

**INVENTORY OF ENVIRONMENTAL TECHNOLOGIES
FOR THE HOG INDUSTRY**

FINAL REPORT

SUBMITTED BY

CETAC – WEST



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AN INVENTORY OF ENVIRONMENTAL TECHNOLOGIES FOR THE HOG INDUSTRY

FINAL REPORT

EXECUTIVE SUMMARY

If the question were asked, Are there manure treatment options currently available to ensure a sustainable hog industry? The answer is YES. They may not be the final solution, or a complete solution, but there are options.

There are also manure management practices (Best Management Practices — BMP) currently being used which have the ability to contribute immediate economic, social and environmental benefits to producers. This report recognizes the value of incorporating BMP into the inventory and to disseminate that information to Canadian producers

The overall results of this project have led to a global inventory of potential manure management and treatment technologies for the hog industry to address environmental, social and economic issues. The challenge remains to include information from the companies identified and contacted, who for various reasons, did not respond. However, with implementation of the recommendations of this project, it is likely these technology companies will want to be included in the inventory.

Based on the Request for Proposal documentation, Agriculture and Agri-Food Canada (AAFC) and the Canadian Pork Council (CPC), intend to use the information from this project to serve as a basis for formulating joint initiatives within the Hog Environmental Management Strategy (HEMS). It will allow them to develop and assess technologies that will be useful for farmers to solve manure handling in an environmentally, socially and economic manner.

The results of this study have lead to several conclusions and recommendations. They follow under the four categories identified in the proposal.

A. Inventory

Through the course of the project, the manure management and treatment technologies identified, currently available or under development, offer the hog producer a variety and level of sophistication that ranges from:

- improved manure injection systems
- lagoon covers (sometimes called earthen manure storage — EMS)
lagoon treatment
- specific treatment components such as separation, aeration, composting,
- complete, enclosed treatment systems.

Although many technologies have been documented, their applicability to the hog producer's operation is less easily identified. Of the 291 questionnaires sent to technology developers, 85 (29%) were returned. Of those 85 respondents, 28 (33%) provided operating information. In reviewing the operation information, there is little to suggest any formal or standardized testing protocols have been used for evaluating the technologies.

The technology developers suggest financial assistance (21%) as their greatest need to complete the commercialization of their technology, with testing (20%) and demonstration (14%) as a close second and third.

B. Classification

A review of manure management and treatment technology classifications indicated the need to take a 'systems' approach to this task. It permits classification of individual components as well as providing for the ability to match compatible, sequential integrated components to create complete or continuous manure management systems.

In order to achieve a classification system that is optimal in terms of utility and accessibility to a diverse range of users:

WE RECOMMEND

- **The technology and treatment inventory be incorporated into a database**
- **The database be robust and user friendly**
- **The database be capable of multi-tiered data filtering based on the multiple categories for classification identified in this document.**
- **The integration and communication of current 'best management practices' — to do what is currently being done — better.**

C. Evaluation

At the present time numerous institutions, agencies and producer organizations undertake the evaluation of hog manure management and treatment technologies. This is usually done in the context of accommodating provincial, regional or municipal (county) requirements.

WE RECOMMEND

- **These organizations be coordinated to develop a national core standard for the evaluation of technologies.**
- **The evaluation process include a technical review according to specific areas of application as well as a comprehensive evaluation to permit comparison of all technologies according to social, economic, technical and other standards.**
- **A national committee be established as one mechanism through which evaluation standards could be developed and implemented.**

D. Information Dissemination

Distribution of timely, useful information is a critical factor leading to the implementation of hog manure management and treatment technologies nationally. 36% of those responding stated they use the information they receive to change current manure management practices. 38% share the information with others.

Surveys undertaken to gauge the effectiveness of various information dissemination techniques underscored to producers, the importance of on-farm demonstrations and field trials as a means of communicating the ability, appropriateness, efficacy and net benefit of various technologies.

WE RECOMMEND

- **The support for on-farm demonstration of manure management and treatment technologies.**
- **The information from the demonstrations of the technologies be widely available**
- **The technology information be integrated into a national coordinated program using Manure Net, Manure Happenings (Alberta), and the Prairie Swine Centre web site as examples.**

A multi-stakeholder group of government, producer and private interests would most likely prove most appropriate in generating financing for such demonstrations.

1. PROJECT OBJECTIVES

The overall objective of this project is to develop an inventory of environmental technologies, which are one component necessary to ensure sustainable economic development of the hog industry, and ultimately for the intensive livestock industry.

The objectives of this study were fourfold:

- To compile an **inventory of technologies** in various stages of development with an application in hog manure treatment and management.
- To suggest **mechanisms for classification** of these compile inventories in order that information would be easily accessible to a range of potential users, including producers.
- To review **mechanisms for evaluation** of hog manure management and treatment technologies and to suggest mechanisms for standardized evaluation techniques for these.
- To investigate **mechanisms for information distribution** pertaining to hog manure management and treatment technologies and to highlight the most effective information distribution techniques.

The results from the study could lead to the:

- Establishment of national priorities in technology development and commercialization in the area of manure treatment and management
- Establishment of a central location to collect, disseminate, sort, update technologies available to producers
- Establishment of a manure treatment and management database
- Extension of a 'Best Management Practices
Establishment of a national classification protocol
- Establishment of a national evaluation process
- Establishment of a technology demonstration agenda, including program funding

The four categories (Inventory, Classification, Evaluation and Information Dissemination) identified in the proposal 'Inventory of Environmental Technologies for the Hog Industry in Canada', have been completed to the extent possible within time and budget constraints. Much of the work in February and March 1999 concentrated on the distribution, collection and recording of questionnaires and on completing the classification and evaluation components. CETAC-WEST has worked closely with OCETA (Ontario) and Enviro-Access (Quebec and the Maritimes) as well as other key contacts in the hog manure management and treatment field.

2. INVENTORY OF TECHNOLOGIES

As of March 26, 1999 a total of 291 surveys had been sent via fax and e-mail to the inventors or proponents of hog manure management and treatment technologies and products. The list of contacts was generated from a variety of sources. They include CETAC's Hog Manure

Management Initiative contacts; United States National Pork Producer Council's list of vendors interested in their odour control program; and OCETA's and Enviro-Access's contacts. A general fax was also sent to hog industry stakeholders requesting contact information for potential technology inventory participants. Follow-up email, fax and phone calls were made throughout late February and early March.

Of the 291 questionnaires sent and through personal contact, plus questionnaires accessed through CETAC-WEST's website, completed surveys are as follows:

REGION	SURVEYS SENT	COMPLETE SURVEYS RETURNED	REFUSED OR NOT APPLICABLE	% RESPONSE
Western Canada (including USA and International)	140	40 + 34*	3	
Ontario	54	23	1	
Quebec and Eastern Canada (including France)	97	22		
TOTAL	291	85 +34*	4	29%

***CETAC-WEST has additional information from 54 contacts through the Western Canadian Hog Manure Management Initiative. They have all been included in the inventory. The information in the inventory does not include operating data from the 34 that did not sign the release form.**

Technology developers completing the questionnaire indicate the following:

- 76% of respondents indicated their technology as beyond the feasibility stage.
- 55% of the respondents identified the need for field tests to verify their technology
- 26% listed demonstrations as necessary to gain acceptance by Canadian livestock producers.

The survey responses continue to come in and new contacts are identified. They can be added to the inventory as they come in. Due to time and budget constraints it was not possible to personally contact companies to complete additional questionnaires.

The inventory of technologies is found in Appendix A. A full listing of companies contacted appears in Appendix B.

3. CLASSIFICATION OF TECHNOLOGIES

A Canada-wide (and United States) conference call to discuss the classification of technologies reflected a number of possible mechanisms for categorizing technologies. Eleven categories were identified and include:

- Application area
- Economic criteria
- Environmental issues and objectives
- Limiting criteria
- Technology type
 - Process involved
- Stage of development
- End products
- Human resource requirements
- Nature of end products
- Technology efficacy
- Producer preference

The primary limitation to the proposed classification system will be in terms of identifying technologies that are relevant to the characteristics of a given hog operation and the specific geography (land, water), economic and social conditions applicable to any specific operation. The user of a system will be able to select a fairly detailed subsection of the complete inventory for review. The final decision as to a technology's suitability to specific conditions is beyond the scope of any classification system.

There are numerous criteria that can be employed for classifying hog manure management and treatment technologies. While all of these categories have some validity, the ability to classify and sort technologies according to multiple sets of criteria will be of greater benefit than to classify according to a single category. This will assist in assessing the net benefit of the system or component to the producer.

Any classification system must first be able to filter technologies according to regional regulations and regional uniqueness. For example, while soil nutrients are the primary driving force for manure management and treatment in Quebec, odour is the big issue on the prairies and in Ontario. Relevant technologies will be different for these regions.

A classification system must be user-oriented and include producer preferences. For example, if pork producers are to have access to the inventory, classification according to environmental issues on the farm or according to net benefit will be important.

There is a need for a multi-tiered classification system involving various combinations of categories. Such factors as environmental issues, cost-benefit, capital investment, end products and applicability to a producer's particular operation (e.g. human resources, ability to retrofit existing infrastructure) would be components of a classification system.

The classification system discussions mainly involved new and emerging technologies. This report recognizes that current best manure management practices are important when producers are considering changes to their current management practices. They can contribute to the immediate sustainability of the industry and may provide options for other manure management technologies and treatment discussions.

In keeping with the recommendation to develop a multi-tiered classification system,

WE RECOMMEND

- **The development and maintenance of a robust, user-friendly computer database using information gathered through the inventory process.**
- **The integration and communication of current ‘best management practices’**

This database will allow for multi-tiered classifications with innumerable combinations. Such a system will appeal to a wide range of potential users of an inventory.

WE RECOMMEND

- **The establishment of a committee, with national representation, to receive, screen, review and recommend for demonstration manure management and treatment technologies.**
- **The evaluation process include an application-specific technical review, and a comprehensive evaluation to compare all technologies to broader standards.**
- **The committee coordinate the interests and needs of industry stakeholders.**

The results of such technology reviews will be useful in providing discipline for technical comparisons of similar technologies within the inventory. It is important that any review be unbiased, especially when comparing technologies at different stages of development or intended for partial rather than full treatment. A matrix could be developed to assure that these sorts of bias do not result in down-rated evaluations in such cases.

A summary document from that discussion was prepared, sent to participants for comment and revisions and appears in **Appendix C**.

Those contributing to the document were:

- Mr. Rick van Kleeck British Columbia Agriculture
- Dr. John Feddes University of Alberta
- Dr. Ernie Barber University of Saskatchewan
- Dave Gullacher Prairie Agricultural Machinery Institute (PAMI)
- Dr. Jan Oleszkiewicz University of Manitoba
- Dr. Sylvio Tessier Manitoba Agriculture
- Dr. Michael Goss University of Guelph
- Dr. Lucien Bordeleau Biolistik Ltd. (Quebec)
- Dr. Phil Westerman North Carolina State University
- Lynda Aycock National Pork Producers Council

4. EVALUATION

Protocols or methods concerning the evaluation of technologies from eleven different evaluation techniques for hog manure management and treatment technologies were reviewed. The strategy for analysis of these evaluations involved the creation of a synthesis document comparing and contrasting the various methods. The document was circulated to a group of panelists selected on the basis of their interest in the subject area. E-mail and fax circulation of the discussion paper to

the panel for review and comment of the document provided a basis for recommendations concerning the development of a standardized protocol for technology evaluation.

As a consequence of regional and local needs there are no definitive mechanisms for evaluation, but there are some common themes contained in those protocols and processes reviewed.

WE RECOMMEND

- **The development and implementation of a standardized evaluation and research process that incorporates both a technical review and a comprehensive evaluation of a technology's economic, social and environmental acceptance / feasibility.**

In addition to the development of a standard primary system for evaluation,

WE RECOMMEND

- **A national committee develops procedures to review hog manure technologies for use in Canada.**
- **That the protocols be developed as required to meet international standards (ETV, etc)**

Coordination of research and evaluation agencies will be important in maintaining an evaluation standard for technologies. In addition to overseeing that various technology verification processes are being followed, a third party organization or panel would also be responsible for evaluation of technologies from the non-technical perspectives. The results of such reviews will be useful in making technical comparisons of similar technologies within the inventory.

The development of an evaluation process that incorporates the above factors will fill gaps evident in many existing processes that look primarily at technical elements with little or no consideration of other important components. By identifying weaknesses, technology proponents will be encouraged to improve their products accordingly.

The complete document can be found in **APPENDIX F**.

5. INFORMATION DISSEMINATION

Part 1 - Disseminators

The first stage of work in this category was to survey 'distributors of information' regarding hog manure technologies and management. The questionnaire was sent to government departments, consulting engineers, universities and colleges, producer associations, hog marketing boards, agriculture and enviro-clubs and stewardship organizations, and various media sources.

The choices for disseminating information included fact sheets, agricultural shows, brochures, personal contact, agriculture newspapers, club meetings and newsletters, videos, press releases, annual meetings and conventions.

From those responses, a list of primary recipients was compiled and a second survey was formulated to target recipients.

The results and summary of this survey appears in **Appendix D**.

As of March 26, 1999 a total of 415 surveys had been sent via fax and e-mail to known distributors of information concerning hog manure management and treatment initiatives. A breakdown by region is as follows:

DISSEMINATION VEHICLES

REGION	SURVEYS SENT	COMPLETE SURVEYS RETURNED	% RESPONSES
Western Canada	149	84	
Ontario	132	35	
Quebec and Eastern Canada	134	18	
TOTAL	415	137	33%

Part 2 - Recipients

The second survey targeting recipients of information was prepared and sent to special interest groups such as those identified above as well as to a cross-section of producers from across Canada. This cross-section was identified in conjunction with the provincial pork producers associations. The results of this survey appear in **Appendix E**.

RECIPIENT / INFORMATION SHARING

REGION	SURVEYS SENT	COMPLETE SURVEYS RETURNED	% RESPONSES
Western Canada	35	15	
Ontario	36 *	24	
Quebec and Eastern Canada	17	3	
TOTAL	88	42	47%

* Ontario Pork included 336 questionnaires with payments to producers

Those that received the second questionnaire included producers as well as industry participants who may have an interest in technologies and products (e.g. facility designers/builders, extension

workers, banks.) The respondents suggested the most effective methods of receiving information regarding new technologies was through workshops, demonstrations and field days, television and other media, pork associations, Herd Health, Prairie Swine Centre and hog and farm related industry publications (20 hog or farm related publications were identified.). Several respondents identified Best Management Practices — BMP's as an effective source of information.

When asked the question, 'What are your primary reasons for wanting to stay abreast of trends on new methods, approaches or technologies to manage hog manure?', 36% of the respondents stated they used the information to change current management practices. 38% stated they wanted to share the information with others. The majority of the respondents for this question were producers, and it shows they are seeking relevant information for their operations.

It is apparent that the effectiveness of information vehicles varies with the recipient. Some disseminators have a small well-known audience, while others have a wide and varied audience. Many of the Quebec organizations found newsletters and other printed material less effective than personal contact.

There was a strong response for results from on-farm demonstration and awareness for information from other activities. One respondent says, "I believe there is a great deal of research going on, but the industry needs to have a place to go . . . to see what projects are being formulated, being conducted, and being completed (and where to find the results)." Another respondent suggests, "I think farmers are well informed about manure management in general. What is lacking is effective technology." And, ". . . we just don't have enough 'success stories'

There are at least two levels of information sharing. Producers are one level, and the other level are those in the area of support to producers (extension and consultants). Information sharing can and should be carried out in two different ways. Both groups recognize the benefits of demonstration and field days. One-on-one is very important to producers. Few producers currently listed the internet as a source of information, but it is growing as a resource. The fact that there is 'a great deal' of information available suggests the usefulness of a centralized clearinghouse or location with various methods of accessing the information.

6. CONCERNS AND ISSUES ARISING FROM THE PROJECT

Though not serious impediments to the project, a variety of concerns and difficulties were identified. They included:

- Hesitancy to sign the Intellectual Property Rights Release form. A number of comments have been received concerning this form. It appears that some hesitation exists over the formality of the procedure. *Following discussions with AAFC, a revised form was drafted and was sent when technology firms expressed concern with the original form.*

- Difficulties identifying specific persons within large organizations to receive surveys. This is especially true for the information dissemination questionnaire.
- Identification of technologies to add to the inventory. Attempts are being made to ensure the inventory is as comprehensive as possible, but it will be virtually impossible to submit an exhaustive inventory.
- Some technology companies wished to be included in the inventory, but chose not to complete the questionnaire.
- Procurement of contact information for overseas technologies.
- Concerns raised by some companies that an inventory has already been done before, but what’s going to be done with the information this time.

7. NEXT STEPS

The technology identification phase has been completed. Additional information will continue to become available as technology developers are identified. The information captured in a user-friendly database will allow producers to look for manure management options, and it will allow for the addition of and changes to information on technologies as they becomes available through additional research, development or demonstration.

Identification and evaluation (step 1 and 2) of technologies without demonstration and dissemination of results (step 3 and 4) will prevent the widespread acceptance of new manure management and treatment technologies to hog producers.

The recommendations in this report list several steps which could lead to the:

EXPANSION OF THE INTENSIVE LIVESTOCK INDUSTRY AND ECONOMIC GROWTH

Step 1	Step 2	Step 3	Step 4	Step 5	
Technology identification	Evaluate and select	Demonstrate & evaluate	Disseminate demonstration results	Industry acceptance and use Expanded ‘BMP’	Economic growth
Completed	Completed	<i>To be done</i>	<i>To be done</i>	<i>to be done</i>	
DATABASE To be developed	EXPERTISE	\$’S To be allocated	EXPERTISE	\$’ S Net gain to producer Revenue to developer Industry expansion	