prevention in educational contexts.

5. Comparing and contrasting practices, knowledge and perceptions of pollution prevention between vocational (agriculture included) educators and educators of traditional sciences may facilitate a more efficient development of holistic pollution prevention resources for educators.

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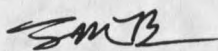
APPENDICES

APPENDIX A  
PRE-SURVEY POSTCARD

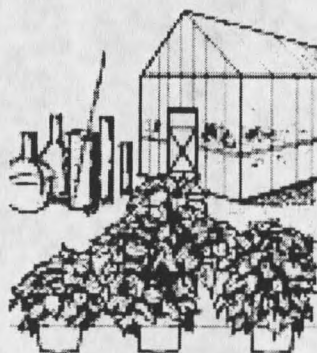
Dear Agricultural Educator,

In the next few days you will be receiving a survey from the Agricultural Education Program at Montana State University. This survey deals with management of potential waste and pollution prevention in agricultural teaching laboratories. I encourage you to take a little time and complete the survey. The results of this study are very important to field of Agricultural Education and the agriculture industry as a whole.

Thank you,

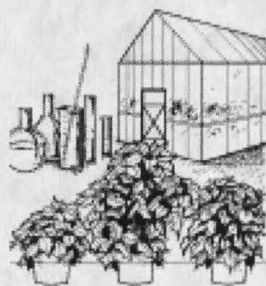


Thomas M. Bass  
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APPENDIX B  
SURVEY INSTRUMENT

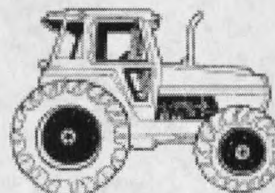
Pollution Prevention in Agricultural Education  
Laboratories and Field Areas



Agricultural Education Program  
Montana State University - Bozeman

Montana State University  
Extension Service  
Pollution Prevention Program

Investigator:  
Thomas M. Bass  
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Cheever Hall  
Montana State University  
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Dear Agricultural Educator,

Thank you for taking the time to complete this survey. Myself, and the Agricultural Education faculty at MSU believe that this project can really make a contribution to Montana's natural environment, to agriculture and to agricultural education. Once again this is a non-regulatory effort, meaning the purpose of this project is to help you as an educator make your own decisions on how to better manage waste, reduce pollution and instill these values in your students. You also have a chance become a model program within your institution exhibiting progressive waste management and heightened human and environmental safety.

The survey was designed to provide the most amount of information in a simple and efficient manner. Most questions are "fill in the dot", while a few ask for further explanation. Please feel free to comment on any question by using a separate sheet of paper or on space provided at the back of this survey. *In the case where pollution prevention, recycling and certain waste management methods are not being practiced, I ask that you comment on barriers that have prevented, or will continue to prevent the implementation of such practices by your program.*

Please take about 20 minutes to respond to the following survey. Pencil is preferred, but you may use ink. If you wish to identify yourself, at the bottom of this page, you may.

Sincerely,

Thomas M. Bass  
Agricultural Education Program  
Montana State University - Bozeman  
(406) 994-2132 tmbass@montana.edu

name: \_\_\_\_\_  
program name: \_\_\_\_\_  
address: \_\_\_\_\_  
phone: \_\_\_\_\_  
e-mail: \_\_\_\_\_

**Demographics**

- 1) What is your age group?  
 21-25    26-30    31-35    36-40  
 41-45    46-50    51-55    55+
- 2) What is your gender?  
 male    female
- 3) What is the highest level of education you have attained?  
 bachelor's degree    some graduate course work  
 masters degree    doctorate
- 4) How many years teaching experience do you have? \_\_\_\_\_ (enter number of years)
- 5) Did you receive any pollution prevention or waste management training in college?  
 yes    no
- 6) Have you ever had any in service pollution prevention or waste management training?  
 yes    no

**Program Information**

- 1) Which of the following labs or field areas do you maintain?
  - a)    ag/power mechanics lab
  - b)    green house
  - c)    garden or small farm plot
  - d)    wood lab
  - e)    metals/welding lab
  - f)    animal confinement or pasture area
  - g)    other \_\_\_\_\_

2) Rank the previous lab areas in order of use, from most to least, by your program. (For example: b, c, a, d, e, f) \_\_\_\_\_

3) How many students, in grades 8-12, are in your program? \_\_\_\_\_  
(enter number of students)

**Agricultural or Power Mechanics Lab**

1) Which of the following waste/used engine fluids do you acquire in your labs or on your property?

- |  |  |
|--|--|
| <input type="radio"/> oil                | <input type="radio"/> brake fluid              |
| <input type="radio"/> transmission fluid | <input type="radio"/> waste diesel or gasoline |
| <input type="radio"/> antifreeze         | <input type="radio"/> waste cleaning solvents  |

2) Do you store any amounts of these waste/used fluids on your property for more than a few days?

- yes       no

Are these fluids in sealed containers and stored in a place to prevent or contain spills?

- yes       no       n/a

3) How aware are you of recycling options and best disposal methods for these fluids?

- very aware     aware       not aware

4) Do you make use of recycling or best disposal avenues for these fluids?

- always       mostly       seldom       never

5) Does your mechanics work area make use of spill containment methods, ie: sump with reservoir, dams, trapped drains?

- yes       no

6) Which of the following mechanical waste products do you acquire?

- |                                 |  |
|---------------------------------|--|
| <input type="radio"/> batteries | <input type="radio"/> used oil filters |
| <input type="radio"/> tires     | <input type="radio"/> other _____      |

7) How aware are you of recycling options and best disposal methods for these items?

- very aware       aware       not aware

8) Do you make use of local recycling, collection or best disposal avenues?

- always       mostly       seldom       never

9) Please comment on how you dispose of wastes generated through your mechanics lab.

---

---

**Green House and/or Farm Plot**

1) Do you maintain an inventory of pesticides and fertilizers?

- yes       no

2) Are these materials stored in a safe and secure place, where water will not penetrate?

- yes       no

3) Do you monitor plants and apply pesticide for specific pests (target organisms) only?

- always       mostly       seldom       never

4) Are you aware of the water run-off patterns from your plots and green houses?

- yes       no

Does this run-off immediately threaten surface water (creek or river) or ground water?

- yes       no

5) Do you and your students follow labeled instructions of pesticides/fertilizers/chemicals concerning application rates?

- always       mostly       seldom       never

6) Do you and your students follow instructions concerning your personal safety, ie: protective clothing, respiratory equipment?

- always       mostly       seldom       never

7) Do you mix pesticides on a pad that will contain spills and prevent contamination of soils or water sources?

- always       mostly       seldom       never

8) Do you regularly calibrate spraying equipment?

- yes       no       n/a

9) Do you compost left over plant material for future addition to the soil?

- always       mostly       seldom       never

10) Do you store pesticides/fertilizers/chemicals in their original containers?

- always       mostly       seldom       never

Is all of your inventory well labeled and identified?

- yes       no       n/a

11) How aware are you of recycling options and best disposal methods for these agricultural chemicals and empty containers?

- very aware       aware       not aware

12) Do you make use of local recycling, collection or best disposal avenues?

- always       mostly       seldom       never

13) Please comment on how you dispose of ag chemical wastes, rinse water and empty containers from your greenhouses and field plots. \_\_\_\_\_

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### Wood Lab

1) Which of the following surplus materials do you create or acquire?

- paint       stain       solvents or paint stripping materials  
 other \_\_\_\_\_

2) Do you store any of these materials on your property for more than a few days?

- yes                       no

3) Are your paints and solvents stored in a fire retardant cabinet?

- yes                       no

4) How aware are you of recycling options and best disposal methods for these paints and finishing chemicals?

- very aware                       aware                       not aware

5) Do you make use of recycling, collection or best disposal avenues?

- always                       mostly                       seldom                       never

6) Are you aware sawdust from non-treated, non-painted wood is an excellent addition to compost?

- yes                       no

7) Please comment on how you dispose of paints, solvents, finishing chemicals and empty containers. \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_

8) Please comment on how you dispose of wood scraps and sawdust. \_\_\_\_\_

\_\_\_\_\_

9) Please comment on how you dispose of cleaning wastes from spray guns, brushes and rollers (please consider paint waste generated in other lab areas as well). \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_

**Metals/Welding Lab**

1) Do you generate any waste solvents, paint or waste rinse water related to your welding/metals lab?

- yes                       no

2) Do you utilize any hazardous gases for welding purposes?

- yes                       no

3) Do you monitor gas tanks for leaks, check that the system is turned off after use?

- always                       mostly                       seldom                       never

4) Are those working in the metal shop required to wear safety clothing?

- always                       mostly                       seldom                       never

5) How aware are you of recycling options for scrap metals?

- very aware                       aware                       not aware

6) Do you make use of recycling options?

- always                       mostly                       seldom                       never

7) Please comment on how you manage and dispose of metal dust, shavings and scraps.

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**Animal Confinement or Pasture Area**

1) What animal species does your program keep and maintain?

- swine                       cattle                       sheep  
 poultry                       other \_\_\_\_\_

2) How many animal units are there, what is the approximate stocking rate?

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3) Is there in waste management plan or procedure in place?

- yes                       no

4) Are you aware of the water run-off patterns of your animal confinement area?

- yes                       no

Does this run-off immediately threaten surface water (creek or river) or ground water?

- yes                       no

5) Is there a need to remove animal waste from confinement area?

- yes                       no

6) Do you generate any veterinary, medical or bio-hazard waste?

- yes                       no

7) Please comment on how animal waste, vet waste, medical or bio-hazard waste is removed and disposed of. \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

### **Curriculum and Classroom Management**

1) Do you recycle any classroom materials or other waste not mentioned under other parts of this survey?

- yes                       no

If yes, what? \_\_\_\_\_

\_\_\_\_\_

2) Does your curriculum include any education on pollution prevention or the environment?

- yes                       no

What curriculum areas deal with environmental topics? Please comment on this material.

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### Perceptions

Please indicate your feelings towards the following statements.

1) The behavior of one person or a small group of people can have a significant affect on larger environments.

strongly agree  agree  disagree  strongly disagree

2) Agriculture is dependent on clean and safe soil, air and water.

strongly agree  agree  disagree  strongly disagree

3) Agriculturalists are responsible for their own actions concerning the environment.

strongly agree  agree  disagree  strongly disagree

4) Monetary cost, time and labor are issues to be considered when making decisions which may affect the environment.

strongly agree  agree  disagree  strongly disagree

5) Considering the previous issues, it is still possible for agriculturalists to make environmentally responsible decisions in almost all situations.

strongly agree  agree  disagree  strongly disagree

6) Agriculturalists are currently doing enough to protect the environment and sustain their industry.

strongly agree  agree  disagree  strongly disagree

7) Agriculturalists are capable of policing themselves without intervention by the government and regulatory agencies.

strongly agree  agree  disagree  strongly disagree

**Barriers to Pollution Prevention**

My pollution prevention could be improved by: (check all that apply)

- increased knowledge
- increased administrative support
- new funds for implementation of more Pollution Prevention
- increased community support
- more community resources (recycling, special collections, outside assistance)
- other \_\_\_\_\_

In situations mentioned previously in this survey, where pollution prevention methods and recycling were not utilized, please further describe barriers that have prevented you from engaging in such activity.

**Further Comments**

Please feel free to comment on any part of this survey or related topics. Your input will only make this project more successful.

(Blank page corresponds to blank page in survey document.)

The Montana State Extension Service Pollution Prevention Program is interested in developing a Montana EcoStar Educators' Award, to complement its existing EcoStar Small Business Award. This award will be given to educational programs who set good examples by working toward responsible management of waste and promotion of pollution prevention in their classrooms and laboratories. If enough interest is shown by survey respondents, further development of this award will be done, and applications made available.

- Yes, I would be interested in participating in the Extension Service EcoStar Award program should it be developed for educators.
- No, I would not be interested in participating in the Extension Service EcoStar Award program should it be developed for educators.

Special thanks to the Montana Vocational Agricultural Teachers Association for assistance in distributing and collecting this survey.

Thank you for your time and attention. Please close,  
tape shut and  
return via U.S. Mail

APPENDIX C  
REMINDER POSTCARD

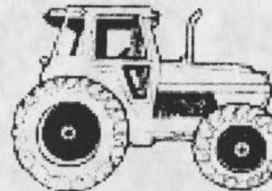
Dear Agricultural Educator,

Within the last couple of weeks you most likely received a survey dealing with management of potential waste and pollution prevention in agricultural teaching laboratories. If you are one of those who has already returned the survey, **thank you very much**. I have received many great comments and ideas. If you have not returned your survey, please take a few minutes to complete it and drop it in the mail. In the case that you have lost your copy, please call me to request another (406) 994-2132.

Thank you,



Thomas M. Bass  
Agricultural Education Program  
Montana State University  
(406) 994-2132  
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APPENDIX D  
SURVEY COMMENTS

Program Information

**Question 1) Which of the following lab areas do you maintain? Responses indicated under "other".**

Classroom

Grounds around green house

(checked other, left blank)

Agricultural or Power Mechanics Lab

**Question 6) Which of the following mechanical waste products do you acquire? Responses indicated under "other".**

Very little

Metal

**Question 9) Please comment on how you dispose of waste generated through your mechanics lab.**

Agreement with local garage to take all of our wastes

Used oil is given to a local garage to burn in their oil burning furnace. Most of the items above are included.

Ranchers use oil to paint fences.

Haul to dump.

Try to recycle what I can - to dump with the rest.

We collect oils and solvents and take them to a local auto shop where they dispose of them for us.

We collect used petroleum based [products] into a drum, the city and county use used oil to heat. They pick up on call

[Sent] to district bus barn, in barells

Used motor oils are recycled, batteries are taken in for salvage, filters are sent to the landfill.

Filters are sent to landfill, oil and antifreeze in a storage tank.

Land fill, oil pick-up services

Take to local mechanic to burn oil in waste oil furnace. Other items are taken to the local gas station to dispose of.

Haven't disposed of anything except for scrap metal which was recycled.

Drying of filters and dispose in regular trash

Trade in program

Our school system/maintenance people/ bus garage-store and then dispose of or recycle certain used products.

Local collection- approved dumpster- recycle when available

Recycle center

Oil- is burned as fuel at wrecking yard- Antifreeze is stored until we can get it cleaned, oil filters are thrown as are tires. Batteries are turned in as [illegible] at NAPA.

Used oil is taken to a shop in used oil burner

Agri-Power - recycle oil

I have only been here a short time so waste has been minimal. I could really use some info in this area.

Placed in containers and then handled by janitorial staff.

Couple of private shops have oil burners. Metal, batteries are sold. Oil filters thrown away. Antifreeze goes down the drain.

In containers soaked in sawdust, then to land fill.

Janitor takes barrel to county yard.

Oil goes to local machinery dealership. Filters to Pacific Recycling.

Green House and/or Farm Plot

**Question 13) Please comment on how you dispose of ag chemical wastes, rinse water and empty containers from your greenhouses and field plots.**

County disposal system

Don't have many, dump.

We don't really use pesticides, but do use miracle grow fertilizer.

Rinse water is diluted in the containment sump, ag chemicals are kept until all is sprayed.

Use up all chemicals, dispose of container in landfill.

Don't have a greenhouse yet.

Rinse well/throw in general trash.

I triple rinse containers used to handle pesticides. Rinse water is absorbed into soil under greenhouse.

Rinse water is used to apply chemical with

We just have a small garden plot - other than a little fertilizer and "seven" - we use no other chemicals.

Use collection methods.

Usually down the drain in the floor.

We use only for educational purposes. We don't have a lot on hand.

Local dealers handle empty containers.

Wood Lab

**Which of the following surplus materials do you create or acquire? Responses indicated under "other".**

(Response to other not identified)

**Question 7) Please comment on how you dispose of paints, solvents, finishing chemicals and empty containers.**

County disposal

Empty containers to garbage

I don't [dispose of paints...], they just sit around for 20 years.

Dump

We try not to use oil-based paints.

Paints and solvents are stored in plastic containers and taken to a local business for disposal.

Into the used petroleum barrel.

Rarely have waste.

Bus/district garage

We sometimes soak our solvents with sawdust and then send it to the landfill.

Dumpster

Empty containers go out with trash.

Haven't yet

I put them in a plastic garbage bag which is hauled to the landfill.

Garbage (frequency 3)

Haven't thrown any away yet.

Some are dried and local disposal - some EPA approved collection.

Sent to trash; paint thinner put with used oil and solvents.

Garbage cans, drains, sump

Use them up. Landfill

Don't use - fire hazard in temporary building.

The drain? With lots of H<sub>2</sub>O of course. Haven't had much yet.

Trash can

Into cans that are sealed and dropped in landfill

Put in garbage

Empty containers rinsed and sent to landfill.

**Question 8) Please comment on how you dispose of wood scraps and sawdust.**

People get scraps to burn

Burning

Garbage - landfill (frequency 3)

Haul to local dump or some pick up wood to burn in stove

Burn, compost

Sawdust is collected and used for bedding, and wood scraps are given away for firewood kindling.

Sawdust is collected and used as a floor cleaner, wood scraps go to landfill

Fireplace

City dumpster

Sawdust is used for bedding, spills, and others to the landfill, wood scraps are burned by homeowners and landfill.

Give to people with fireplaces

Scraps are given to people to burn in wood stove. Sawdust is thrown away with trash.

Burn or give to people who want it

Don't yet

I put them in a plastic garbage bag which is hauled to the landfill.

Fireplace and garden

Used as compost. Also used to soak up spilled oil, etc.

Fire starter

Wood scraps - firewood

Sawdust - used as oil pickup, then sent to trash

Green boxes (garbage)

Wood stoves, landfill, compost

Kindling and firewood

To city incinerator

Reuse. Garbage dump

Trash can

Garbage

Animal bedding; oil spill pickup; wood stove use

Put in garbage or let janitor take home to burn in fireplace.

Wood scraps burned by students with wood stoves - sawdust is composted

**Question 9) Please comment on how you dispose of cleaning wastes from spray guns, brushes and rollers (please consider paint waste generated in other lab areas as well).**

Latex paints primarily, landfill

Dump or burn

Dump

Place in 5-gallon waste container

We try not to use oil-based paints, but if we do, rollers are left to dry and then dispose of at the local landfill.

Petroleum barrel [into the used]

Drain

H2O-based paint- building drain

We use as much latex paint as possible and that is diluted greatly and put down the drain; oil bases are soaked up by sawdust and sent to landfill.

Dumpster

Latex - wash down sink. Oil-based - put with waste oil to burn in waste oil furnace.

Don't yet

These wastes are dumped in our sink and extra water is used to flush them out of the sink trap so corrosion is kept to a minimum.

Garbage

Rags, brushes, rollers, etc. usually in dumpster. - no liquids or fluids though

Put with used oil and solvents

Wash in sink

Recycle collector

City disposal, trash can

Pour into used-oil containers, goes to oil burning heater

(You don't want to know) bottle up and put in landfill

Out the backdoor drain

No recycling center available. Cleaning wastes are sent to local dealership with used oil.

Metals/Welding Lab

**Question 7) Please comment on how you manage and dispose of metal dust, shavings and scraps.**

County picks them up

To the dumpster

Haul to recycling center

Haul material to local scrap buyer

Trade in for new scrap

Local junk dealer

We collect metal waste and dispose of it at Pacific Recycling - Billings

Scrap metal is transported to Havre, to Pacific Steel and Recycling.

Scrap dealer or garbage

Shaving and scraps are taken to the recycler in Sidney, some dusts from grinding and cutting are sent to the landfill

Metal barrels collect all metal products and sent to recycle center

Dust and shavings go out with trash. scraps are recycled at Pacific or Border Steel

Take it to recycling center (frequency 2)

Throw them in garbage

Return to Pacific Steel or local welding shop

These are put in the garbage plastic bag which is hauled to the landfill.

Scrap is recycled in Billings; dust and shavings - garbage

Collected in 55 gallon drums - transport to Billings, for recycle

Packaged and taken for scrap to Pacific Recycling

Recycle (frequency 2)

Metal dust - swept up and put in trash - scrap metal - taken to recycler

Green box

Metal recyclers

Metal dust - shavings - trash; scraps - (Pacific Steel)

Garbage. I think we can take scraps into town for exchange.

Metal recycling barrels

Placed in scrap barrel then either taken to scrap yard or given to someone who will.

Haul to Pacific - Take metal for welding

Send to Pacific Steel and Recycling

#### Animal Confinement or Pasture Area

**Question 1) What animal species do you keep or maintain. Responses indicated under other.**

Rabbits

Cattle shipping yards (see comment 2, question 2)

Fish

Emus and horses

**Question 2) How many animal units are there, what is the approximate stocking rate?**

Beef - 6; Sheep - 6; Swine - 30

Used in fall to ship and weigh cattle - animals are only there temporarily.

2 emus, 8 cattle, 2 horses (40 acres)

**Question 7) Please comment on how animal waste, vet waste, or bio-hazard waste is removed and disposed of.**

Animal waste - compost; medical or biohazard - burn

Dropping pans from rabbits and other small animals are lined with sawdust and then disposed of in the landfill.

Thrown in garbage

Municipal sewer (re: fish)

Trash barrel

Curriculum and Classroom Management

**Question 1) What other class room materials or waste not mentioned under other parts of this study do you recycle?**

Paper (frequency 9)

Grader blade (from county)

Aluminum

Newspaper

Paper products

Pop cans/plastic pop bottles

Paper - empty cans

Paper when possible

Paper - Aluminum

Paper maybe once a year

Cardboard, newspaper, Aluminum cans

Paper/cardboard

**Question 2) What curriculum areas include any pollution prevention or environmental topics?**

Crops - soils - livestock

Semester class called Natural Resources. Unit on tropical rainforest in Plant Science and some other units dealing with environmental concerns.

All areas should include environmental education.

General information mostly with water pollution.

Pesticide use and application - teaches methods of safe application and disposal of pesticides. H<sub>2</sub>O management - discusses pollution caused by pasture or crop land runoff.

Proper use of range, soils and water.

We utilize "Project Wet" while planning building site selection; lot drainage for stock pens; water quality for range management.

Ag Science, 7<sup>th</sup> and 8<sup>th</sup> grade ag awareness, pesticides, vet, ag management, wood construction

Very big on H<sub>2</sub>O quality. (Yellowstone River watch)

Water curriculum Soil curriculum

Natural Resources class - we spend at least 2 days on this topic

Wildlife Management; Range Management; Soils

Mostly natural resource management. Also encourage in other classes. Will discuss Ag Mech (oil, metal, etc. recycling) An. Sci (animal waste, etc.)

All - same approach as with career development

Range and Soils; Water Quality; Land Management

Aqua Culture; Animal Science; Plant Science; Ag Mechanics; Horticulture

"Pollution prevention"

MT. Weeds

Soil runoff, livestock facilities

Mechanics - Plant Technology - Ag Chemicals - Animal Science

Barriers to Pollution Prevention

**Question A) My pollution prevention could be improved by:**

**Responses under "other"**

Time and proper disposal methods

Spending less time on forms such as this one!

Simple products

Developing safer products.

Recycling is not economically feasible at this time.

**Question B) In situations mentioned previously in this survey, where pollution prevention methods and recycling were not utilized, please further describe barriers that have prevented you from engaging in such activity.**

Isolation is a problem in most of Montana. We have no where, within a reasonable distance, to go with things like batteries, used oil, etc. If the U.S. wants to support and get recycling to work then the price of recycling at least has to break even.

Locally there is no collection spot for used oil - this is used by a local business for heating - but it must be clean and free of H<sub>2</sub>O. Our district produces a lot of used oil and housekeeping becomes a major issue. Locally - recycling is a voluntary organization - and contact persons change as they get burnt out. Shipping charges often outweigh income from objects recycled. Tried recycling school wide - but became each teacher's responsibility - junky rooms were frowned upon so it became easier to throw away.

Our type of soil (high clay) allows more misuse or lazy habits because the pollutants don't travel far. There is very little drinking water from wells - nothing really to pollute.

No place to store waste paper, no place for pick up nearby; my wife and I don't care to drive a great distance to recycle plastic, but would if it were closer.

Lack of time and recycling locations.

Used oil - one time I looked into setting up an "Icy Igloo" recycle center for the town. But once in place it would still cost \$0.75/gal to get it recycled. Not worth it! You need a cost factor.

Lack of recycling center - Pacific and Eastern Montana Industries certainly help!

### Further Comments

**Please feel free to comment on any part of this survey or related topics. Your input will only make this project more successful.**

Excellent ideas - some chapters in more populated areas could do much more - closer distances [populated areas] contribute more \$ which means more recycling - locally cardboard is a big issue filling landfill, so a crusher and bailer was bought.

Universal use by a few creates problems for many with pesticides and fertilizers. Even what occurs in other countries can affect our population's perceptions of agriculture.

-This is basically useless. -You want idealism but don't realize we are in an economic survival battle. -Get Real! -Eco B.S. is just what got us into our present situation. - Show me ONE farmer or rancher or any other person directly related to Ag. Who is not now, or has not always been PRO-ENVIRONMENT. -I checked the address twice... I expected this to come from Missoula!

Let's review the survey & be trained at MVATA update.

(RE: perception #7) Agriculturalists are capable of policing themselves without govt. agencies but need these agencies to keep them honest.

I know I have a lot to learn and I would certainly appreciate suggestions on how to handle wastes in my shop area. Another couple of questions should have dealt with perceptions and attitudes concerning waste management, pollution prevention, and the environment. Many times this is the root of the problem.

We need some improvements in this area.

As a teacher and a farmer, I like the idea of government incentives to prevent pollution. Regulation is difficult to enforce and distribute enforcement fairly.

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