

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

**APPENDIX F: Evaluation Document**

**SUBMITTED BY:**

**CETAC-WEST**



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HOG MANURE MANAGEMENT TECHNOLOGY EVALUATION PROCESS

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CLASSIFICATION STRATEGY FOR HOG MANURE MANAGEMENT TECHNOLOGIES IN CANADA

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## **HOG MANURE MANAGEMENT TECHNOLOGY EVALUATION PROCESS**

### **INTRODUCTION**

As part of a contract from Agriculture and Agri-Food Canada (AAFC) to inventory hog manure management technologies in Canada, CETAC-WEST is reviewing various options for the evaluation of these technologies. Currently, methods for technology evaluation are many, with most major interest groups in this sector having developed their own procedures. While these procedures obviously assist individual organisations or groups, processes are not necessarily directly compatible. Comparison of technologies evaluated using different processes is, consequently, difficult.

While there is no definitive mechanism for evaluation, this paper intends to outline the commonalties and differences in procedures with the intention of providing suggestions towards the design of an evaluation system that will be supported and used by hog manure technology reviewers nation-wide.

### **CURRENT EVALUATION PROCESSES IN USE IN CANADA**

In the absence of centralized evaluation or assessment procedures, various organizations involved in the review of hog manure management technologies have independently developed mechanisms of their own. A listing of those identified to date follows:

#### Agriculture and Agri-Food Canada

Developed a protocol to test pit additives. This is a strictly technical procedure involving such indicators as pH, temperature, electrical conductivity, dry matter, ash, viscosity, ammonia, volatile fatty acid and hydrogen sulfide gas contents of slurries.

#### Agricultural Value Added Corporation (AVAC)

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The Progrid-TA<sup>2</sup> method of assessment is used. The process is based on assessment of technical strength and marketing strength as the two indicators of future success of a technology. A given technology is located on a grid according to scientific and commercial readiness. The following criteria are used to generate a complete evaluation:

- Scientific strength (technical framework, level of verification, excellence of project team)
- Technological strength (commercial readiness, proprietary strength, technological durability)
- Commercial strength (market characteristics, margin and profit potential, commercialization)

#### B.C. Pork Producers Association

Technologies are assessed according to the following criteria:

Overall acceptability

Proposed technology (feasibility for geographic location, applicability to local environmental issues of land scarcity and nutrient overload, environmental impacts of technology operation)

Site requirements (suitability for regional farm size, ease of meeting space and utility requirements)

Technology evaluation (is there a process for evaluation proposed?)

Economics (description and expected cost per pig marketed)

Required time for design, construction, start-up and evaluation

Personnel (ability of proponent to deliver, suitable qualifications and experience)

References

#### 4. CETAC-WEST

A multi-stakeholder pool of over twenty reviewers has been formed to evaluate technologies and proponents using four key categories.

Categories are technology, management capacity, financial capacity and market analysis.

Between six and eight reviewers chosen from the pool evaluate each technology submitted to CETAC-WEST.

Numerical scores out of a possible 220 and comments are submitted to CETAC-WEST and are combined with CETAC-WEST's own independent review.

Results are presented in the form of an Environmental Business Opportunity document. It is suitable for review by the technology proponent, potential investors and industry stakeholders.

#### 5. Federation des producteurs de porcs du Quebec

Evaluation of liquid hog manure management and treatment technologies. The protocol was developed by a multi-stakeholder working group of twelve persons. Evaluation is based on approximately 40 environmental, agricultural, economic and social criteria.

Criteria are broken into five categories.

environmental (emissions, workplace safety, energy requirements of technology, etc.)

agronomic (nutrient availability and composition for spreading

animal health, reduction of toxins, etc.)

technical (regional and local adaptability, availability of equipment and infrastructure requirements, technical support availability, availability of appropriate inputs etc.)

economic (investment and operation costs, end product markets, awareness of all associated costs, support costs, etc.)

social (impact of technology on public image of the pork industry, reduction of odours and environmental risks, health and safety of workers and the public, etc.) criteria

Proponents of technologies submit to the Federation detailed information concerning:  
 physical/chemical characteristics of the manure slurry pre- and post-treatment by  
 completing a flow chart of the process  
 complete balance of manure constituents by mass and analysis of gaseous emissions

Recommendations made by this group include:  
 development of a protocol for testing and evaluating efficacy of additives  
 subsequent development of a ?registration? procedure for additives  
 development of standards for measuring odours, and  
 development of standards to ensure safety and technical effectiveness of technologies

Technologies / products are evaluated according to four sectors within the manure  
 production stream:

Efficiency of manure production ? feed additives / feed formulation to decrease nitrogen  
 and phosphorous excretion

Efficiency of manure collection techniques ? scrapers, channels, pans, bedding,  
 temperature of storage, odour control

Efficiency of manure storage . treatment techniques ? solid/liquid separation, anaerobic  
 treatment, constructed wetlands, aerobic treatment, composting

Efficiency of manure application techniques ? surface application, direct injection, cold air  
 treatment

#### Manitoba Agriculture

A Technical Advisory Group on Manure Management has been established to help funding  
 agencies evaluate a growing number of proposals on new manure management structures,  
 practices and technologies. The TAG-Manure Management offers its evaluation  
 ?service? to government programs and departments as well as to private industry (e.g.  
 Manitoba Pork).

The purpose of TAG is to help coordinate research and development endeavors in the  
 province by rating the relevance of proposals with respect to the provincial Manure  
 Management efforts as well as avoiding duplication of projects via networking with those  
 various funding agencies. TAG is an expert committee of professionals from departments  
 of Environment, Natural Resources, Agriculture (including agricultural engineers and a  
 business management agronomist), Rural Development, PFRA, and Industry, Trade and  
 Tourism.

A core group of the TAG developed Manitoba Agriculture?s Manure Management  
 Strategy in early 1998. Project relevance and priority for funding are evaluated with  
 respect to the research and development topics listed in the Strategy. The Strategy  
 requires a demonstration of the technical and economic viability of the technologies  
 proposed at the proposal stage of the process.

7. Manitoba Livestock Manure Management Initiative Inc.

An industry-driven initiative, the review committee includes a panel of government and industry stakeholders. Technologies seeking funding from this initiative are evaluated according to the following categories:

Project objective, description and impact (realistic, appropriate to needs, clarity of description, feasibility, planning of project protocol, timelines, monitoring and reporting, compliance with Initiative, expected economic viability, expected impact on livestock manure management)

Budget analysis (reasonable expenditures, in-kind expenditures reasonable, percentage of total expenditures requested from Initiative, proponent's portion of expenditures)

Assessment of applicant (relevant past experience, relevant education)

8. Prairie Swine Centre

A Pit additive study is currently underway to measure and evaluate physical and chemical characteristics of swine manure treated with three manure pit additives. The study is carried out in commercial scale manure channels and simulated outdoor lagoons.

Protocols for the evaluation of pit additives have been developed according to technical criteria including 8 replications of each additive to generate data. The study is expected to be repeated with other pit additive suppliers.

9. Triple S ? proven technology demonstration fund

Triple S uses an evaluation process for existing technologies applying for further funding to launch full scale demonstrations of technology. Technologies are evaluated according to nine categories.

general (demonstration exists, producer and public interest)

technical (availability of data, verification)

management practice (economics and consistency with current operating parameters)

demonstration viability

business opportunity

creation of value-added end products

resources required/requested

benefit from supporting demonstration, environment/safety (compliance, odour control)

## INTERNATIONAL PROCESSES IN USE

### 1. National Pork Producers Council (USA)

The NPPC has developed an evaluation system and full research protocol specifically for review of pit additives. The protocol was developed for testing the effectiveness of additives in treating swine manure to achieve reduction in odour, ammonia, hydrogen sulfide, volatile organic compounds, solids, etc.

Following from the technology evaluation protocol is a more general scorecard that rates technologies on a scale of 1-100 using four categories.

technical

C. economic

C. environmental impact

C. capability of supplier to deliver technology (financial, operator training, construction/retrofit time)

The evaluation process involves multi-stakeholder committee. At least 6 stakeholders review a technology before the full committee provides further evaluation comments.

The NPPC has adopted the CETAC-WEST evaluation procedure for use with a more complete range of technologies.

### 2. North Carolina State University

A Proposal Evaluation Protocol (PEP) has been developed to identify technologies worthy of demonstration. The protocol requires proponents of technologies to submit proposals including the following components:

- |  |   |
|--|---|
| C. Standard information<br>(contacts, general overview,<br>economic benefits)  | C.Regulatory compliance   |
| C. Graphical depiction of<br>technology including loading<br>rates, material flows and end<br>products / by-products | C.Resource requirement (land, labour,<br>power, testing, technical skill,<br>maintenance, operator<br>certifications) |
| C. Design criteria and<br>assumptions  | C.Environmental benefits  |
| C. Construction details  | C.Costs   |
|  | C.Business plan   |
|  | C.Time frame to validate data   |
|  | C.Experimental plan / protocol  |

The protocol is expected to provide a uniform procedure for evaluation of technologies, permit a shorter review period and more thorough review due to more complete proposals. A more accurate and expedient evaluation should therefore be produced.

## 1. CONCLUSIONS AND RECOMMENDATIONS

Hog manure management technologies are very much in a development phase at present, with few technologies at the commercialization stage. Consequently, for many technologies, there is a lack of available information and data to complete a full analysis of their effectiveness. The opportunity exists to implement a standardized evaluation and research process prior to the rigorous testing of these technologies.

This review indicates the diversity of approaches to hog manure technology evaluation taken across Canada at present. While differences do exist, it seems possible that a single evaluation can be developed that will address the needs of most reviewers of technologies. This standardized procedure will facilitate comparison of technologies and be a first step to the establishment of standards with protocols included for specific products and processes for hog manure management technologies in Canada.

In addition to the development of a single system for evaluation, it is recommended that a third party verification procedure is developed to review hog manure technologies for use in Canada. Such a procedure could use an organization or team of independent reviewers to evaluate technologies according to national evaluation standards. Not only would a third party verification system ensure that objective and consistent levels of comparison were being achieved, but information stemming from evaluations would be accessible to interested parties from one central source. A third party verification team may only be required for the first few years to provide assistance with and training for the technology reviews.

A standardized evaluation system would utilize specific processes for the verification of technology while social, economic and financial analysis would make use of a common procedure for all technologies. In terms of technology verification, evaluation processes for the following categories should be established:

- C. Nutrient supplements
- C. Pit additives
- C. Solid/liquid separators
- C. Land applications (including compost)
- C. Water recycling
- C. Digestion processes
- C. Other

The development of evaluation processes in each of these technology categories will permit analysis to determine the efficacy of each technology as well as providing a means for comparison amongst similar technology types. The collaboration of agencies currently using evaluation processes in any of these categories should be encouraged in the development of standard procedures applicable nation-wide.



Education and support to research and evaluation agencies will be important in implementing and maintaining an evaluation standard for technologies. While such agencies will be important in the design, implementation and execution of evaluation processes, it is recommended that a third party organization or panel be responsible for overseeing the total process. This third party would be responsible for ensuring that the process is followed according to set standards regardless of which institution / organization is performing an evaluation on a particular technology.

In addition to overseeing that various technology verification protocol standards processes are being met, a third party organization or panel would be responsible for evaluation of technologies from non-technical perspectives. A common evaluation process for all technologies should be developed that incorporates the following:

#### Environmental

- C. safety of technology (workplace)
- C. level of emissions / discharge produced; nature of end products and by-products
- C. ability to address environmental issues and minimise adverse environmental impacts
- C. energy requirements of technology
- C. contribution to environmental sustainability, net environmental cost / benefit
- C. contribution to national / international environmental initiatives (e.g. greenhouse gas reduction)

#### Technical

- C. level of development technology has reached to date
- C. ease of installation and operation
- C. adaptability to local/regional conditions
- C. availability of technical support
- C. durability

#### Economic

- C. markets for end products / revenue generation potential of end products
- C. marketing strategy for technology and for its end products
- C. availability in Canada
- C. cost ? financial (investment, operation and associated costs to producers) and human resources
- C. financibility of technology
- C. management team / background of proponent

#### Social

- C. public acceptance of technology in terms of odor / environmental risk reduction
- C. ability of technology to cater to the needs and capacities of hog producers
- C. likelihood of producers to embrace the technology
- C. contribution of technology to enhanced public image of the pork industry
- C. on-farm acceptance of technology (health and safety)
- C. regulatory compliance nationally, provincially, municipally

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.

An important consideration in the development of evaluation procedures and protocols is to build in a rigorous monitoring and record keeping component. A rigid, data-based and standardized format for evaluating technologies should be adopted rather than depending on softer evaluation techniques such as testimonials or conceptual reviews.

#### Chronology for Technology Commercialization

- C. Technology Identification
  - C. Inventory
    - C. Classification
      - C. Evaluation according to technical protocol
      - C. Evaluation according to common protocol
      - C. Selection for demonstration
        - C. Evaluation and monitoring of demonstration
          - C. Further development and demonstration
            - C. Commercialization of technology
              - C. Dissemination of information
                - C. Industry acceptance
                  - C. Economic growth

Any gaps or barriers to commercialisation of a given technology will be identified by the technical and common evaluation procedures and protocols. Initiation of evaluations early in the process will help to separate technologies that are likely to succeed commercially from those that require further development prior to the more expensive demonstration and commercialisation stages.

The process will also identify technologies that do not meet current needs of producers, providing important feedback for further improvements and development of manure management alternatives.