

**Final Report
For
Advanced Manure Management Technologies For
Ontario Project**

A Project Funded
By

Cold Springs Farm
Selves Farms
Ontario Pork
Premium Pork
Ontario Pork Industry Council
Poultry Industry Council
Ontario Ministry of Agriculture and Food
Through
Healthy Futures For Ontario Program

Richard St. Jean
Geomatrix Consultants
AMMTO Project Manager

John Alderman
Cold Springs Farm
Project Chair

March 20, 2004
AMMTO

Advanced Manure Management Technologies For Ontario



Disclaimer

**Use of Information in
This Report is at the
Users Own Risk.**

**AMMTO and all persons
associated with the
AMMTO project do not
accept any liability for
the use of this
information.**



Table of Contents

Section Number	Section Title	Page Number
1.0	Project Background	1
2.0	Project Objectives	1
3.0	Summary of Project Activities	2
3.1	Public Meeting	2
3.2	Develop Technology Information Request Form	3
3.3	Identification of Manure Management Technologies	3
3.4	Soliciting Technology Information	4
3.5	Technology Database Development	4
3.6	Technical Review Process	7
3.7	Development of Economic Evaluation Template	8
3.8	Development of Decision Making Database	9
4.0	Farm Manure Management Case Studies	9
4.1	David Bromley "Zero Waste Discharge System" for a 110 Sow Farrow to Finish Farm	10
4.1.1	Case Study Farm Description	10
4.1.2	Description of Case Study Manure Management Technology	11
4.1.3	Capital Cost Summary for the David Bromley "Zero Waste Discharge System"	14
4.1.4	Economic Evaluation of Implementing the David Bromley "Zero Waste Discharge System" on a 110 Sow Farrow to Finish Farm	19
4.1.5	Sensitivity Analysis	21
4.1.6	Summary	25
4.2	Böhni Compact Anaerobic System for a 2,000 Sow Finishing Farm	26
4.2.1	Case Study Farm Description	26
4.2.2	Description of Case Study Manure Management Technology	27
4.2.3	Capital Cost Summary for the Böhni Compact Biogas Plant	32
4.2.4	Economic Evaluation of Implementing the Böhni Compact Biogas Plant on the Cold Springs Wright Farm	35
4.2.5	Sensitivity Analysis	40
4.2.6	Summary	47
4.3	J.F. BioEnergy Pyrolysis System for a 28,000 Bird Broiler Farm	50
4.3.1	Case Study Farm Description	50
4.3.2	Description of Case Study Manure Management Technology	51

Section Number	Section Title	Page Number
4.3.3	Capital Cost Summary for the J.F. BioEnergy Pyrolysis System	53
4.3.4	Economic Evaluation of Implementing the J.F. BioEnergy Pyrolysis System on the McKinlay Farm	57
4.3.5	Sensitivity Analysis	60
4.3.6	Summary	63
4.4	New Logic "VSEP" Membrane System for a 2,500 Sow Farrow to Wean Farm	64
4.4.1	Case Study Farm Description	64
4.4.2	Description of Case Study Manure Management Technology	65
4.4.3	Capital Cost Summary for the New Logic "VSEP" Membrane System	69
4.4.4	Economic Evaluation of Implementing the New Logic "VSEP" System on The Premium Pork 2,500 Sow Farm	72
4.4.5	Sensitivity Analysis	74
4.4.6	Summary	77
4.5	Summary of Case Study Manure Management Economic Evaluations	77
5.0	Project Findings	79
5.1	Overview of Technology Submissions to AMMTO	79
5.2	Benefits of Adopting Advanced Manure Management Technology	79
5.3	Assessing "Perceived" Advantages of Manure Management Systems	80
5.4	Technologies Not Included in the AMMTO Report	82
5.5	Parallels Between Municipal Wastewater and Manure Treatment	82
5.6	Mineralized Nutrients and Their Potential to Move with Soil Water	83
5.7	Manure Spreader Versatility	84
5.8	Uncertainty of Pathogen Decline that Occurs During Biological Treatment	84
5.9	The Use of Soil as a Treatment Component of a Manure Management System	85
5.10	Sale of Residuals as a Source of Economic Return	86
5.11	Diverting Manure Nutrients Away from Agricultural Systems	86
5.12	Energy from Manure	87
5.13	Manure Water Content as a Barrier to Treatment	87

List of Appendices

Appendices Number	Appendices Title	Page Number
1	Summary of AMMTO Public Meeting Discussions Posted on AMMTO Website	I
2	AMMTO "Technology Submission Form"	II
3	Database of Technology Suppliers Identified	III
4	Technology Information Request Letter	IV
	Summary Of Technologies Submitted to AMMTO for Review	V
6	AMMTO Technology Review Committee Members	VI
7	Technology Evaluation Sheets	VII
	Example Of Mathematical Calculations for Determining Technology Comparison	
8	VIII Rankings Using AMMTO Process	
9	Economic Evaluation Template.	IX
10	Flow Chart for Use of "Steps to Implement" Database and Typical Database Entry	X
11	Instructions For Using The AMMTO Manure Management "Steps To Implement" Database	IX

Appendix 7

Technology Evaluation Sheets

Manure Additives

Disclaimer

Users of the information provided in the Technology Evaluation Sheets do so at their own risk. AMMTO and persons associated with the AMMTO project accept no liability for the use of the information provided in the Technology Evaluation Sheets. The information included in the Technology Evaluation Sheets is based on AMMTO's interpretation of information provided by the Technology Suppliers and the knowledge of AMMTO Evaluation Team Members. Different individuals may interpret and rank the technologies differently.

AMMTO Technology Evaluation Sheet

Disclaimer

Use of this information is at the users own risk
 AMMTO and all persons associated with the AMMTO project do not accept any liability for the use of this information

Technology Submission Company: Distributors Processing Inc.

Type of Technology: Manure Additive & Feed Additive Available

Evaluation Criteria	Performance Ranking	Confidence Ranking	AMMTO Technical Committee Evaluation Comments
Odour reduction			- product available for feed that reduces emission of ammonia odours by reducing ammonia levels in manure that is defecated - product available that is added to the manure to reduce ammonia in manure - some independent university testing has been completed to verify results
Reduction of green house gas emissions			- no claim made for green house gas reduction
Reduction of nitrogen loading to ground water			no claim made for reduction of nitrogen loading
Reduction in bacteria loading to ground and surface water			- no claim made regarding bacteria but the product increases biological activity which may reduce some pathogens
Reduction in manure volume and/or mass			- no claim made for volume reduction but the product increases biological activity in stored manure which will break down solids
Ease of meeting government regulations with technology			- manufacturer indicates that the product is accepted by Agriculture Canada and the USA Food and drug agency
Reduction of nitrogen loading to surface water			- no claim made
Reduction of phosphorus loading to surface water			- product is an additive and does not change total phosphorus content
Potential for degrading medicines and other by-pass substances found in manures			- manufacturer indicates that the product increases biological activity in stored manure. The increased biological activity may cause some pathogen decline
Potential to reduce dependency on local land base for manure application			- product is an additive and can not directly reduce land base requirements
Capital costs			- pricing not provided
O&M costs			- costs not provided

Evaluation comments are based on AMMTO's interpretation of information provided to AMMTO by the Technology Suppliers as of December 31, 2002 and knowledge of AMMTO Evaluation Team Members regarding the technology.

AMMTO Technology Evaluation Sheet

Disclaimer

Use of this information is at the users own risk
AMMTO and all persons associated with the AMMTO project do not accept any liability for the use of this information

Technology Submission Company: SHAC

Type of Technology: Manure Additive & Feed Additive Available

Evaluation Criteria	Performance Ranking	Confidence Ranking	AMMTO Technical Committee Evaluation Comments
Odour reduction			-SHAC indicate a reduction in ammonia and volatile fatty acids due to increased biological activity - no information of degree of odour reduction -the presence of volatile fatty acids are a precursor of odours so a reduction should decrease odour potential
Reduction of green house gas emissions			- no claim that green house gases are reduced
Reduction of nitrogen loading to ground water			-information indicates that there is an increase in available nitrogen which could increase the potential nitrogen movement with soil water depending on timing of application
Reduction in bacteria loading to ground and surface water			-no indication that there is a bacteria reduction - stimulation of aerobic bacterial activity could provide some pathogen decline
Reduction in manure volume and/or mass			-data indicates that the SHAG product breaks down solids but there is no liquid volume reduction
Ease of meeting government regulations with technology			- the product has been independently tested by AURI and University of Iowa but no indication is given as to what Ontario regulations the product complies with
Reduction of nitrogen loading to surface water			-product increases nitrogen availability - under conditions of soil water migration soluble nitrogen may migrate
Reduction of phosphorus loading to surface water			- data indicates that there is a reduction in phosphate - total phosphorus will be conserved because phosphorus is not volatile
Potential for degrading medicines and other by-pass substances found in manures			- product claim is that it increases biological activity so it should increase degradation of medicines and other by-pass substances
Potential to reduce dependency on local land base for manure application			- some reduction of ammonia other wise nutrients are conserved, therefore no reduction in land base requirements
Capital costs			- no capital costs just cost for product - product costs \$1.00 to treat 425 gallons of manure
O&M costs			- \$1.00/425 gallons of manure treated

Evaluation comments are based on AMMTO's interpretation of information provided to AMMTO by the Technology Suppliers as of December 31, 2002 and knowledge of AMMTO Evaluation Team Members regarding the technology.

AMMTO Technology Evaluation Sheet

Disclaimer

Use of this information is at the users own risk
AMMTO and all persons associated with the AMMTO project do not accept any liability for the use of this information

Technology Submission Company: Enviro Science Laboratories

Type of Technology : Manure Additive - Use of Copper as Inhibitor to Anaerobic Activity

Evaluation Criteria	Performance Ranking	Confidence Ranking	AMMTO Technical Committee Evaluation Comments
Odour reduction			- product reduces odour by inhibiting anaerobic bacteria; - data claims product eliminates H ₂ S & ammonia -olfactory tests conducted at UBC
Reduction of green house gas emissions			- product inhibits anaerobic bacteria - if no anaerobic activity then methane gas is not produced which is the major greenhouse gas associated with manures
Reduction of nitrogen loading to ground water			- nutrients conserved therefore no change in total nitrogen loading - data indicates reduced nitrogen loading but no details provided to explain how this occurs - some mineral nitrogen (ammonia) may be converted to organic form as bacterial biomass if product promotes aerobic bacterial activity; - aerobic degradation converts organic nitrogen in manure to ammonia then nitrate as part of degradation process - may be potential for increased mineral nitrogen concentration which is more susceptible to leaching
Reduction in bacteria loading to ground and surface water			if product is promoting aerobic activity there may be potential for pathogen kill from aerobic biological activity
Reduction in manure volume and/or mass			- no process to reduce volume
Ease of meeting government regulations with technology			- there may be concern over copper loading to soil from treated manure; - composition of material may be questioned and reviewed prior to approval for use; - research data may be requested to support claims - benefits claimed resolve some concerns with manure
Reduction of nitrogen loading to surface water			- nutrients conserved therefore no change in total nitrogen loading; - data indicates reduced nitrogen loading but no details provided to explain how this occurs; - some mineral nitrogen (ammonia) may be converted to organic form as bacterial biomass if product promotes aerobic bacterial activity; - aerobic degradation converts organic nitrogen in manure to ammonia then nitrate as part of degradation process; - may be potential for increased mineral nitrogen concentration which is more susceptible to leaching
Reduction of phosphorus loading to surface water			- nutrients conserved therefore no change in total phosphorus loading - aerobic degradation may result in higher concentration of mineralized phosphorus in manure if product promotes aerobic biological activity; - higher mineralized phosphorus concentration could increase potential for phosphorus movement to tile drains and surface water
Potential for degrading medicines and other by-pass			if product promotes aerobic activity, aerobic biological activity will degrade medicines etc. provided they are not at levels inhibitory to biological activity
Potential to reduce dependency on local land base for manure application			- no opportunity for volume reduction - nutrients conserved therefore no decrease in total land base required - if odours reduced it may allow the manure to be applied closer to residences which will increase the amount of local land available for manure applications.
Capital costs			No costs provided. Require chemical dosing system which will be relatively in-expensive
O&M costs			\$0.54/m ³ of manure treated

Evaluation comments are based on AMMTO's interpretation of information provided to AMMTO by the Technology Suppliers as of December 31, 2002 and knowledge of AMMTO Evaluation Team Members regarding the technology.

AMMTO Technology Evaluation Sheet

Disclaimer

Use of this information is at the users own risk
AMMTO and all persons associated with the AMMTO project do not accept any liability for the use of this information

Technology Submission Company: Hydra-Logic Systems Inc.

Type of Technology : Manure Additive - Promotes Aerobic Conditions

Evaluation Criteria	Performance Ranking	Confidence Ranking	AMMTO Technical Committee Evaluation Comments
Odour reduction			- material promotes aerobic biological activity; - data claims product reduces H ₂ S, and ammonia; - elimination of anaerobic conditions will reduce the levels of odorous compounds produced; - ammonia and H ₂ S are not necessarily the most objectionable of odour compounds
Reduction of green house gas emissions			- data indicates that aerobic conditions are promoted; - elimination of anaerobic activities will eliminate the production of methane a significant greenhouse gas released from anaerobic manure
Reduction of nitrogen loading to ground water			- nutrients conserved therefore no change in total nitrogen loading - some mineral nitrogen (ammonia) may be converted to organic form as bacterial biomass - aerobic degradation converts organic nitrogen in manure to ammonia then nitrate as part of degradation process - may be potential for increased mineral nitrogen concentration which is more susceptible to leaching
Reduction in bacteria loading to ground and surface water			- no claims made for pathogen kill - increased aerobic biological activity will promote biological destruction of pathogens
Reduction in manure volume and/or mass			- no process to reduce volume
Ease of meeting government regulations with technology			- composition of material may be questioned and reviewed prior to approval for use - research data may be requested to support claims of odour reduction - benefits claimed resolve some concerns with manure
Reduction of nitrogen loading to surface water			- nutrients conserved therefore no change in total nitrogen loading; - some mineral nitrogen (ammonia) may be converted to organic form as bacterial biomass; - aerobic degradation converts organic nitrogen in manure to ammonia then nitrate as part of degradation process; - may be potential for increased mineral nitrogen concentration which is more susceptible to movement to tile drains and surface water
Reduction of phosphorus loading to surface water			- nutrients conserved therefore no change in total phosphorus loading - aerobic degradation may result in higher concentration of mineralized phosphorus in manure - higher mineralized P concentration could increase potential for phosphorus movement to tile drains and surface water
Potential for degrading medicines and other by-pass substances found in manures			- aerobic biological activity will degrade medicines etc. provided they are not at levels inhibitory to biological activity
Potential to reduce dependency on local land base for manure application			- no opportunity for volume reduction; - nutrients conserved therefore no decrease in total land base required - if odours reduced it may allow the manure to be applied closer to residences which will increase the amount of local land available for manure applications.
Capital costs			Capital costs will be relatively low. May require chemical addition metering system.
O&M costs			Require 1 quart/ 50,000 gallons Approximate costs for product are \$0.019/m ³ of storage per day

Evaluation comments are based on AMMTO's interpretation of information provided to AMMTO by the Technology Suppliers as of December 31, 2002 and knowledge of AMMTO Evaluation Team Members regarding the technology.

AMMTO Technology Evaluation Sheet

Disclaimer

Use of this information is at the users own risk
AMMTO and all persons associated with the AMMTO project do not accept any liability for the use of this information

Technology Submission Company: Natures Key Company-A Division of American Eco-Systems Inc.

Type of Technology : Manure Additive - Promotes Biological Degradation

Evaluation Criteria	Performance Ranking	Confidence Ranking	AMMTO Technical Committee Evaluation Comments
Odour reduction			- product promotes biological activity; - data does not say if product promotes both aerobic and anaerobic activity or one or the other - testing data provided indicates a 95% reduction in ammonia & hydrogen sulfide in air space above manure and an 85% decrease in offensiveness of odours; - data indicates a 75% increase in Indol in the manure which is an offensive odour causing compound - if product promotes anaerobic biological activity it could increase odours
Reduction of green house gas emissions			- data indicates product increases biological activity - if anaerobic biological activity is increased there could be an increase in greenhouse gas emissions in the form of methane gas
Reduction of nitrogen loading to ground water			- nutrients conserved therefore no change in total nitrogen loading; - data confirms no change in total nitrogen in manure - some mineral nitrogen (ammonia) may be converted to organic form as bacterial biomass; data indicates 95% reduction in ammonia - aerobic degradation converts organic nitrogen in manure to ammonia then nitrate as part of degradation process - may be potential for increased mineral nitrogen concentration which is more susceptible to leaching
Reduction in bacteria loading to around and surface water			- no claims made for pathogen kill - increased biological activity will promote biological destruction of pathogens
Reduction in manure volume and/or mass			no process to reduce volume
Ease of meeting government regulations with technology			- composition of material may be questioned and reviewed prior to approval for use - research data may be requested to support claims of odour reduction; - benefits claimed resolve some concerns with manure - some conflicting data on odorous compounds presented and will need resolution (indol concentration increased in manure and there is an offensive odour associated with Indol)
Reduction of nitrogen loading to surface water			- nutrients conserved therefore no change in total nitrogen loading data confirms no change in total nitrogen in manure - some mineral nitrogen (ammonia) may be converted to organic form as bacterial biomass; data indicates 95% reduction in ammonia - aerobic degradation converts organic nitrogen in manure to ammonia then nitrate as part of degradation process - may be potential for increased mineral nitrogen concentration which is more susceptible to leaching
Reduction of phosphorus loading to surface water			- nutrients conserved therefore no change in total phosphorus loading - biological degradation may result in higher concentration of mineralized phosphorus in manure - higher mineralized phosphorus concentration could increase potential for phosphorus movement to tile drains and surface water
Potential for degrading medicines and other by-pass substances found in manures			- biological activity will degrade medicines etc. provided they are not at levels inhibitory to biological activity - information provided indicates that antibiotics at concentrations less than 10% of total manure solids will not affect effectiveness of product
Potential to reduce dependency on local land base for manure application			- no opportunity for volume reduction - nutrients are conserved therefore land base requirements are unchanged by use of product - if odours reduced it may allow the manure to be applied closer to residences which will increase the amount of local land available for manure applications.
Capital costs			Capital costs will be relatively low. May require chemical addition metering system.
O&M costs			\$0.0036/gallon of manure produced

Evaluation comments are based on AMMTO's interpretation of information provided to AMMTO by the Technology Suppliers as of December 31, 2002 and knowledge of AMMTO Evaluation Team Members regarding the technology.

AMMTO Technology Evaluation Sheet

Disclaimer

Use of this information is at the users own risk
AMMTO and all persons associated with the AMMTO project do not accept any liability for the use of this information

Technology Submission Company: NEP

Type of Technology : Manure Additive (Derived from seaweed)

Evaluation Criteria	Performance Ranking	Confidence Ranking	AMMTO Technical Committee Evaluation Comments
Odour reduction			- product promotes aerobic biological activity therefore it has potential to reduce odours - no data to support degree of odour reduction
Reduction of greenhouse gas emissions			- product promotes aerobic biological activity therefore it has potential to reduce anaerobic conditions that generate greenhouse gas emissions - no data to support degree of greenhouse gas reduction
Reduction of nitrogen loading to ground water			- nutrients presumably conserved therefore no change in total nitrogen loading - some mineral nitrogen (ammonia) may be converted to organic form as bacterial biomass - aerobic degradation converts organic nitrogen in manure to ammonia then nitrate as part of degradation process
Reduction in bacteria loading to ground and surface water			- information claims pathogens in the manure are killed general knowledge of aerobic degradation tends to support this theory; aerobic bacteria produce natural antibiotics
Reduction in manure volume and/or mass			- no process to reduce volume
Ease of meeting government regulations with technology			- composition of material may be questioned and reviewed prior to approval for use - research data may be requested to support claims of odour and greenhouse gas reduction - benefits claimed resolve some concerns with manure
Reduction of nitrogen loading to surface water			- nutrients conserved therefore no change in total nitrogen loading - some mineral nitrogen (ammonia) may be converted to organic form as bacterial biomass - aerobic degradation converts organic nitrogen in manure to ammonia then nitrate as part of degradation process - may be potential for increased mineral nitrogen concentration which is more susceptible to movement to the drains and surface water
Reduction of phosphorus loading to surface water			- nutrients conserved therefore no change in total phosphorus loading - aerobic degradation may result in higher concentration of mineralized phosphorus in manure - higher mineralized P concentration could increase potential for phosphorus movement to tile drains and surface water
Potential for degrading medicines and other by-pass substances found in manures			- aerobic biological activity will degrade medicines etc. provided they are not at levels inhibitory to biological activity
Potential to reduce dependency on local land base for manure application			- no opportunity for volume reduction - nutrients conserved therefore no reduction in total land base required - if odours reduced it may allow the manure to be applied closer to residences which will increase the amount of local land available for manure applications
Capital costs			Capital costs are less than \$2,000 for metering pump or material can be applied periodically in bulk amounts
O&M costs			A number of products available - No costs provided

Evaluation comments are based on AMMTO's interpretation of information provided to AMMTO by the Technology Suppliers as of December 31, 2002 and knowledge of AMMTO Evaluation Team Members regarding the technology.

AMMTO Technology Evaluation Sheet

Disclaimer

Use of this information is at the users own risk
AMMTO and all persons associated with the AMMTO project do not accept any liability for the use of this information

Technology Submission Company: Organic Biotech Systems Inc.

Type of Technology : Manure Additive - Product Stimulates Microbial Activity (Both Aerobic & Anaerobic)

Evaluation Criteria	Performance Ranking	Confidence Ranking	AMMTO Technical Committee Evaluation Comments
Odour reduction			<ul style="list-style-type: none"> - product stimulates microbial activity - data indicates the product works for anaerobic systems and aerobic systems - information provided states that H₂S and ammonia odours reduced b 75%
Reduction of green house gas emissions			<ul style="list-style-type: none"> - product stimulates microbial activity - data indicates the product works for anaerobic systems and aerobic systems - if anaerobic bacteria are stimulated in stored manure there will be an increase in methane production and therefore an increase in greenhouse gas emissions
Reduction of nitrogen loading to ground water			<ul style="list-style-type: none"> - no indication that nitrogen is reduced or that mineral nitrogen concentrations are reduced by conversion to organic nitrogen in the form of bacterial biomass - product is indicated to increases aerobic and anaerobic biological activity - mineral nitrogen may be converted to organic form as microbial biomass but data provided does not confirm this
Reduction in bacteria loading to ground and surface water			<ul style="list-style-type: none"> - increased microbial activity will likely result in increased biological destruction of pathogens
Reduction in manure volume and/or mass			<ul style="list-style-type: none"> - no process to reduce volume
Ease of meeting government regulations with technology			<ul style="list-style-type: none"> - composition of material may be questioned and reviewed prior to approval for use - research data may be requested to support claims of odour reduction - benefits claimed resolve some concerns with manure
Reduction of nitrogen loading to surface water			<ul style="list-style-type: none"> - no indication that nitrogen is reduced or that mineral nitrogen concentrations are reduced by conversion to organic nitrogen in the form of bacterial biomass - product is indicated to increases aerobic and anaerobic biological activity - mineral nitrogen may be converted to organic form as microbial biomass but data provided does not confirm this
Reduction of phosphorus loading to surface water			<ul style="list-style-type: none"> - phosphorus is conserved therefore no change in total phosphorus loading - biological degradation of organic solids in manure may result in higher concentration of mineralized phosphorus in manure - higher mineralized phosphorus concentration could increase potential for phosphorus movement to tile drains and surface water
Potential for degrading medicines and other by-pass substances found in manures			<ul style="list-style-type: none"> - increased biological activity will promote the biological break down of medicines etc provided they are not at concentrations inhibitory to biological activity
Potential to reduce dependency on local land base for manure application			<ul style="list-style-type: none"> - no opportunity for volume reduction - nutrients conserved therefore no reduction in total land base required - if odours reduced it may allow the manure to be applied closer to residences which will increase the amount of local land available for manure applications.
Capital costs			<ul style="list-style-type: none"> - Equipment capital costs will be relatively low. - May require a chemical addition pumping system.
O&M costs			\$0.44/m ³ of manure treated

Evaluation comments are based on AMMTO's interpretation of information provided to AMMTO by the Technology Suppliers as of December 31, 2002 and knowledge of AMMTO Evaluation Team Members regarding the technology.

AMMTO Technology Evaluation Sheet

Disclaimer

Use of this information is at the users own risk
AMMTO and all persons associated with the AMMTO project do not accept any liability for the use of this information

Technology Submission Company: Planistics Management Ltd.
Type of Technology : Manure Additive - Sea Weed Derived Product

Evaluation Criteria	Performance Ranking	Confidence Ranking	AMMTO Technical Committee Evaluation Comments
Odour reduction			- material promotes biological activity by providing vibration resonance energy that acts as a catalyst to promote positive aerobic microbial activity, - aerobic conditions will eliminate production of foul compounds generated under anaerobic conditions - data claims total elimination of ammonia in 30 days and total odour elimination
Reduction of green house gas emissions			- material promotes biological activity by providing vibration resonance energy that acts as a catalyst to promote positive aerobic microbial activity - aerobic conditions will eliminate production of greenhouse gases generated under anaerobic conditions
Reduction of nitrogen loading to ground water			- nutrients presumably are conserved therefore no change in total nitrogen loading - some mineral nitrogen (ammonia) may be converted to organic form as bacterial biomass - aerobic degradation converts organic nitrogen in manure to ammonia then nitrate as part of degradation process
Reduction in bacteria loading to round and surface water			- information claims use of the product provides pathogen kill general knowledge of aerobic degradation tends to support this then if indeed product is promoting aerobic activity
Reduction in manure volume and/or mass			- no process to reduce volume
Ease of meeting government regulations with technology			- composition of material may be questioned and reviewed prior to approval for use - research data may be requested to support claims of odour reduction - benefits claimed resolve some concerns with manure
Reduction of nitrogen loading to surface water			- nutrients are presumably conserved therefore no change in total nitrogen loading - some mineral nitrogen (ammonia) may be converted to organic form as bacterial biomass - aerobic degradation converts organic nitrogen in manure to ammonia then nitrate as part of degradation process - may be potential for increased mineral nitrogen concentration which is more susceptible to movement to the drains and surface water
Reduction of phosphorus loading to surface water			- nutrients conserved therefore no change in total phosphorus loading - aerobic degradation may result in higher concentration of mineralized phosphorus in manure - higher mineralized phosphorus concentration could increase potential for phosphorus movement to tile drains and surface water
Potential for degrading medicines and other by-pass substances found in manures			- aerobic biological activity will degrade medicines etc. provided they are not at levels inhibitory to biological activity
Potential to reduce dependency on local land base for manure application			- no opportunity for volume reduction - nutrients are presumably conserved so there is no reduction in the total land base required - if odours reduced it may allow the manure to be applied closer to residences which will increase the amount of local land available for manure applications. - may be some conversion of nitrate to nitrogen gas if anoxic conditions exist, which would reduce nitrogen concentration
Capital costs			No costs provided.
O&M costs			\$0.80 per pig fattened

Evaluation comments are based on AMMTO's interpretation of information provided to AMMTO by the Technology Suppliers as of December 31, 2002 and knowledge of AMMTO Evaluation Team Members regarding the technology.

AMMTO Technology Evaluation Sheet

Disclaimer

Use of this information is at the users own risk
 AMMTO and all persons associated with the AMMTO project do not accept any liability for the use of this information

Technology Submission Company: Super-F Inc.

Type of Technology : Manure Additive - Produces Chemical Reactions That Destroy Odour Causing Compounds

Evaluation Criteria	Performance Ranking	Confidence Ranking	AMMTO Technical Committee Evaluation Comments
Odour reduction			- data indicates material produces chemical reactions to eliminate odour compounds - listed data for reduction of ammonia, hydrogen sulfide, skatole, methane, and mercaptan
Reduction of green house gas emissions			- data indicates that methane production is reduced by 80% - this is possible if anaerobic conditions are eliminated
Reduction of nitrogen loading to ground water			- no data provided regarding nitrogen removal therefore it has been assumed that denitrification does not occur - nutrients conserved therefore no change in total nitrogen loading
Reduction in bacteria loading to ground and surface water			- no information provided on pathogen kill - aerobic biological activity may be stimulated that will potentially provide some pathogen kill
Reduction in manure volume and/or mass			- no process to reduce volume
Ease of meeting government regulations with technology			- composition of material may be questioned and reviewed prior to approval for use - copies of research data may be requested to support claims of odour and greenhouse gas reduction - benefits claimed resolve some concerns with manure
Reduction of nitrogen loading to surface water			- no data provided regarding nitrogen removal therefore it has been assumed that denitrification does not occur - nutrients conserved therefore no change in total nitrogen loading
Reduction of phosphorus loading to surface water			- nutrients conserved therefore no change in total phosphorus loading
Potential for degrading medicines and other by-pass substances found in manures			- data does not indicate that medicine break down is promoted by the product - data provided indicates that the product "dissolves sludges" which tends to indicate that there is increased aerobic biological activity - aerobic biological activity will degrade medicines etc. provided the _____ are not at levels inhibitory to biological activity
Potential to reduce dependency on local land base for manure application			- no opportunity for volume reduction - nutrients are conserved therefore there is no reduction in the total land base required - if odours reduced it may allow the manure to be applied closer to residences which will increase the amount of local land available for manure applications.
Capital costs			No costs provided
O&M costs			\$0.18 - \$0.30 per hog (cost to treat manure generated by one hog over the hogs stay in the barn)

Evaluation comments are based on AMMTO's interpretation of information provided to AMMTO by the Technology Suppliers as of December 31, 2002 and knowledge of AMMTO Evaluation Team Members regarding the technology.

Aerobic Biological Treatment Based Systems

Disclaimer

Users of the information provided in the Technology Evaluation Sheets do so at their own risk. AMMTO and persons associated with the AMMTO project accept no liability for the use of the information provided in the Technology Evaluation Sheets.

The information included in the Technology Evaluation Sheets is based on AMMTO's interpretation of information provided by the Technology Suppliers and the knowledge of AMMTO Evaluation Team Members. Different individuals may interpret and rank the technologies differently.

AMMTO Technology Evaluation Sheet

Disclaimer

Use of this information is at the users own risk
 AMMTO and all persons associated with the AMMTO project do not accept any liability for the use of this information

Technology Submission Company: Bion Technologies Inc.

Type of Technology: Solids Settling, Facultative Lagoons and Wetland Treatment

Evaluation Criteria	Performance Ranking	Confidence Ranking	AMMTO Technical Committee Evaluation Comments
Odour reduction			<ul style="list-style-type: none"> - wet solids removed from settling basins will generate odours if not composted or kept aerobic - settling ponds, facultative lagoons and wetland with large surface area and potential for odours - only surface liquid kept aerated in facultative lagoons therefore anaerobic conditions in lower part of lagoon that can generate odorous compounds that can off gas
Reduction of green house gas emissions			<ul style="list-style-type: none"> - settling ponds, facultative lagoons and wetland all have some potential to generate greenhouse gases
Reduction of nitrogen loading to ground water			<ul style="list-style-type: none"> - nutrients should be tied up in microbial biomass which should reduce potential for movement to ground water when land applied - potential for some nitrogen loading from wetland if it is not a sealed wet land - nutrients concentrated in solids are applied at a low volumetric loading rate that reduces potential for nitrogen movement to groundwater - potential for nitrogen loading from lagoons if not sealed; - potential to sell solids to horticultural market which will reduce farm application of nutrients
Reduction in bacteria loading to ground and surface water			<ul style="list-style-type: none"> - natural pathogen kill due to time manure is in various stages of treatment system - pathogen kill will likely not be complete; data provided is for indicator organisms rather than actual pathogen species - solids require composting in order to obtain some level of pathogen kill - wetland may be an issue with increase in West Nile virus and potential of wetland to be a mosquito breeding ground
Reduction in manure volume and/or mass			<ul style="list-style-type: none"> - no step for volume reduction other than natural evaporation - large surface area of lagoons will result in large volume of rainwater and snow accumulation and system may actually increase volume of liquid
Ease of meeting government regulations with technology			<ul style="list-style-type: none"> - lagoons may require a liner; - may be some opposition to large lagoon based system - off farm sale of organics will have to meet government regulations for horticultural products/fertilizer act - may be difficult to get approval for a direct discharge from wetland and wetland effluent will likely have to be land applied
Reduction of nitrogen loading to surface water			<ul style="list-style-type: none"> - nitrogen should be tied up in microbial biomass which will reduce potential for movement of nitrogen to tile drains and surface water - nutrients concentrated in solids are applied at a low volumetric loading rate that reduces potential for nitrogen movement to the drains & surface water - potential to sell solids to off farm horticultural market; therefore reduced nitrogen loading at farm site - liquid applied at hydraulic rates rather than nutrient loading rate and there is some potential for liquid loading to carry commercial fertilizer out of root zone which will increase potential for nitrogen to reach the drains
Reduction of phosphorus loading to ground water			<ul style="list-style-type: none"> - data indicates 90 % of phosphorus removed with solids; University data to support claim - Ontario research would suggest that less than 90% of phosphorus is removed with solids - nutrients concentrated in solids are applied at a low volumetric loading rate that reduces potential for P movement to the drains and surface water - potential to sell solids to off farm horticultural market; therefore reduced phosphorus loading at farm site
Potential for degrading medicines and other by-pass substances found in manures			<ul style="list-style-type: none"> - biological process with long retention time so some break down of medicines and other by-pass substances should occur provided they are not at concentrations that are toxic to the aerobic, facultative and anaerobic bacteria in the treatment system - aerobic composting of solids is required to provide thermal and bacterial break down of medicines etc. in the solids
Potential to reduce dependency on local land base for manure application			<ul style="list-style-type: none"> - high portion of nutrients removed with the solids with potential for off farm sales of solids; this will reduce nutrient loading from liquid phase significantly and reduce land base required for liquid application - horticultural market may dry up if too many farms try selling solids to horticultural market
Capital costs			Costs vary with size. General estimate of \$9,040/M3 /day of treatment capacity
O&M costs			Costs vary with size. General estimate of \$2.57/m ³ treated

Evaluation comments are based on AMMTO's interpretation of information provided to AMMTO by the Technology Suppliers as of December 31, 2002 and knowledge of AMMTO Evaluation Team Members regarding the technology.

AMMTO Technology Evaluation Sheet

Disclaimer

Use of this information is at the users own risk
AMMTO and all persons associated with the AMMTO project do not accept any liability for the use of this information

Technology Submission Company; Envirogain Inc.

Type of Technology: Solid Liquid Separation Followed by Activated Sludge Process with Clarification (Solids Settling) and Solids Composting

Evaluation Criteria	Performance Ranking	Confidence Ranking	AMMTO Technical Committee Evaluation Comments
Odour reduction			- aerobic treatment will reduce volatile solids concentration and reduce odour potential of liquid phase - solids separated out may go anaerobic and generate odours - solids are intended for aerobic composting which will reduce potential for odours
Reduction of green house gas emissions			- liquid phase aerobically treated to point where there is little potential for anaerobic conditions that produce greenhouse gases - solids separated out before and after anaerobic treatment may generate greenhouse gases if stored wet under anaerobic conditions. - solids are suppose to be aerobically composted which will eliminate greenhouse gases
Reduction of nitrogen loading to ground water			- data provided indicates that there is a 99% reduction in nitrogen in the liquid phase after aerobic treatment and the clarification step. - nitrogen loading from the solids will not change but volumetric loading will be greatly reduced which will reduce the potential for movement of nitrogen to the groundwater; - composting solids should convert mineral nutrients present in solids to organic form as microbial biomass which should reduce potential for movement of nitrogen to the groundwater
Reduction in bacteria loading to ground and surface water			- pathogen kill will occur in the aerobic treatment step of the system but it will not be 100% - pathogen kill will occur during composting of the solids
Reduction in manure volume and/or mass			- have same basic volume but it is divided into a solids phase and liquid phase - composting will reduce the volume of solids by up to 50% and reduce the moisture content of the solids
Ease of meeting government regulations with technology			- proven processes - bacterial kill may not be sufficient in aerobic process - need to manage land application of liquid phase to minimize potential for surface or groundwater contamination
Reduction of nitrogen loading to surface water			- data provided indicates that there is a 99% reduction in nitrogen in the liquid phase after anaerobic treatment and the clarification step. - nitrogen loading from the solids will not change but volumetric loading will be greatly reduced which will reduce the potential for movement of nitrogen to the groundwater; - composting solids should convert mineral nutrients present in solids to organic form as microbial biomass which should reduce potential for movement of nitrogen to the groundwater
Reduction of phosphorus loading to ground water			- reduction of phosphorus in liquid phase by use of coagulants in clarifier - reduced volumetric loading from solids will reduce potential for nutrient movement to tile drains and surface water
Potential for degrading medicines and other by-pass substances found in manures			- there is potential for degrading medicines and other by-pass substances in the aerobic biological treatment of the liquid phase - potential for degrading medicines and other by-pass substances in solids phase during the solids composting phase
Potential to reduce dependency on local land base for manure application			- nutrients concentrated in the solid phase which makes it economical to transport the solids a longer distance - solids are composted so there should be no odour and land application can occur closer to residences which will make more local land available
Capital costs			No costs provided
O&M costs			No costs provided

Evaluation comments are based on AMMTO's interpretation of information provided to AMMTO by the Technology Suppliers as of December 31, 2002 and knowledge of AMMTO Evaluation Team Members regarding the technology.

AMMTO Technology Evaluation Sheet

Disclaimer

**Use of this information is at the users own risk
AMMTO and all persons associated with the AMMTO project do not accept any liability for the use of this information**

Technology Submission Company: Hoffland Environmental Inc.

Type of Technology: Removal of Organic Solids by Screening, Removal of Solids by Gravity Settling, Aerobic Treatment

Evaluation Criteria	Performance Ranking	Confidence Ranking	AMMTO Technical Committee Evaluation Comments
Odour reduction			- potential for odours from screening and clarification treatment processes - potential for odours from wet solids removed if they are not kept aerated; may be difficult to maintain aerobic conditions in stored solids if they are not continuously mixed to maintain porosity
Reduction of green house gas emissions			green house gas production possible during screening and clarification processes and from stored solids if they go anaerobic - aerobic biological treatment of liquid phase will reduce potential for greenhouse gas emissions - treated water will still have sufficient organics that it can go anaerobic and generate some greenhouse gases
Reduction of nitrogen leading to ground water			- process description indicates that biological nitrification/denitrification occurs in treatment system although there is no indication how an anoxic zone is maintained for denitrification to occur; - denitrification will reduce nitrogen content of the liquid phase being treated - solids phase has 20% solids therefore less potential for migration to groundwater/tie drains if applied on a nutrient loading basis - solids phase potentially has majority of nutrients in organic form which are less susceptible to leaching
Reduction in bacteria loading to round and surface water			- no process to enhance pathogen kill in recovered solids; therefore pathogen reduction will be limited to natural decline that occurs with time. - some pathogen kill will occur in aerobic treatment step due to aerobic bacterial attack and natural decline with time
Reduction in manure volume and/or mass			- the system provides no opportunity for volume reduction; System simply segregates the manure into a low solids phase and a high solids phase - data indicates that treated effluent can be recycled back to barn for flush systems; flush type barns should not be promoted so reuse of treated water has limited application, therefore little opportunity in Ontario to make use of treated water for flushing barns
Ease of meeting government regulations with technology			- aerobic biological treatment systems, screening and settling clarification are all well accepted treatment processes - does not produce effluent for water course discharge - may be health regulations associated with recycling treated water back to barn for flushing (pathogens, salts build up etc.) - large aerated lagoon required that may cause some concern regarding approvals
Reduction of nitrogen loading to surface water			- process description indicates that biological nitrification/denitrification occurs in treatment system although there is no indication how an anoxic zone is maintained for denitrification to occur; - denitrification will reduce nitrogen content of the liquid phase being treated - solids phase has 20% solids therefore less potential for migration to groundwater/file drains if applied on a nutrient loading basis - solids phase potentially has majority of nutrients in organic form which are less susceptible to leaching
Reduction of phosphorus loading to ground water			- no indication of phosphorus removal level from liquid phase - potentially a significant portion of phosphorus should be removed from the liquid phase with the solids - less potential for phosphorus movement with solids application to land if applied based on nutrient loading - lower phosphorus level in liquid phase reduces potential for phosphorus movement with spray irrigated liquid phase
Potential for degrading medicines and other by-pass substances found in manures			- there is potential for degrading medicines and other by-pass substances in the aerobic biological treatment of the liquid phase - some potential for natural degradation of medicines etc. during storage of solids just due to time, and due to natural bacterial attack - no means to enhance medicine etc. break down in solids phase
Potential to reduce dependent on local land base for manure application			- phosphorus is conserved in the processes involved so if phosphorus is the limiting nutrient for land application the process does not reduce total land base required; - process does remove nitrogen through denitrification process so if nitrogen is the limiting nutrient for land application there will be some reduction in the total land base required. - high solids phase generated in the process has more nutrient value than liquid phase and can be hauled a greater distance and still have economic value, therefore reducing the dependency on local land base
Capital costs			Complete costs not provided. Typical cost for screen and clarifier is \$202/(M3 /day capacity)
O&M costs			Complete costs not provided. Typical cost for energy ranges from \$0.01 to \$0.02 per animal (wiener/finisher)

Evaluation comments are based on AMMTO's interpretation of information provided to AMMTO by the Technology Suppliers as of December 31, 2002 and knowledge of AMMTO Evaluation Team Members regarding the technology.

AMMTO Technology Evaluation Sheet

Disclaimer

**Use of this information is at the users own risk
AMMTO and all persons associated with the AMMTO project do not accept any liability for the use of this information**

Technology Submission Company: Rosenberg International Inc.

Type of Technology: Low Volume Air Fixed Film Aerobic Process (uses drainage tile as fixed film media) with "Oxidation Ditch"

Evaluation Criteria	Performance Ranking	Confidence Ranking	AMMTO Technical Committee Evaluation Comments
Odour reduction			- aerobic process therefore potential for reducing production of offensive odours that accompany anaerobic conditions - passive oxidation ditch with potential for odours and fly/mosquito problems - no data to substantiate odour reduction
Reduction of green house gas emissions			- aerobic process so methane production should be reduced or eliminated - system may not work during winter months and there will be anaerobic conditions in the spring when system first starts up
Reduction of nitrogen loading to ground water			- nutrients should be tied up in microbial biomass which should reduce potential for movement to ground water when land applied - no data to support this - no data to indicate how nutrients are removed from system as system produces direct discharge effluent
Reduction in bacteria loading to ground and surface water			- aerobic treatment and long manure retention time in the system should provide some pathogen kill - data provided on the destruction of some microorganisms but not direct pathogens
Reduction in manure volume and/or mass			- data indicates manure converted to water with 5% algae concentration - data indicates that effluent is directly discharged - no indication that nutrients are removed anywhere from the system - alternately the treated effluent can be land applied
Ease of meeting government regulations with technology			- oxidation ditch may be an issue because of percolation from the ditch, potential odours, fly problems - oxidation ditch may require Ministry of Environment Approval - Ministry of Environment approval required to directly discharge to a stream
Reduction of nitrogen loading to surface water			- nutrients should be tied up in microbial biomass (including algae) - no indication of how nutrients removed from the system - nutrients in organic form not likely to move to tile drains and surface water
Reduction of phosphorus loading to ground water			- nutrients should be tied up in microbial biomass (including algae) - no indication of how nutrients removed from the system - nutrients in organic form not likely to move to tile drains and surface water
Potential for degrading medicines and other by-pass substances found in manures			- biological process with long retention time so some break down of medicines and other by-pass substances should occur provided they are not at concentrations that are toxic to the aerobic bacteria in the treatment system
Potential to reduce dependency on local land base for manure application			- data provided indicates that there is a 100% reduction in land base required - no details on how nutrients are removed from system - biological treatment so microbial biomass needs to be removed from system some how before direct discharge to water course
Capital costs			Costs vary with size. General estimate of \$15,000/m ³ /day of treatment capacity
O&M costs			Costs vary with size. General estimate of \$1,500/yr/ (m ³ /day of treatment capacity)

Evaluation comments are based on AMMTO's interpretation of information provided to AMMTO by the Technology Suppliers as of December 31, 2002 and knowledge of AMMTO Evaluation Team Members regarding the technology.

AMMTO Technology Evaluation Sheet

Disclaimer

**Use of this information is at the users own risk
AMMTO and all persons associated with the AMMTO project do not accept any liability for the use of this information**

Technology Submission Company: SARC International

Type of Technology: Surface Pond Aerator (Wind or Hydro Powered) Supplies Sufficient Air to Inhibit Anaerobic Activity

Evaluation Criteria	Performance Ranking	Confidence Ranking	AMMTO Technical Committee Evaluation Comments
Odour reduction			- if anaerobic conditions are eliminated, odours will be reduced - if sufficient air is provided to inhibit anaerobic activity the system should function as advertised - no study data given to support odour reduction
Reduction of green house gas emissions			- if anaerobic conditions are eliminated greenhouse gas emissions will be eliminated - if sufficient air is provided to inhibit anaerobic activity the system should function as advertised - no study data given to support odour reduction
Reduction of nitrogen loading to ground water			- ammonia and nitrates are intermediate compounds of aerobic treatment - information provided indicates that ammonia in treated manure is non-detectable - ammonia nitrogen may be converted to nitrate nitrogen which is soluble and easily moves with soil water to the groundwater - if facultative conditions exist in lagoon or manure storage there will be some denitrification with loss of ammonia nitrogen to the atmosphere which will reduce ammonia concentration of manure - no data to support what happens to nitrogen
Reduction in bacteria loading to ground and surface water			- aerobic activity will provide some pathogen kill - long retention time of manure will allow natural pathogen decline to occur
Reduction in manure volume and/or mass			- no means for volume reduction other than natural evaporation - precipitation will replace any evaporation and possible result in an increase in volume
Ease of meeting government regulations with technology			- simple system - benefits of maintaining aerobic conditions are well understood and documented
Reduction of nitrogen loading to surface water			- ammonia and nitrates are intermediate compounds of aerobic treatment; - information provided indicates that ammonia in treated manure is non-detectable - ammonia nitrogen may be converted to nitrate nitrogen which is soluble and easily moves with soil water to tile drains and surface water - if facultative conditions exist in lagoon or manure storage there will be some denitrification with loss of ammonia nitrogen to the atmosphere which will reduce ammonia
Reduction of phosphorus loading to ground water			- phosphorus is conserved so no reduction of total phosphorus - aerobic degradation of organic matter may release some of the organic phosphorus to a more soluble form
Potential for degrading medicines and other by-pass substances found in manures			- potential for breakdown of medicines etc. due to aerobic biological activity - long system retention time will provide some natural breakdown - no mechanism to significantly accelerate breakdown
Potential to reduce dependency on local land base for manure application			- no opportunities for significant volume reduction - system may promote denitrification with loss of nitrogen to the atmosphere - if nitrogen is limiting nutrient for land application, loss of nitrogen will reduce total land base required - reduced odours will allow manure to be spread closer to residences and in that way make more local land available for spreading
Capital costs			\$500/m ³ of manure produced per day
O&M costs			Wind powered mill available with no energy cost to operate. Electric model also available but no O&M costs provided.

Evaluation comments are based on AMMTO's interpretation of information provided to AMMTO by the Technology Suppliers as of December 31, 2002 and knowledge of AMMTO Evaluation Team Members regarding the technology.

Anaerobic Based Systems

Disclaimer

Users of the information provided in the Technology Evaluation Sheets do so at their own risk. AMMTO and persons associated with the AMMTO project accept no liability for the use of the information provided in the Technology Evaluation Sheets.

The information included in the Technology Evaluation Sheets is based on AMMTO's interpretation of information provided by the Technology Suppliers and the knowledge of AMMTO Evaluation Team Members. Different individuals may interpret and rank the technologies differently.

AMMTO Technology Evaluation Sheet

Disclaimer

Use of this information is at the users own risk

AMMTO and all persons associated with the AMMTO project do not accept any liability for the use of this information

Technology Submission Company: Rentec Renewable Energy Technologies

Type of Technology: Anaerobic Digestion with Vacuum Evaporator - Mesophylic Operation; Co-generation

Evaluation Criteria	Performance Ranking	Confidence Ranking	Evaluation Criteria
Odour reduction			- well documented that anaerobic digestion reduces manure odours provided degradation of volatile solids is complete; - Rentec data provided to show 90% reduction in volatile fatty acids, 70% reduction in scatole and indole which are odorous compounds associated with manures
Reduction of green house gas emissions			- green house gas reduction in two ways; methane emissions eliminated from stored manures & biogas produced is considered green energy which displaces fossil fuels and results in a net greenhouse gas emission reduction; green house gas emissions still possible from stored anaerobic effluent from off gassing and continued break down of volatile solids if volatile solids degradation is not complete in the anaerobic process; - organic or hydraulic overloading of digestion system can result in incomplete volatile solids break down during treatment process - Rentec digester designed to ensure complete digestion of organics but can still possible to have some off gassing of methane present in effluent that leaves digester
Reduction of nitrogen loading to ground water			much of the organic nitrogen present in the raw manure is converted to mineralized nitrogen during the anaerobic digestion process mineralized nitrogen is very susceptible to leaching and land application timing has to be changed or there will be a net increase in nitrogen loading to groundwater; - vacuum evaporation proposed to concentrate nutrients which will reduce volumetric loading associated with solids application to soil and therefore reduce potential for liquid movement to water table due to low volume of application
Reduction in bacteria loading to ground and surface water			proposed anaerobic system operates at mesophylic range therefore pathogen destruction will not be complete vacuum drying will provide additional bacterial kill digestion vessel designed se there is no cross contamination of raw incoming influent with treated out going effluent
Reduction in manure volume and/or mass			manure volume is basically conserved during anaerobic digestion; - negligible moisture loss occurs during anaerobic digestion due to moisture carried from system with the biogas; - Rentec offers vacuum drying option which reduces volume by 30%
Ease of meeting government regulations with technology			technologies offered by Rentec are well accepted treatment processes - regulations need to be changed to ban fall, winter and early spring applications of anaerobically digested manure due to high mineralized nutrient content; - C of A may be required for burning biogas; may be some concern over odour and volatile emissions from drying process
Reduction of nitrogen loading to surface water			- much of the organic nitrogen present in the raw manure is converted to mineralized nitrogen during the anaerobic digestion process mineralized nitrogen is very susceptible to leaching and application timing must be limited to the crop growing season or there will potentially be a net increase in nitrogen loading to surface water via movement to tile drains - option for vacuum drying to concentrate nutrients which will reduce volumetric loading to soil and therefore reduce potential for liquid movement to reach tiles due to low volume of application and therefore reduced risk of nitrogen movement to tiles
Reduction of phosphorus loading to ground water			- much of the organic phosphorus present in the raw manure is converted to mineralized phosphorus during the anaerobic digestion process - mineralized phosphorus is more susceptible to movement with soil water and land application timing should be restricted to crop growing period or there will potentially be a net increase in phosphorus loading to surface water via movement to tile drains - vacuum drying proposed for concentration of nutrients which will reduce volumetric loading required to achieve same nutrient loading to the soil and therefore reduce potential for liquid movement to reach tiles due to low volume of application
Potential for degrading medicines and other by-pass substances found in manures			- methanogenic bacteria required for anaerobic digestion are inhibited or killed by low levels of antibiotics and other chemicals - anaerobes may degrade some antibiotics and other manure by-pass substances provided they are at very low concentrations
Potential to reduce dependency on local land base for manure application			nutrients are conserved therefore anaerobic itself does not reduce land base requirements 30% volume reduction with vacuum drying therefore volume reduction advantage minimal odour associated with anaerobically digested manures therefore may be able to apply closer to residences which will increase the availability of localized land base; - Vacuum drying for concentration of nutrients which will generate a low volume high nutrient concentration fraction that has sufficient value that it can be hauled longer distances and still offer economic benefit as a nutrient sou; ce for crops
Capital costs			Not Provided
O&M costs			Not Provided

Evaluation comments are based on AMMTO's interpretation of information provided to AMMTO by the Technology Suppliers as of December 31, 2002 and knowledge of AMMTO Evaluation Team Members regarding the technology.

AMMTO Technology Evaluation Sheet

Disclaimer

Use of this information is at the users own risk

AMMTO and all persons associated with the AMMTO project do not accept any liability for the use of this information

Technology Submission Company: Alaksandar Gujicic

Type of Technology: Anaerobic Digestion with Solids Separation & Wetland Treatment - Mesophylic Operation; Co-generation

Evaluation Criteria	Performance Ranking	Confidence Ranking	AMMTO Technical Committee Evaluation Comments
Odour reduction			- well documented that anaerobic digestion reduces manure odours provided degradation of volatile solids is complete; - incomplete volatile solids break down during treatment will result in effluent that can generate significant odours; - stored solids are wet and may generate odours
Reduction of green house gas emissions			- green house gas reduction in two ways; methane emissions eliminated from stored manures & biogas produced is considered green energy which displaces fossil fuels results in a net greenhouse gas emission reduction; - green house gas emissions still possible from stored anaerobic effluent from off gassing and continued break down of volatile solids if volatile solids degradation is not complete in the anaerobic process; - organic or hydraulic overloading of digestion system can result in incomplete volatile solids break down during treatment process; - stored solids from solid liquid separation can generate greenhouse gases; - wetland system can generate greenhouse gases the same way that natural wetlands do
Reduction of nitrogen loading to ground water			- much of the organic nitrogen present in the raw manure is converted to mineralized nitrogen during the anaerobic digestion process - mineralized nitrogen is very susceptible to leaching and land application timing has to be changed or there will be a net increase in nitrogen loading to groundwater; - option for solid liquid separation to concentrate nutrients which will reduce volumetric loading associated with solids application to soil and therefore reduce potential for liquid movement to water table due to low volume of application; - liquid fraction from solid liquid separation treated in wetland; - treated effluent proposed for reuse in farm operation and spray irrigation on crops; - reuse only practical for flush barns and flush barns should not be promoted so only viable option is spray irrigation
Reduction in bacteria loading to ground and surface water			proposed anaerobic system operates at mesophylic range therefore pathogen destruction will not be complete
Reduction in manure volume and/or mass			- manure volume is basically conserved during anaerobic digestion; - negligible moisture loss occurs during anaerobic digestion due to moisture carried from system with biogas; - solids/liquid separation and wetland treatment proposed to produce an effluent for possible reuse in barn and spray irrigation; - barn reuse only possible for flush barns and flush barns should not be promoted; - no volume reduction with spray irrigation option
Ease of meeting government regulations with technology			- all technologies offered by Gujicic are well accepted treatment processes; - supplier proposes to produce effluent for spray irrigation and barn reuse - regulations need to be changed to ban fall, winter and early spring applications of anaerobically digested manure due to high mineralized nutrient content; - C of A may be required for burning biogas; - maybe concern over use of wetland because of increase in West Nile Virus
Reduction of nitrogen loading to surface water			- much of the organic nitrogen present in the raw manure is converted to mineralized nitrogen during the anaerobic digestion process; - mineralized nitrogen is very susceptible to leaching and land application timing must be limited to the crop growing season or there will potentially be a net increase in nitrogen loading to surface water via movement to tile drains; - option for solid liquid separation to concentrate nutrients which will reduce volumetric loading to soil and therefore reduce potential for liquid movement to reach tiles due to low volume of application and therefore reduced risk of nitrogen movement to tiles; - crop irrigation proposed for treated effluent from combined system. If irrigation occurs after application of solids there is potential for irrigation water to carry nutrients to tile drains
Reduction of phosphorus loading to ground water			- much of the organic phosphorus present in the raw manure is converted to mineralized phosphorus during the anaerobic digestion process; - mineralized phosphorus is more susceptible to movement with soil water and land application timing should be restricted to crop growing period or there will potentially be a net increase in phosphorus loading to surface water via movement to tile drains; - solid liquid separation proposed for concentration of nutrients which will reduce volumetric loading required to achieve same nutrient loading to the soil and therefore reduce potential for liquid movement to reach tiles due to low volume of application; - spray irrigation could transport mineralized phosphorus to tile drains if irrigation occurs after solids application
Potential for degrading medicines and other by-pass substances found in manures			- methanogenic bacteria required for anaerobic digestion are inhibited or killed by low levels of antibiotics and other chemicals - anaerobics may degrade some antibiotics and other manure by-pass substances provided they are at very low concentrations
Potential to reduce dependency on local land base for manure			- nutrients are conserved therefore anaerobic itself does not reduce land base requirements; - negligible volume reduction therefore no nutrient concentrating or volume reduction advantage; - minimal odour associated with anaerobically digested manures therefore may be able to apply closer to residences which will increase the available localized land base; - solid liquid separation proposed for concentration of nutrients which will generate a low volume high nutrient concentration solids fraction that has sufficient value that it can be hauled longer distances and still offer economic benefit as a nutrient source for crops; - some evaporation from wetland will occur but volume of liquid essentially conserved with liquid fraction being spray irrigated on a volumetric loading basis rather than nutrient loading basis
Capital costs			Not Provided
O&M costs			Not Provided

Evaluation comments are based on AMMTO's interpretation of information provided to AMMTO by the Technology Suppliers as of December 31, 2002 and knowledge of AMMTO Evaluation Team Members regarding the technology.

AMMTO Technology Evaluation Sheet

Disclaimer

**Use of this information is at the users own risk
AMMTO and all persons associated with the AMMTO project do not accept any liability for the use of this information**

Technology Submission Company: Anergen Corp.

Type of Technology: 2-Temperature Phase Anaerobic System /w Solid/liquid Separation Before & After Anaerobic Treatment & Membrane Separation of anaerobic Effluent After solid/liquid Sel

Evaluation Criteria	Performance Ranking	Confidence Ranking	AMMTO Technical Committee Evaluation Comments
Odour reduction			- well documented that anaerobic digestion reduces manure odours provided degradation of volatile solids is complete; - system has a thermophilic phase which will increase volatile solids destruction; - system has solid separation step before anaerobic treatment to remove larger sized solids which should increase efficiency of volatile solids destruction in anaerobic system; - separated solids may generate odours
Reduction of green house gas emissions			- green house gas reduction in two ways; methane emissions eliminated from stored manures & biogas produced is considered green energy which displaces fossil fuels and results in a net greenhouse gas emission reduction; - green house gas emissions still possible from stored anaerobic effluent from off gassing and continued break down of volatile solids if volatile solids degradation is not complete in the anaerobic process - organic or hydraulic overloading of digestion system can result in incomplete volatile solids break down during treatment process - separated solids may generate greenhouse gases if they go anaerobic
Reduction of nitrogen loading to ground water			- much of the organic nitrogen present in the raw manure is converted to mineralized nitrogen during the anaerobic digestion process - mineralized nitrogen is very susceptible to leaching and land application timing should be limited to active crop growth period or there will be a net increase in nitrogen loading to groundwater; - membrane solid liquid separation after digestion - nutrients concentrated into small volume liquid phase; therefore very low volumetric land application rate required to meet nutrient loading rate and less potential for movement to groundwater due to low volume at time of application; same applies for recovered solids in solid/liquid separation steps
Reduction in bacteria loading to ground and surface water			- proposed anaerobic system operates at mesophilic followed by a thermophilic temperature step. - thermophilic phase will increase pathogen kill; - no pathogen kill for solids separated before anaerobic treatment - no further pathogen kill in solids recovered after anaerobic treatment or in concentrate phase from membrane separation
Reduction in manure volume and/or mass			- manure volume is basically conserved during anaerobic digestion; - negligible moisture loss occurs during anaerobic digestion due to moisture carried from system with the biogas; - membrane separation of solids can be used to remove all nutrients from liquid phase. - liquid phase can then be spray irrigated as water on a hydraulic loading basis rather than nutrient loading basis therefore the actual volume of nutrient containing material requiring land application is reduced substantially
Ease of meeting government regulations with technology			- technologies offered are well accepted treatment processes; - regulations will likely be changed to limit land application of anaerobically digested effluent (including concentrate from membrane separation and solids from solid/liquid separation of anaerobic effluent) to the crop growing period due to high mineralized nutrient content; - C of A may be required for burning biogas
Reduction of nitrogen loading to surface water			- much of the organic nitrogen present in the raw manure is converted to mineralized nitrogen during the anaerobic digestion process - mineralized nitrogen is very susceptible to leaching and land application timing should be limited to the crop growing season or there will potentially be a net increase in nitrogen loading to surface water via movement to tile drains; - nutrients concentrated in solids recovered and in membrane concentrate liquid so application volume required to achieve desired nutrient loading will be greatly reduced. - Low volume application reduces potential for movement to tile drains.
Reduction of phosphorus loading to ground water			- much of the organic P present in the raw manure is converted to mineralized phosphorus during the anaerobic digestion process; - mineralized P is very susceptible to leaching and land application timing should be limited to the crop growing season or there will potentially be a net increase in phosphorus loading to surface water via movement to tile drains. - nutrients concentrated in solids recovered and in membrane concentrate liquid so application volume required to achieve desired nutrient loading will be greatly reduced. Low volume application reduces potential for phosphorus movement to tile drains.
Potential for degrading medicines and other by-pass substances found in manures			- methanogenic bacteria required for anaerobic digestion are inhibited or killed by low levels of antibiotics and other chemicals - anaerobics may degrade some antibiotics and other manure by-pass substances provided they are at very low concentrations - membrane concentration of solids may concentrate any by-pass substances
Potential to reduce dependency on local land base for manure application			- nutrients are conserved during anaerobic digestion therefore anaerobic itself does not reduce land base requirements - nutrients are concentrated into a significantly reduced volume by solid liquid separation and membrane separation - concentrated nutrients can be hauled a significant distance and still have economic value, therefore the requirement for local land base is reduced. - reduction in odour means manure can be applied closer to residences which increases the availability of local land base
Capital costs			Costs are variable but in neighborhood of \$30,084 Cnd./(m ² /day treatment capacity)
O&M costs			Costs are variable but in neighborhood of \$6.51 Cnd. /(m ² treated/day) (Includes all O&M costs but does not include credit for heat and electricity generated by co-gen system)

Evaluation comments are based on AMMTO's interpretation of information provided to AMMTO by the Technology Suppliers as of December 31, 2002 and knowledge of AMMTO Evaluation Team Members regarding the technology.

AMMTO Technology Evaluation Sheet

Disclaimer

Use of this information is at the users own risk

AMMTO and all persons associated with the AMMTO project do not accept any liability for the use of this information

Technology Submission Company: Biowaste Energy Canada

Type of Technology: Anaerobic Digestion (Attached Growth Media, Thermophylic Phase) & Co-generation with Membrane Solid Liquid Separation and Liquid Disinfection

Evaluation Criteria	Performance Ranking	Confidence Ranking	AMMTO Technical Committee Evaluation Comments
Odour reduction			- well documented that anaerobic digestion reduces manure odours provided degradation of volatile solids is complete.
Reduction of green house gas emissions			- green house gas reduction in two ways; methane emissions eliminated from stored manures & biogas produced is considered green energy which displaces fossil fuels and results in a net greenhouse gas emission reduction - green house gas emissions still possible from stored anaerobic effluent from off gassing and continued break down of volatile solids if volatile solids degradation is not complete in the anaerobic process - organic or hydraulic overloading of digestion system can result in incomplete volatile solids break down during treatment process
Reduction of nitrogen loading to ground water			- much of the organic nitrogen present in the raw manure is converted to mineralized nitrogen during the anaerobic digestion process - mineralized nitrogen is very susceptible to leaching and land application timing should be limited to active crop growth period or there will be a net increase in nitrogen loading to groundwater - membrane solid liquid separation
Reduction in bacteria loading to ground and surface water			- proposed anaerobic system operates at mesophylic followed by short time period at thermophylic temperature. - thermophylic phase will increase pathogen kill; - disinfection option offered for water phase after membrane concentration of solids - no further pathogen kill in solids concentrate phase from membrane separation
Reduction in manure volume and/or mass			- manure volume is basically conserved during anaerobic digestion; - negligible moisture loss occurs during anaerobic digestion due to moisture carried from system with the biogas; - membrane separation of solids can be used to remove all nutrients from liquid phase. - liquid phase can then be spray irrigated as water on a hydraulic loading basis rather than nutrient loading basis therefore the actual volume of nutrient containing material; requiring land application is reduced substantially
Ease of meeting government regulations with technology			- technologies offered are well accepted treatment processes - regulations will likely be changed to limit land application of anaerobically digested effluent (including concentrate from membrane separation) to the crop growing period due to high mineralized nutrient content - C of A may be required for burning biogas
Reduction of nitrogen loading to surface water			- much of the organic nitrogen present in the raw manure is converted to mineralized nitrogen during the anaerobic digestion process - mineralized nitrogen is very susceptible to leaching and land application timing should be limited to the crop growing season or there will potentially be a net increase in nitrogen loading to surface water via movement to tile drains - nutrients concentrated to a 20-10-10 liquid so application volume required to achieve desired nutrient loading will be greatly reduced. Low volume application reduces
Reduction of phosphorus loading to ground water			- much of the organic phosphorus present in the raw manure is converted to mineralized phosphorus during the anaerobic digestion process - mineralized phosphorus is very susceptible to leaching and land application timing should be limited to the crop growing season or there will potentially be a net increase in phosphorus loading to surface water via movement to tile drains - nutrients concentrated to a 20-10-10 liquid so application volume required to achieve desired nutrient loading will be greatly reduced. Low volume application reduces potential for phosphorus movement to tile drains.
Potential for degrading medicines and other by-pass substances found in manures			- methanogenic bacteria required for anaerobic digestion are inhibited or killed by low levels of antibiotics and other chemicals - anaerobics may degrade some antibiotics and other manure by-pass substances provided they are at very low concentrations - membrane concentration of solids may concentrate any by-pass substances
Potential to reduce dependency on local land base for manure application			- nutrients are conserved during anaerobic digestion therefore anaerobic itself does not reduce land base requirements - nutrients are concentrated into a significantly reduced volume by membrane separation which produces a nutrient concentration of 20-10-10 - concentrated nutrients can be hauled a significant distance and still have economic value, therefore the requirement for local land base is reduced.; - reduction in odour means manure can be applied closer to residences which increases the availability of local land base
Capital costs			Not Provided by supplier due to high variability related to size and options
O&M costs			Not Provided by supplier due to high variability related to size and options

Evaluation comments are based on AMMTO's interpretation of information provided to AMMTO by the Technology Suppliers as of December 31, 2002 and knowledge of AMMTO Evaluation Team Members regarding the technology.

AMMTO Technology Evaluation Sheet

Disclaimer

Use of this information is at the users own risk
AMMTO and all persons associated with the AMMTO project do not accept any liability for the use of this information

Technology Submission Company: Bohni Energie & Umwelt GmbH
Type of Technology: Anaerobic Digestion (Mesophylic) with Co-Generation

Evaluation Criteria	Performance Ranking	Confidence Ranking	AMMTO Technical Committee Evaluation Comments
Odour reduction			- well documented that anaerobic digestion reduces manure odours provided degradation of volatile solids is complete - incomplete volatile solids break down during treatment will result in effluent that can generate significant odours
Reduction of green house gas emissions			- green house gas reduction in two ways; methane emissions eliminated from stored manures & biogas produced is considered green energy which displaces fossil fuels and results in a net greenhouse gas emission reduction
Reduction of nitrogen loading to ground water			- much of the organic nitrogen present in the raw manure is converted to mineralized nitrogen during the anaerobic digestion process - mineralized nitrogen is very susceptible to leaching and land application of anaerobic effluent should be limited to the crop growing season or there will be a net increase in nitrogen loading to groundwater
Reduction in bacteria loading to ground and surface water			- proposed system operates at mesophylic range therefore pathogen destruction will not be complete
Reduction in manure volume and/or mass			- manure volume is basically conserved during anaerobic digestion - negligible moisture loss occurs due to moisture carried from system with the biogas
Ease of meeting government regulations with technology			- anaerobics is a well accepted treatment process - does not produce effluent for water course discharge - regulations will likely be changed to limit application of anaerobically digested manure to crop growing season due to high mineralized nutrient content - C of A may be required for burning biogas and co-mingling off farm organic wastes
Reduction of nitrogen loading to surface water			- much of the organic nitrogen present in the raw manure is converted to mineralized nitrogen during the anaerobic digestion process - mineralized nitrogen is very susceptible to leaching and land application timing should be limited to the crop growing season or there will potentially be a net increase in nitrogen loading to surface water via movement to tile drains
Reduction of phosphorus loading to ground water			- much of the organic phosphorus present in the raw manure is converted to mineralized phosphorus during the anaerobic digestion process - mineralized phosphorus is more susceptible to movement with soil water and land application timing should be limited to the active crop growing period or there will potentially be a net increase in phosphorus loading to surface water via movement to tile drains
Potential for degrading medicines and other by-pass substances found in manures			- methanogenic bacteria required for anaerobic digestion are inhibited or killed by low levels of antibiotics and other chemicals - anaerobics may degrade some antibiotics and other manure by-pass substances provided they are at very low concentrations
Potential to reduce dependency on local land base for manure application			- nutrients are conserved therefore anaerobic itself does not reduce land base requirements - negligible volume reduction therefore no nutrient concentrating or volume reduction advantage - minimal odour associated with anaerobically digested manures therefore may be able to apply closer to residences which will increase the availability of localized land base
Capital costs			information provided indicates capital costs range from \$16,700/m ³ /day capacity to \$27,800/m ³ /day capacity
O&M costs			information provided indicates \$500/yr/(m ³ /day capacity)

Evaluation comments are based on AMMTO's interpretation of information provided to AMMTO by the Technology Suppliers as of December 31, 2002 and knowledge of AMMTO Evaluation Team Members regarding the technology.

AMMTO Technology Evaluation Sheet

Disclaimer

Use of this information is at the users own risk

AMMTO and all persons associated with the AMMTO project do not accept any liability for the use of this information

Technology Submission Company: Clear-Green Technologies

Type of Technology: Anaerobic Digestion with Solids Separation & Nitrogen capture Options - Mesophylic Operation; Co-generation

Evaluation Criteria	Performance Ranking	Confidence Ranking	AMMTO Technical Committee Evaluation Comments
Odour reduction			- well documented that anaerobic digestion reduces manure odours provided degradation of volatile solids is complete; - incomplete volatile solids break down during treatment will result in effluent that can generate significant odours; - green house gas reduction in two ways; methane emissions eliminated from stored manures & biogas produced is considered green energy which displaces fossil fuels and results in a net greenhouse gas emission reduction
Reduction of green house gas emissions			- green house gas emissions still possible from stored anaerobic effluent from off gassing and continued break down of volatile solids if volatile solids degradation is not complete in the anaerobic process
Reduction of nitrogen loading to ground water			- much of the organic nitrogen present in the raw manure is converted to mineralized nitrogen during the anaerobic digestion process; - mineralized nitrogen is very susceptible to leaching and land application timing should be limited to the active crop growing period or there will be a net increase in nitrogen loading to groundwater; - option for solid liquid separation and membrane concentration of nutrients which will reduce volumetric loading to soil and therefore reduce potential for liquid movement to water table due to low volume of application - option for ammonia nitrogen removal offered. Information provided indicates all ammonia removed but there is no research data to support claim
Reduction in bacteria loading to ground and surface water			- proposed system operates at mesophylic range therefore pathogen destruction will not be complete
Reduction in manure volume and/or mass			- manure volume is basically conserved during anaerobic digestion; - negligible moisture loss occurs during anaerobic digestion due to moisture carried from system with the biogas- option offered for solids/liquid separation and membrane treatment which literature states will concentrate manure nutrients into 20% of original volume; - concentration of nutrients with membrane technology feasible but through put capacity is very low to achieve high concentration of nutrients therefore may not be acceptable option
Ease of meeting government regulations with technology			- all technologies offered by Clear-Green are well accepted treatment processes; - supplier proposes to produce effluent for water course discharge which will require a Certificate of Approval from MOE and will likely be difficult to obtain approval for direct discharge - regulations need to be changed to ban fall, winter and early spring applications of anaerobically digested manure due to high mineralized nutrient content; - C of A may be required for burning biogas and co-mingling off farm organic wastes if these options are considered
Reduction of nitrogen loading to surface water			- much of the organic N present in the raw manure is converted to mineralized nitrogen during the anaerobic digestion process; - mineralized nitrogen is very susceptible to leaching and land application timing has to be changed or there will potentially be a net increase in nitrogen loading to surface water via movement to tile drains; - option for solid liquid separation and membrane concentration of nutrients which will reduce volumetric loading to soil and therefore reduce potential for liquid movement to reach tiles due to low volume of application and therefore reduced risk of nitrogen movement to tiles; - option for ammonia nitrogen removal offered. Information provided indicates all ammonia removed but there is no research data to support claim
Reduction of phosphorus loading to ground water			- much of the organic phosphorus present in the raw manure is converted to mineralized phosphorus during the anaerobic digestion process - mineralized phosphorus is more susceptible to movement with soil water and land application timing should be restricted to crop growing period or there will potentially be a net increase in phosphorus loading to surface water via movement to tile drains - option for solid liquid separation and membrane concentration of nutrients which will reduce volumetric loading required to achieve same nutrient loading to the soil and therefore reduce potential for liquid movement to reach tiles due to low volume of application
Potential for degrading medicines and other by-pass substances found in manures			- methanogenic bacteria required for anaerobic digestion are inhibited or killed by low levels of antibiotics and other chemicals anaerobics may degrade some antibiotics and other manure by-pass substances provided they are at very low concentrations
Potential to reduce dependency on local land base for manure application			- nutrients are conserved therefore anaerobic itself does not reduce land base requirements; - negligible volume reduction therefore no nutrient concentrating or volume reduction advantage; - minimal odour associated with anaerobically digested manures therefore maybe able to apply closer to residences which will increase the availability of localized land base - supplier offers option for solid liquid separation and membrane concentration of nutrients which will generate a low volume high nutrient concentration solids fraction that has sufficient value that it can be hauled longer distances and still offer economic benefit as a nutrient source for crops
Capital costs			Not Provided
O&M costs			Not Provided

Evaluation comments are based on AMMTO's interpretation of information provided to AMMTO by the Technology Suppliers as of December 31, 2002 and knowledge of AMMTO Evaluation Team Members regarding the technology.

AMMTO Technology Evaluation Sheet

Disclaimer

Use of this information is at the users own risk
AMMTO and all persons associated with the AMMTO project do not accept any liability for the use of this information

Technology Submission Company: Farm Energy

Type of Technology: Anaerobic Digestion with Co-Generation

Evaluation Criteria	Performance Ranking	Confidence Ranking	AMMTO Technical Committee Evaluation Comments
Odour reduction			- well documented that anaerobic digestion reduces manure odours provided degradation of volatile solids is complete - incomplete volatile solids break down during treatment will result in effluent that can generate significant odours
Reduction of green house gas emissions			- green house gas reduction in two ways; methane emissions eliminated from stored manures & biogas produced is considered green energy which displaces fossil fuels and results in a net greenhouse gas emission reduction
Reduction of nitrogen loading to ground water			- much of the organic nitrogen present in the raw manure is converted to mineralized nitrogen during the anaerobic digestion process - mineralized nitrogen is very susceptible to leaching and land application timing has to be changed or there will be a net increase in nitrogen loading to groundwater
Reduction in bacteria loading to ground and surface water			- proposed system operates at mesophylic range therefore pathogen destruction will not be complete
Reduction in manure volume and/or mass			- manure volume is basically conserved during anaerobic digestion - negligible moisture loss occurs due to moisture carried from system with the biogas
Ease of meeting government regulations with technology			- anaerobics is a well accepted treatment process - does not produce effluent for water course discharge - regulations need to be changed to ban fall, winter and early spring applications of anaerobically digested manure due to high mineralized nutrient content - C of A may be required for burning biogas and co-mingling off farm organic wastes
Reduction of nitrogen loading to surface water			- much of the organic nitrogen present in the raw manure is converted to mineralized nitrogen during the anaerobic digestion process - mineralized nitrogen is very susceptible to leaching and land application timing has to be changed or there will potentially be a net increase in nitrogen loading to surface water via movement to tile drains - option for solid liquid separation which may reduce nitrogen content of effluent
Reduction of phosphorus loading to ground water			- much of the organic phosphorus present in the raw manure is converted to mineralized phosphorus during the anaerobic digestion process - mineralized phosphorus is more susceptible to movement with soil water and land application timing should be changed or there will potentially be a net increase in phosphorus loading to surface water via movement to tile drains - option for solid liquid separation which may reduce phosphorus content of effluent
Potential for degrading medicines and other by-pass substances found in manures			- methanogenic bacteria required for anaerobic digestion are inhibited or killed by low levels of antibiotics and other chemicals - anaerobics may degrade some antibiotics and other manure by-pass substances provided they are at very low concentrations
Potential to reduce dependency on local land base for manure application			- nutrients are conserved therefore anaerobic itself does not reduce land base requirements - negligible volume reduction therefore no nutrient concentrating or volume reduction advantage - minimal odour associated with anaerobically digested manures therefore may be able to apply closer to residences which will increase the availability of localized land base - supplier offers option for solid liquid separation which will generate a low volume high nutrient concentration solids fraction that has sufficient value that it can be hauled longer distances and still offer economic benefit as a nutrient source for crops
Capital costs			Information provided indicates costs range from \$50 to \$135 per animal unit treatment capacity
O&M costs			Not provided

Evaluation comments are based on AMMTO's interpretation of information provided to AMMTO by the Technology Suppliers as of December 31, 2002 and knowledge of AMMTO Evaluation Team Members regarding the technology.

AMMTO Technology Evaluation Sheet

Disclaimer

Use of this information is at the users own risk

AMMTO and all persons associated with the AMMTO project do not accept any liability for the use of this information

Technology Submission Company: Horton CBI Ltd.

Type of Technology: Anaerobic Digestion - Large capacity systems - Mesophylic or Thermophylic Operation; Co-generation

Evaluation Criteria	Performance Ranking	Confidence Ranking	AMMTO Technical Committee Evaluation Comments
Odour reduction			- well documented that anaerobic digestion reduces manure odours provided degradation of volatile solids is complete - incomplete volatile solids break down during treatment will result in effluent that can generate significant odours - information provided indicates only 50% reduction in volatile solids therefore still some potential for odours being generated from stored effluent
Reduction of green house gas emissions			- green house gas reduction in two ways; methane emissions eliminated from stored manures & biogas produced is considered green energy which displaces fossil fuels and results in a net greenhouse gas emission reduction; - green house gas emissions still possible from stored anaerobic effluent from off gassing and continued break down of volatile solids if volatile solids degradation is not complete in the anaerobic process - organic or hydraulic overloading of digestion system can result in incomplete volatile solids break down during treatment process - information provided indicates only 50% reduction in volatile solids; still some potential for greenhouse gas emissions from stored effluent
Reduction of nitrogen loading to ground water			- much of the organic nitrogen present in the raw manure is converted to mineralized nitrogen during the anaerobic digestion process - mineralized nitrogen is very susceptible to leaching and land application timing has to be changed or there will be a net increase in nitrogen loading to groundwater; - vacuum evaporation proposed to concentrate nutrients which will reduce volumetric loading associated with solids application to soil and therefore reduce potential for liquid movement to water table due to low volume of application
Reduction in bacteria loading to around and surface water			- proposed anaerobic system can operate at mesophylic or thermophylic temperature range - incomplete pathogen kill if operated at mesophylic temperature range - effective pathogen kill if operated at thermophylic temperature range but may not be 100%
Reduction in manure volume and/or mass			- manure volume is basically conserved during anaerobic digestion - negligible moisture loss occurs during anaerobic digestion due to moisture carried from system with the biogas
Ease of meeting government regulations with technology			- technologies offered are well accepted treatment processes - regulations will likely be changed to limit applications of anaerobically digested manure to crop growing season due to high mineralized nutrient content; - C of A may be required for burning biogas
Reduction of nitrogen loading to surface water			- much of the organic nitrogen present in the raw manure is converted to mineralized nitrogen during the anaerobic digestion process - mineralized nitrogen is very susceptible to leaching and land application timing must be limited to the crop growing season or there will potentially be a net increase in nitrogen loading to surface water via movement to tile drains - option for vacuum drying to concentrate nutrients which will reduce volumetric loading to soil and therefore reduce potential for liquid movement to reach tiles due to low volume of application and therefore reduced risk of nitrogen movement to tiles
Reduction of phosphorus loading to ground water			- much of the organic phosphorus present in the raw manure is converted to mineralized phosphorus during the anaerobic digestion process - mineralized phosphorus is more susceptible to movement with soil water and land application timing should be restricted to crop growing period or there will potentially be a net increase in phosphorus loading to surface water via movement to tile drains
Potential for degrading medicines and other by-pass substances found in manures			- methanogenic bacteria required for anaerobic digestion are inhibited or killed by low levels of antibiotics and other chemicals - anaerobics may degrade some antibiotics and other manure by-pass substances provided they are at very low concentrations - systems offered are most appropriate for a centralized plant which will likely test for toxic levels of antibiotics and metals; therefore farmers will have to be careful or manures will be rejected at plant
Potential to reduce dependency on local land base for manure application			- nutrients are conserved therefore anaerobic itself does not reduce land base requirements - minimal odour associated with anaerobically digested manures therefore may be able to apply closer to residences which will increase the availability of localized land base - system offered is most appropriate for a centralized plant. Therefore there will be some opportunity to distribute nutrients in a larger area which will decrease dependency on local land base
Capital costs			Information provided indicates costs range between \$14,010/m ³ /day capacity and \$20,639/m ³ /day capacity
O&M costs			Information provided indicates \$0.30/m ³ treated

Evaluation comments are based on AMMTO's interpretation of information provided to AMMTO by the Technology Suppliers as of December 31, 2002 and knowledge of AMMTO Evaluation Team Members regarding the technology.

AMMTO Technology Evaluation Sheet

Disclaimer

Use of this information is at the users own risk
AMMTO and all persons associated with the AMMTO project do not accept any liability for the use of this information

Technology Submission Company: Linde-KCA-Dresden GmbH

Type of Technology: Anaerobic Digestion (Mesophylic Operation) & Co-generation with Solids/Liquid Separation from Anaerobic Effluent Followed by Aerobic Treatment of Liquid & Aerobic Composting of Solids

Evaluation Criteria	Performance Ranking	Confidence Ranking	AMMTO Technical Committee Evaluation Comments
Odour reduction			<ul style="list-style-type: none"> - well documented that anaerobic digestion reduces manure odours provided degradation of volatile solids is complete - incomplete volatile solids break down during treatment will result in effluent that can generate significant odours - solid/liquid separation with aerobic treatment of solids and liquid phases will reduce potential for odour
Reduction of green house gas emissions			<ul style="list-style-type: none"> - green house gas reduction in two ways; methane emissions eliminated from stored manures & biogas produced is considered green energy which displaces fossil fuels and results in a net greenhouse gas emission reduction - green house gas emissions from stored effluent reduced by aerobic treatment of solids and liquid phases after separation of anaerobic effluent, - organic or hydraulic overloading of digestion system can result in incomplete volatile solids break down during treatment process that may overload aerobic treatment of liquid portion of anaerobic effluent
Reduction of nitrogen loading to ground water			<ul style="list-style-type: none"> - much of the organic nitrogen present in the raw manure is converted to mineralized nitrogen during the anaerobic digestion process - mineralized nitrogen is very susceptible to leaching; - option for solid liquid separation of effluent and aerobic treatment of solid and liquid phases which will convert mineralized nutrients back to an organic form as bacterial biomass; nitrogen in organic form is less susceptible to leaching.
Reduction in bacteria loading to ground and surface water			<ul style="list-style-type: none"> - proposed system operates at mesophylic or thermophylic temperature range, Higher degree of pathogen kill operating in thermophylic temperature range; - aerobic composting of solids separated from anaerobic effluent will provide pathogen kill - aerobic treatment of liquid phase of anaerobic effluent will increase level of pathogen kill
Reduction in manure volume and/or mass			<ul style="list-style-type: none"> - manure volume is basically conserved during anaerobic digestion - negligible moisture loss occurs during anaerobic digestion due to moisture carried from system with the biogas- option offered for solids/liquid separation and membrane treatment which literature states will concentrate manure nutrients into 20% of original volume - 50% reduction in volume of solids possible due to composting; - no significant change in total liquid volume
Ease of meeting government regulations with technology			<ul style="list-style-type: none"> - all technologies offered are well accepted treatment processes; - effluent not released to water course - C of A may be required for burning biogas and co-mingling off farm organic wastes if these options are considered
Reduction of nitrogen loading to surface water			<ul style="list-style-type: none"> - much of the organic nitrogen present in the raw manure is converted to mineralized nitrogen during the anaerobic digestion process - mineralized nitrogen is very susceptible to leaching - aerobic treatment of solids and liquid phase of anaerobic effluent will convert mineralized nutrients back to organic form as bacterial biomass. - solid liquid separation concentrates nutrients in solids phase. Composting of solids concentrates nutrients further and reduces volume and moisture of solids. Application of composted solids less likely to result in nitrogen movement to tile drains and surface waters - aerobic treatment of liquid phase will convert some of the mineralized nitrogen to an organic form which is less likely to leach to tile drains.
Reduction of phosphorus loading to ground water			<ul style="list-style-type: none"> - much of the organic phosphorus present in the raw manure is converted to mineralized phosphorus during the anaerobic digestion process - mineralized phosphorus is more susceptible to movement with soil water. - aerobic treatment of solid and liquid phases will convert some of the mineralized phosphorus back to organic form as bacterial biomass - application of phosphorus in the composted solid phase is less likely to migrate to tile drains or surface water
Potential for degrading medicines and other by-pass substances found in manures			<ul style="list-style-type: none"> - methanogenic bacteria required for anaerobic digestion are inhibited or killed by low levels of antibiotics and other chemicals - anaerobics may degrade some antibiotics and other manure by-pass substances provided they are at very low concentrations - aerobic treatment of solids and liquid phases will result in further degradation of medicines etc.
Potential to reduce dependency on local land base for manure application			<ul style="list-style-type: none"> - all nutrients are conserved during anaerobic treatment. All nutrients except nitrogen are conserved during aerobic treatment, Therefore there would only be a reduction in land base in nitrogen was the limiting nutrient for land application. - negligible liquid volume reduction; - nutrients concentrated in solid phase through solid liquid separation and composting. Solids phase will have sufficient nutrient value that it can be hauled a significant distance and still provide economic value as a nutrient source for crops.
Capital costs			Not Provided
O&M costs			Not Provided

Evaluation comments are based on AMMTO's interpretation of information provided to AMMTO by the Technology Suppliers as of December 31, 2002 and knowledge of AMMTO Evaluation Team Members regarding the technology.

AMMTO Technology Evaluation Sheet

Disclaimer

Use of this information is at the users own risk

AMMTO and all persons associated with the AMMTO project do not accept any liability for the use of this information

Technology Submission Company: Lipp Gmbh

Type of Technology: Anaerobic Digestion (Mesophylic) with Co-Generation; Compost option available but not evaluated

Evaluation Criteria	Performance Ranking	Confidence Ranking	AMMTO Technical Committee Evaluation Comments
Odour reduction			- well documented that anaerobic digestion reduces manure odours provided degradation of volatile solids is complete - incomplete volatile solids break down during treatment will result in effluent that can generate significant odours
Reduction of green house gas emissions			- green house gas reduction in two ways; methane emissions eliminated from stored manures & biogas produced is considered green energy which displaces fossil fuels and results in a net greenhouse gas emission reduction
Reduction of nitrogen loading to ground water			- much of the organic nitrogen present in the raw manure is converted to mineralized nitrogen during the anaerobic digestion process - mineralized nitrogen is very susceptible to leaching and land application of anaerobic effluent should be limited to the crop growing season or there will be a net increase in nitrogen loading to groundwater
Reduction in bacteria loading to ground and surface water			- proposed system operates at mesophylic range therefore pathogen destruction will not be complete - have special certification in Germany that indicates superior process control which will provide confidence of constant level of pathogen kill
Reduction in manure volume and/or mass			- manure volume is basically conserved during anaerobic digestion - negligible moisture loss occurs due to moisture carried from system with the biogas
Ease of meeting government regulations with technology			- anaerobics is a well accepted treatment process - does not produce effluent for water course discharge - regulations will likely be changed to limit application of anaerobically digested manure to crop growing season due to high mineralized nutrient content - C of A may be required for burning biogas and co-mingling off farm organic wastes
Reduction of nitrogen loading to surface water			- much of the organic nitrogen present in the raw manure is converted to mineralized nitrogen during the anaerobic digestion process - mineralized nitrogen is very susceptible to leaching and land application timing should be limited to the crop growing season or there will potentially be a net increase in nitrogen loading to surface water via movement to tile drains
Reduction of phosphorus loading to ground water			- much of the organic phosphorus present in the raw manure is converted to mineralized phosphorus during the anaerobic digestion process - mineralized phosphorus is more susceptible to movement with soil water and land application timing should be limited to the active crop growing period or there will potentially
Potential for degrading medicines and other by-pass substances found in manures			- methanogenic bacteria required for anaerobic digestion are inhibited or killed by low levels of antibiotics and other chemicals - anaerobics may degrade some antibiotics and other manure by-pass substances provided they are at very low concentrations
Potential to reduce dependency on local land base for manure application			- nutrients are conserved therefore anaerobic itself does not reduce land base requirements - negligible volume reduction therefore no nutrient concentrating or volume reduction advantage - minimal odour associated with anaerobically digested manures therefore may be able to apply closer to residences which will increase the availability of localized land base
Capital costs			No capital costs provided
O&M costs			No O&M costs provided

Evaluation comments are based on AMMTO's interpretation of information provided to AMMTO by the Technology Suppliers as of December 31, 2002 and knowledge of AMMTO Evaluation Team Members regarding the technology.

AMMTO Technology Evaluation Sheet

Disclaimer

Use of this information is at the users own risk

AMMTO and all persons associated with the AMMTO project do not accept any liability for the use of this information

Technology Submission Company: RCM Digesters

Type of Technology: Anaerobic Digestion with Co-Generation (Mesophylic Lagoon)

Evaluation Criteria	Performance Ranking	Confidence Ranking	AMMTO Technical Committee Evaluation Comments
Odour reduction			- well documented that anaerobic digestion reduces manure odours provided degradation of volatile solids is complete - incomplete volatile solids break down during treatment will result in effluent that can generate significant odours
Reduction of green house gas emissions			- green house gas reduction in two ways; methane emissions eliminated from stored manures & biogas produced is considered green energy which displaces fossil fuels and results in a net greenhouse gas emission reduction
Reduction of nitrogen loading to ground water			- much of the organic nitrogen present in the raw manure is converted to mineralized nitrogen during the anaerobic digestion process - mineralized nitrogen is very susceptible to leaching and land application timing has to be changed or there will be a net increase in nitrogen loading to groundwater
Reduction in bacteria loading to ground and surface water			- proposed system operates at mesophylic range therefore pathogen destruction will not be complete
Reduction in manure volume and/or mass			- manure volume is basically conserved during anaerobic digestion - negligible moisture loss occurs due to moisture carried from system with the biogas - potential for solids accumulation in the anaerobic lagoon over time
Ease of meeting government regulations with technology			- anaerobics is a well accepted treatment process - does not produce effluent for water course discharge - regulations will likely require that anaerobically digested manure be land applied during crop growing season due to high mineralized nutrient content - C of A may be required for burning biogas and co-mingling off farm organic wastes
Reduction of nitrogen loading to surface water			- much of the organic nitrogen present in the raw manure is converted to mineralized nitrogen during the anaerobic digestion process - mineralized nitrogen is very susceptible to leaching and land application timing has to be changed or there will potentially be a net increase in nitrogen loading to surface water via movement to tile drains
Reduction of phosphorus loading to ground water			- much of the organic phosphorus present in the raw manure is converted to mineralized phosphorus during the anaerobic digestion process - mineralized phosphorus is more susceptible to movement with soil water and land application timing should be changed or there will potentially be a net increase in phosphorus loading to surface water via movement to tile drains
Potential for degrading medicines and other by-pass substances found in manures			- methanogenic bacteria required for anaerobic digestion are inhibited or killed by low levels of antibiotics and other chemicals - anaerobics may degrade some antibiotics and other manure by-pass substances provided they are at very low concentrations
Potential to reduce dependency on local land base for manure application			- nutrients are conserved therefore anaerobic itself does not reduce land base requirements - negligible volume reduction therefore no nutrient concentrating or volume reduction advantage - minimal odour associated with anaerobically digested manures therefore may be able to apply closer to residences which will increase the availability of localized land base
Capital costs			No costs provided
O&M costs			No costs provided

Evaluation comments are based on AMMTO's interpretation of information provided to AMMTO by the Technology Suppliers as of December 31, 2002 and knowledge of AMMTO Evaluation Team Members regarding the technology.

AMMTO Technology Evaluation Sheet

Disclaimer

Use of this information is at the users own risk
AMMTO and all persons associated with the AMMTO project do not accept any liability for the use of this information

Technology Submission Company: Sharp Energy

Type of Technology: Covered Anaerobic Lagoon (limited information provided; no indication if system is heated)

Evaluation Criteria	Performance Ranking	Confidence Ranking	AMMTO Technical Committee Evaluation Comments
Odour reduction			<ul style="list-style-type: none"> - well documented that anaerobic digestion reduces manure odours provided degradation of volatile solids is complete - covered lagoon technology is low rate technology that will provide lower volatile solids destruction level than high rate technologies therefore lower level of odour reduction potential - no indication if system is heated (if no heat even lower volatile solids destruction) and less odour reduction
Reduction of green house gas emissions			<ul style="list-style-type: none"> - green house gas reduction in two ways; methane emissions eliminated from stored manures & biogas produced is considered green energy which displaces fossil fuels and results in a net greenhouse gas emission reduction - green house gas emissions still possible from stored anaerobic effluent from off gassing and continued break down of volatile solids if volatile solids degradation is not complete in the anaerobic process - organic or hydraulic overloading of digestion system can result in incomplete volatile solids break down during treatment process
Reduction of nitrogen loading to ground water			<ul style="list-style-type: none"> - much of the organic nitrogen present in the raw manure is converted to mineralized nitrogen during the anaerobic digestion process - mineralized nitrogen is very susceptible to leaching and land application must be limited to crop production period or there will be a net increase in nitrogen loading to groundwater
Reduction in bacteria loading to ground and surface water			<ul style="list-style-type: none"> - no indication of temperature proposed. If anaerobic system operates at ambient or mesophylic temperature range the pathogen destruction will not be complete
Reduction in manure volume and/or mass			<ul style="list-style-type: none"> - manure volume is basically conserved during anaerobic digestion - negligible moisture loss occurs during anaerobic digestion due to moisture carried from system with the biogas
Ease of meeting government regulations with technology			<ul style="list-style-type: none"> - technology offered is a well accepted treatment process - regulations need to be changed to ban fall, winter and early spring applications of anaerobically digested manure due to high mineralized nutrient content - C of A may be required for burning biogas - may be some concern over odour depending on level of volatile solids break down that occurs in the lagoon
Reduction of nitrogen loading to surface water			<ul style="list-style-type: none"> - much of the organic nitrogen present in the raw manure is converted to mineralized nitrogen during the anaerobic digestion process - mineralized nitrogen is very susceptible to leaching and land application timing must be limited to the crop growing season or there will potentially be a net increase in nitrogen loading to surface water via movement to tile drains
Reduction of phosphorus loading to ground water			<ul style="list-style-type: none"> - much of the organic phosphorus present in the raw manure is converted to mineralized phosphorus during the anaerobic digestion process - mineralized phosphorus is more susceptible to movement with soil water and land application timing should be restricted to crop growing period or there will potentially be a net increase in phosphorus loading to surface water via movement to tile drains or movement with surface runoff
Potential for degrading medicines and other by-pass			<ul style="list-style-type: none"> - methanogenic bacteria required for anaerobic digestion are inhibited or killed by low levels of antibiotics and other chemicals - anaerobics may degrade some antibiotics and other manure by-pass substances provided they are at very low concentrations
Potential to reduce dependency on local land base for manure application			<ul style="list-style-type: none"> - nutrients are conserved therefore anaerobic treatment itself does not reduce land base requirements - minimal odour associated with anaerobically digested manures therefore may be able to apply closer to residences which will increase the availability of localized land base
Capital costs			\$2,500 to \$3,000/m ³ /day of treatment capacity; includes co-generation
O&M costs			\$0.48/m ³ treated

Evaluation comments are based on AMMTO's interpretation of information provided to AMMTO by the Technology Suppliers as of December 31, 2002 and knowledge of AMMTO Evaluation Team Members regarding the technology.

Auto-thermophilic Aerobic Digestion Systems

Disclaimer

Users of the information provided in the Technology Evaluation Sheets do so at their own risk. AMMTO and persons associated with the AMMTO project accept no liability for the use of the information provided in the Technology Evaluation Sheets.

The information included in the Technology Evaluation Sheets is based on AMMTO's interpretation of information provided by the Technology Suppliers and the knowledge of AMMTO Evaluation Team Members. Different individuals may interpret and rank the technologies differently.

AMMTO Technology Evaluation Sheet

Disclaimer

Use of this information is at the users own risk
AMMTO and all persons associated with the AMMTO project do not accept any liability for the use of this information

Technology Submission Company: TAO Corporation

Type of Technology: Enhanced Auto Thermophylic Aerobic Digestion

Evaluation Criteria	Performance Ranking	Confidence Ranking	AMMTO Technical Committee Evaluation Comments
Odour reduction			<ul style="list-style-type: none"> - data indicates 100% destruction of volatile fatty acids, CH₃SH and H₂S - aerobic process therefore eliminates the reduction of compounds that cause offensive odours
Reduction of green house gas emissions			<ul style="list-style-type: none"> - should be complete volatile solids destruction - aerobic process - therefore production of greenhouse gases (particularly methane) should be eliminated
Reduction of nitrogen loading to ground water			<ul style="list-style-type: none"> - aerobic process in which mineralized nitrogen is incorporated into microbial biomass therefore there should be limited mineralized nitrogen present that can move to groundwater from system effluent - data indicates a 35% reduction in ammonia concentration
Reduction in bacteria loading to ground and surface water			<ul style="list-style-type: none"> - high temperature process that operates at 50 to 60 degrees Celsius - pathogen kill should be close to 100%
Reduction in manure volume and/or mass			<ul style="list-style-type: none"> - literature indicates that a 30% volume reduction occurs due to evaporation during the process
Ease of meeting government regulations with technology			<ul style="list-style-type: none"> - well documented process - high certainty of pathogen kill - this process does not require a committed local land base so that if there is a system problem what will the farmer do with the manure while the system is being repaired? - may require committed land base for emergency situations
Reduction of nitrogen loading to surface water			<ul style="list-style-type: none"> - aerobic process in which nitrogen is incorporated into microbial biomass therefore there should be limited mineral nitrogen present that can easily move to tile drains and surface water - nutrients concentrated into a smaller liquid volume; this reduces volumetric loading and potential for nutrient movement
Reduction of phosphorus loading to ground water			<ul style="list-style-type: none"> - aerobic process in which phosphorus is incorporated into microbial biomass therefore there should be limited mineral phosphorus present that can easily move to tile drains and surface water - nutrients concentrated into a smaller volume of liquid therefore there is a reduced volumetric loading to soils which reduces the potential of nutrient movement to tile drains and surface water.
Potential for degrading medicines and other by-pass substances found in manures			<ul style="list-style-type: none"> - very high temperature aerobic bacterial degradation process - should provide thermal and bacterial break down of medicines and by-pass substances in manure
Potential to reduce dependency on local land base for manure application			<ul style="list-style-type: none"> - literature indicates that a 30% reduction in volume occurs - therefore process provides substantial volume reduction - nutrients concentrated into a smaller volume of liquid which can be transported a substantial distance economically - odour free liquid and solids so land application can occur close to residences which will make more local land available
Capital costs			\$11,000/(tonne/day treatment capacity)
O&M costs			\$5.25 - \$565/tonne processed

Evaluation comments are based on AMMTO's interpretation of information provided to AMMTO by the Technology Suppliers as of December 31, 2002 and knowledge of AMMTO Evaluation Team Members regarding the technology.

AMMTO Technology Evaluation Sheet

Disclaimer

Use of this information is at the users own risk
AMMTO and all persons associated with the AMMTO project do not accept any liability for the use of this information

Technology Submission Company: International Bio Recovery Corporation

Type of Technology: Enhanced Auto Thermophylic Aerobic Digestion With Evaporation and Solids Drying Processes

Evaluation Criteria	Performance Ranking	Confidence Ranking	AMMTO Technical Committee Evaluation Comments
Odour reduction			- data indicates 100% conversion of volatile solids to bacterial biomass - aerobic process therefore eliminates the production of compounds that cause offensive odours
Reduction of green house gas emissions			- complete volatile solids destruction - aerobic process - therefore production of greenhouse gases (particularly methane) should be eliminated
Reduction of nitrogen loading to ground water			- aerobic process in which all nitrogen is incorporated into microbial biomass therefore there should be no mineral nitrogen present that can easily move to the groundwater - nutrients concentrated into a small liquid volume and dried solids which will reduce the volumetric loading to land and reduce the potential for movement of nutrients to the groundwater
Reduction in bacteria loading to ground and surface water			- high temperature process that operates at 60 to 80 degrees Celsius - pathogen kill should be close to 100%
Reduction in manure volume and/or mass			- literature indicates that only 12% of original volume remains after treatment, evaporation and drying processes - therefore process provides substantial volume reduction
Ease of meeting government regulations with technology			well documented process; high certainty of pathogen kill - this process does not require a committed local land base so that if there is a system problem what will the farmer do with the manure while the system is being repaired?
Reduction of nitrogen loading to surface water			- aerobic process in which all nitrogen is incorporated into microbial biomass therefore there should be no mineral nitrogen present that can easily move to tile drains and surface water - nutrients concentrated into small liquid volume and dried solids; this reduces volumetric loading and potential for nutrient movement
Reduction of phosphorus loading to ground water			- aerobic process in which all phosphorus is incorporated into microbial biomass therefore there should be no mineral phosphorus present that can easily move to tile drains and surface water - nutrients concentrated into a small volume of liquid and dried solids therefore there is a reduced volumetric loading to soils which reduces the potential of nutrient movement to tile drains and surface water.
Potential for degrading medicines and other by-pass substances found in manures			- very high temperature aerobic bacterial degradation process - should provide thermal and bacterial break down of medicines and by-pass substances in manure
Potential to reduce dependency on local land base for manure application			- literature indicates that only 12% of original volume remains after treatment, evaporation and drying processes - therefore process provides substantial volume reduction - nutrients concentrated into a small volume of liquid and dried solids which can be transported a substantial distance economically - odour free liquid and solids so land application can occur close to residences which will make more local land available
Capital costs			\$56,818/tonne of manure/day treatment capacity
O&M costs			\$56/tonne of manure treated (\$026/ gallon treated)

Evaluation comments are based on AMMTO's interpretation of information provided to AMMTO by the Technology Suppliers as of December 31, 2002 and knowledge of AMMTO Evaluation Team Members regarding the technology.

Composting Systems

Disclaimer

Users of the information provided in the Technology Evaluation Sheets do so at their own risk. AMMTO and persons associated with the AMMTO project accept no liability for the use of the information provided in the Technology Evaluation Sheets.

The information included in the Technology Evaluation Sheets is based on AMMTO's interpretation of information provided by the Technology Suppliers and the knowledge of AMMTO Evaluation Team Members. Different individuals may interpret and rank the technologies differently.

AMMTO Technology Evaluation Sheet

Disclaimer

Use of this information is at the users own risk
AMMTO and all persons associated with the AMMTO project do not accept any liability for the use of this information

Technology Submission Company: Global repair - Outdoor Windrow Composting with Rain Shield

Type of Technology: Aerobic Composting

Evaluation Criteria	Performance Ranking	Confidence Ranking	AMMTO Technical Committee Evaluation Comments
Odour reduction			- aerobic conditions will reduce/eliminate production of foul odour causing compounds associated with anaerobic manure - potential for management problems; composting in a poor location on bare ground, rain shield can blow off, insufficient natural aeration due to natural settling of manure between mixing
Reduction of greenhouse gas emissions			- still potential for some micro anaerobic sites that will generate limited greenhouse gases -- depends on degree and frequency of mixing
Reduction of nitrogen loading to ground water			- mineral nitrogen should be converted to organic nitrogen in the form of bacterial biomass - organic nitrogen less susceptible to movement to groundwater - potential for leaching from out door composting site
Reduction in bacteria loading to ground and surface water			- aerobic composting will provide pathogen kill due to relatively high temperatures (+ 35 C) - aerobic composting will provide some biological pathogen kill due to microbial attack from organisms degrading the manure
Reduction in manure volume and/or mass			generally accepted that composting will provide up to a 50% reduction in volume/mass due to primarily carbon and moisture loss during the degradation process
Ease of meeting government regulations with technology			- aerobic composting is a proven technology; - may be some concern about out door composting on bare ground - level of bacterial kill will be dependent on operating conditions; frequency of mixing, level of aeration achieved, carbon to nitrogen ratio, temperature maintained; - temperature records may be required to verify potential for pathogen kill
Reduction of nitrogen loading to surface water			- mineral nitrogen should be converted to organic nitrogen in the form of bacterial biomass - some reduction in total nitrogen due to volatilization during composting process - organic nitrogen less susceptible to movement to tiles and surface water - important to locate composting windrow away from tiled ground
Reduction of phosphorus loading to surface water			- phosphorus is conserved during the composting process - concentration of phosphorus is higher in finished compost than raw manure due to carbon loss - solids have reduced volume and moisture and are more manageable therefore there is a reduced risk of phosphorus movement from application of composted solids
Potential for degrading medicines and other by-pass substances found in manures			- medicines etc. should break down due to biological degradation and thermal deterioration - any medicines etc. that due not break down will be at a higher concentration in the compost due to loss of solids (carbon)
Potential to reduce dependency reduce local land base for manure application			- composting reduces volume/mass by up to 50% - nutrients concentrated in finished compost due to solids (carbon) loss - compost can be hauled a further distance and still be economical due to concentration of nutrients - compost has potential for off farm sales as a horticultural soil amendment
Capital costs			Windrow turner costs range from \$5,000 to \$15,000
O&M costs			\$30.86/tonne of manure composted (includes addition of materials to provide proven composting recipe)

Evaluation comments are based on AMMTO's interpretation of information provided to AMMTO by the Technology Suppliers as of December 31, 2002 and knowledge of AMMTO Evaluation Team Members regarding the technology.

AMMTO Technology Evaluation Sheet

Disclaimer

Use of this information is at the users own risk
AMMTO and all persons associated with the AMMTO project do not accept any liability for the use of this information

Technology Submission Company: Omega Organics

Type of Technology: Aerobic Composting - Rotary Drum Composter

Evaluation Criteria	Performance Ranking	Confidence Ranking	AMMTO Technical Committee Evaluation Comments
Odour reduction			- aerobic conditions will reduce/eliminate production of foul odour causing compounds associated with anaerobic manure - drum mixing should maintain good aerobic conditions
Reduction of green house gas emissions			- potential for some micro anaerobic sites that will generate limited greenhouse gases - depends on degree and frequency of mixing
Reduction of nitrogen loading to ground water			- mineral nitrogen should be converted to organic nitrogen in the form of bacterial biomass - organic nitrogen less susceptible to movement to groundwater - enclosed system so no potential for leaching to the natural environment during composting
Reduction in bacteria loading to ground and surface water			- aerobic composting will provide pathogen kill due to relatively high temperatures (+ 45 C) - aerobic composting will provide biological pathogen kill due to microbial attack from organisms degrading the manure
Reduction in manure volume and/or mass			- generally accepted that composting will provide up to a 50% reduction in volume/mass due to primarily carbon and moisture loss during the degradation process
Ease of meeting government regulations with technology			- aerobic composting is a proven technology - level of bacterial kill will be dependent on operating conditions; frequency of mixing, level of aeration achieved, carbon to nitrogen ratio, temperature maintained - temperature records may be required to verify potential for pathogen kill
Reduction of nitrogen loading to surface water			- mineral nitrogen should be converted to organic nitrogen in the form of bacterial biomass - some reduction in total nitrogen due to volatilization during composting process - organic nitrogen less susceptible to movement to tiles and surface water
Reduction of phosphorus loading to surface water			- phosphorus is conserved during the composting process - concentration of phosphorus is higher in finished compost than raw manure due to carbon loss - solids have reduced volume and moisture and are more manageable therefore there is a reduced risk of phosphorus movement from application of composted solids
Potential for degrading medicines and other by-pass substances found in manures			- medicines etc. should break down due to biological degradation and thermal deterioration - any medicines etc, that due not break down will be at a higher concentration in the compost due to loss of solids (carbon)
Potential to reduce dependency on local land base for manure application			- composting reduces volume/mass by up to 50% - nutrients concentrated in finished compost due to solids (carbon) loss - compost can be hauled a further distance and still be economical due to concentration of nutrients - compost has potential for off farm sales as a horticultural soil amendment
Capital costs			\$13,000/tonne of treatment capacity per day to \$14,000/tonne of treatment capacity per day
O&M costs			Not provided

Evaluation comments are based on AMMTO's interpretation of information provided to AMMTO by the Technology Suppliers as of December 31, 2002 and knowledge of AMMTO Evaluation Team Members regarding the technology.

AMMTO Technology Evaluation Sheet

Disclaimer

Use of this information is at the users own risk
AMMTO and all persons associated with the AMMTO project do not accept any liability for the use of this information

Technology Submission Company: Transform Compost System- Channel Composting

Type of Technology: Aerobic Composting

Evaluation Criteria	Performance Ranking	Confidence Ranking	AMMTO Technical Committee Evaluation Comments
Odour reduction			- aerobic conditions will reduce/eliminate production of foul odour causing compounds associated with anaerobic manure
Reduction of green house gas emissions			- still potential for some micro anaerobic sites that will generate limited greenhouse gases - depends on degree and frequency of mixing and means of aeration
Reduction of nitrogen loading to ground water			- mineral nitrogen should be converted to organic nitrogen in the form of bacterial biomass - organic nitrogen loss susceptible to movement to groundwater
Reduction in bacteria loading to ground and surface water			- aerobic composting will provide pathogen kill due to relatively high temperatures (+ 35 C) - aerobic composting provide some biological pathogen kill
Reduction in manure volume			- generally accepted that composting will provide up to a 50% reduction in volume/mass due to primarily carbon and moisture loss during the degradation process
Ease of meeting government regulations with technology			- aerobic composting is a proven technology - level of bacterial kill will be dependent on operating conditions; frequency of mixing, level of aeration, carbon to nitrogen ratio - temperature records may be required to verify potential for pathogen kill
Reduction of nitrogen loading to surface water			- mineral nitrogen should be converted to organic nitrogen in the form of bacterial biomass - some reduction in total nitrogen due to volatilization during composting process - organic nitrogen less susceptible to movement to tiles and surface water
Reduction of phosphorus loading to surface water			- phosphorus is conserved during the composting process - concentration of phosphorus is higher in finished compost than raw manure due to carbon loss - solids have reduced volume and moisture and are more manageable therefore there is a reduced risk of phosphorus movement from application of composted solids
Potential for degrading medicines and other by-pass substances found in manures			- medicines etc should break down due to biological degradation and thermal deterioration - any medicines etc that due not break down will be at a higher concentration due to loss solids (carbon)
Potential to reduce dependency on local land base for manure application			- composting reduces volume/mass by up to 50% - nutrients concentrated in finished compost due to solids (carbon) loss - compost can be hauled a further distance and still be economical due to concentration of nutrients - compost has potential for off farm sales as a horticultural soil amendment
Capital costs			\$2,000/ tonne/day of treatment capacity to \$2,700/ tonne of treatment capacity per day. Smaller size units have a higher cost per unit of treatment capacity
O&M costs			Not provided

Evaluation comments are based on AMMTO's interpretation of information provided to AMMTO by the Technology Suppliers as of December 31, 2002 and knowledge of AMMTO Evaluation Team Members regarding the technology.

Advanced Land Application Systems

Disclaimer

Users of the information provided in the Technology Evaluation Sheets do so at their own risk. AMMTO and persons associated with the AMMTO project accept no liability for the use of the information provided in the Technology Evaluation Sheets.

The information included in the Technology Evaluation Sheets is based on AMMTO's interpretation of information provided by the Technology Suppliers and the knowledge of AMMTO Evaluation Team Members. Different individuals may interpret and rank the technologies differently.

AMMTO Technology Evaluation Sheet

Disclaimer

Use of this information is at the users own risk
AMMTO and all persons associated with the AMMTO project do not accept any liability for the use of this information

Technology Submission Company: Agrico Canada Limited

Type of Technology: Precision Land Application with or without Injection

Evaluation Criteria	Performance Ranking	Confidence Ranking	AMMTO Technical Committee Evaluation Comments
Odour reduction			- injection should reduce the volatilization of odour causing compounds - injection will put manure in contact with soil organisms and promote faster break down of odorous compounds
Reduction of green house gas emissions			- under high soil moisture conditions injection may increase greenhouse gas emissions
Reduction of nitrogen loading to ground water			- no change in nitrogen form at time of application - injection may disturb the soil sufficiently to reduce transport in macro pores - injection system has a positive feed system to each injector therefore uniform application rate which will help reduce over application of manure and reduce potential for nitrogen movement to the groundwater
Reduction in bacteria loading to ground and surface water			- injection provides increased exposure of manure to soil organisms which may increase rate of pathogen kill - injection eliminates ultraviolet pathogen kill that occurs when manure is surface applied
Reduction in manure volume and/or mass			- no means for volume reduction
Ease of meeting government regulations with technology			- very accurate placement of manure - variable rate application while on the go based on GPS mapping that will allow manure rates to be reduced or eliminated for sensitive regions of a field
Reduction of nitrogen loading to surface water			- injection may break up macro pores to some extent and reduce potential for manure movement to tile drains - injection eliminates potential for surface movement of manure nutrients to surface water
Reduction of phosphorus loading to ground water			- injection may break up macro pores to some extent and reduce potential for manure movement to tile drains - injection eliminates potential for surface movement of manure nutrients to surface water
Potential for degrading medicines and other by-pass substances found in manures			- limited net effect - injection eliminates breakdown promoted by ultraviolet light - injection increases contact with soil microorganisms and will increase microbial break down
Potential to reduce dependency on local land base for manure application			- system may make hauling manure longer distances more cost effective because of accurate placement and variable rate application - injection will reduce odours and allow manure to be applied closer to residences which will make more land available locally
Capital costs			- No costs provided to purchase a unit
O&M costs			- Cost for custom application is \$190/hr.

Evaluation comments are based on AMMTO's interpretation of information provided to AMMTO by the Technology Suppliers as of December 31, 2002 and knowledge of AMMTO Evaluation Team Members regarding the technology.

AMMTO Technology Evaluation Sheet

Disclaimer

Use of this information is at the users own risk
 AMMTO and all persons associated with the AMMTO project do not accept any liability for the use of this information

Technology Submission Company: Harco Ag Equipment

Type of Technology: Advanced Land Application Using Injection

Evaluation Criteria	Performance Ranking	Confidence Ranking	AMMTO Technical Committee Evaluation Comments
Odour reduction			- injection should reduce the volatilization of odour causing compounds - injection will put manure in contact with soil organisms and promote faster break down of odorous compounds
Reduction of green house gas emissions			- under high soil moisture conditions injection may increase greenhouse gas emissions
Reduction of nitrogen loading to ground water			- no change in nitrogen form at time of application - injection may disturb the soil sufficiently to reduce transport in macro pores - injection allows application directly to root zone of growing crop which will increase potential for immediate uptake of nutrients and reduce potential for nitrogen movement out of root zone
Reduction in bacteria loading to ground and surface water			- injection provides increased exposure of manure to soil organisms which may increase rate of pathogen kill - injection eliminates ultraviolet pathogen kill that occurs when manure is surface applied
Reduction in manure volume and/or mass			- no means for volume reduction
Ease of meeting government regulations with technology			- accurate placement of manure - accurate volume delivery to injectors- allows application to growing hay crop at optimum time
Reduction of nitrogen loading to surface water			- injection may break up macro pores to some extent and reduce potential for manure movement to tile drains - injection eliminates potential for surface movement of manure nutrients to surface water
Reduction of phosphorus loading to ground water			- injection may break up macro pores to some extent and reduce potential for manure movement to tile drains - injection eliminates potential for surface movement of manure nutrients to surface water
Potential for degrading medicines and other by-pass substances found in manures			- limited net effect - injection eliminates breakdown promoted by ultraviolet light - injection increases contact with soil microorganisms and will increase microbial break down
Potential to reduce dependency on local land base for manure application			- system may make hauling manure longer distances more cost effective because of accurate placement and ability to inject directly into hay crop - will reduce odours and allow manure to be applied closer to residences which will make more land available locally injection
Capital costs			\$1,275 to \$1,606 per injection point for injectors
O&M costs			No costs provided

Evaluation comments are based on AMMTO's interpretation of information provided to AMMTO by the Technology Suppliers as of December 31, 2002 and knowledge of AMMTO Evaluation Team Members regarding the technology.

AMMTO Technology Evaluation Sheet

Disclaimer

Use of this information is at the users own risk
AMMTO and all persons associated with the AMMTO project do not accept any liability for the use of this information

Technology Submission Company: Nuhn Industries Ltd.

Type of Technology: Advanced Land Application with or without Injection

Evaluation Criteria	Performance Ranking	Confidence Ranking	AMMTO Technical Committee Evaluation Comments
Odour reduction			- injection should reduce the volatilization of odour causing compounds - injection will put manure in contact with soil organisms and promote faster break down of odorous compounds
Reduction of green house gas emissions			- under high soil moisture conditions injection may increase greenhouse gas emissions
Reduction of nitrogen loading to ground water			- no change in nitrogen form at time of application - injection may disturb the soil sufficiently to reduce transport in macro pores - injection system available with positive feed
Reduction in bacteria loading to ground and surface water			- injection provides increased exposure of manure to soil organisms which may increase rate of pathogen kill - injection eliminates ultraviolet pathogen kill that occurs when manure is surface applied
Reduction in manure volume and/or mass			- no means for volume reduction
Ease of meeting government regulations with technology			- accurate placement of manure - accurate volume delivery to injectors
Reduction of nitrogen loading to surface water			- injection may break up macro pores to some extent and reduce potential for manure movement to tile drains - injection eliminates potential for surface movement of manure nutrients to surface water
Reduction of phosphorus loading to ground water			- injection may break up macro pores to some extent and reduce potential for manure movement to tile drains - injection eliminates potential for surface movement of manure nutrients to surface water
Potential for degrading medicines and other by-pass substances found in manures			- limited net effect - injection eliminates breakdown promoted by ultraviolet light - injection increases contact with soil microorganisms and will increase microbial break down
Potential to reduce dependency on local land base for manure application			- system may make hauling manure longer distances more cost effective because of accurate placement and variable rate application - injection will reduce odours and allow manure to be applied closer to residences which will make more land available locally
Capital costs			No costs provided to purchase a unit
O&M costs			No costs provided

Evaluation comments are based on AMMTO's interpretation of information provided to AMMTO by the Technology Suppliers as of December 31, 2002 and knowledge of AMMTO Evaluation Team Members regarding the technology.

AMMTO Technology Evaluation Sheet

Disclaimer

**Use of this information is at the users own risk
AMMTO and all persons associated with the AMMTO project do not accept any liability for the use of this information**

Technology Submission Company: Patz Manure Solutions

Type of Technology: Solids Removal, Solids Composting, Aeration of Separated Liquid, Micro Irrigation

Evaluation Criteria	Performance Ranking	Confidence Ranking	AMMTO Technical Committee Evaluation Comments
Odour reduction			- aeration provided to top 3 feet of storage; - aeration will reduce odours provided anaerobic conditions are eliminated - still potential for odorless compounds to be formed and offgas from lower liquid depths - off gases may break down as they pass through aerated layer
Reduction of greenhouse gas emissions			- if anaerobic conditions are eliminated greenhouse gas emissions will be eliminated - if sufficient air is provided to inhibit anaerobic activity the system should function as advertised - no study data given to support odour reduction
Reduction of nitrogen loading to ground water			- ammonia and nitrates are intermediate compounds of aerobic treatment; - if facultative conditions exist in manure storage there will be some denitrification which will convert ammonia to N ₂ gas which will be released to the atmosphere. This will reduce ammonia concentration of manure; - solids/liquid separation will reduce nutrients in liquid phase; - composted solids can be used as bedding which may reduce N loading to land depending on how solids are handled; - no data to support what happens to N
Reduction in bacteria loading to around and surface water			- aerobic activity will provide some pathogen kill - long retention time of manure will allow natural pathogen decline to occur
Reduction in manure volume and/or mass			- no means for volume reduction other than natural evaporation - precipitation will replace any evaporation and possible result in an increase in volume
Ease of meeting government regulations with technology			- simple system - benefits of maintaining aerobic conditions is well understood and documented
Reduction of nitrogen loading to surface water			- ammonia and nitrates are intermediate compounds of aerobic treatment; - if facultative conditions exist in manure storage there will be some denitrification which will convert ammonia to nitrogen gas which will be released to the atmosphere. This will reduce ammonia concentration of manure; - solids/liquid separation will reduce nutrients in liquid phase - composted solids can be used as bedding which may reduce nitrogen loading to land depending on how bedding is handled - no data to support what happens to nitrogen
Reduction of phosphorus loading to ground water			- solids/liquid separation will reduce phosphorus content of liquid phase - reduced potential for phosphorus movement from solids phase if land applied on a nutrient loading basis - composted solids can be used as bedding which may reduce phosphorus loading to land depending how bedding is handled - aerobic degradation of organic matter in liquid phase may release some of the organic phosphorus to a more soluble form
Potential for degrading medicines and other by pass substances found in manures			- potential for breakdown of medicines etc. due to aerobic biological activity - long system retention time will provide some natural breakdown - aerobic composting will provide thermal and biological breakdown of medicines etc. in solids
Potential to reduce dependency on local land base for manure application			- nutrients concentrated in solids; - more economical to haul solids a further distance due to nutrient concentration - liquid effluent has a low nutrient content and therefore can be applied at a higher volume per acre than untreated manure without exceeding nutrient loading limits; - relatively odour free liquid and solids can be land applied closer to residences which will make more land available locally
Capital costs			Not provided
O&M costs			\$7.31/m ³ treated based on an annual treatment volume of 13,245 m ³

Evaluation comments are based on AMMTO's interpretation of information provided to AMMTO by the Technology Suppliers as of December 31, 2002 and knowledge of AMMTO Evaluation Team Members regarding the technology.

Other Technologies and Systems

Disclaimer

Users of the information provided in the Technology Evaluation Sheets do so at their own risk. AMMTO and persons associated with the AMMTO project accept no liability for the use of the information provided in the Technology Evaluation Sheets.

The information included in the Technology Evaluation Sheets is based on AMMTO's interpretation of information provided by the Technology Suppliers and the knowledge of AMMTO Evaluation Team Members. Different individuals may interpret and rank the technologies differently.

AMMTO Technology Evaluation Sheet

Disclaimer

Use of this information is at the users own risk
 AMMTO and all persons associated with the AMMTO project do not accept any liability for the use of this information

Technology Submission Company: Enpar Technologies Inc.

Type of Technology : Electro Chemical Treatment of Manure Filtrate From Manure Solids/Liquid Separation for Ammonia Nitrogen Removal

Evaluation Criteria	Performance Ranking	Confidence Ranking	AMMTO Technical Committee Evaluation Comments
Odour reduction			- removing ammonia nitrogen may reduce biological activity due to lack of nitrogen to support cell metabolic processes - reduction in biological activity may reduce generation of odorous compounds under anaerobic conditions
Reduction of green house gas emissions			- removing ammonia nitrogen may reduce biological activity due to lack of nitrogen to support cell metabolic processes - reduction in biological activity may reduce generation of greenhouse gases (methane) under anaerobic conditions
Reduction of nitrogen loading to ground water			- data indicates a 97% removal of ammonia nitrogen - no experimental data presented to support this claim
Reduction in bacteria loading to ground and surface water			- electrochemical treatment may provide some bacterial kill - no benefit stated
Reduction in manure volume and/or mass			- no opportunity for volume/mass reduction
Ease of meeting government regulations with technology			- relatively simple concept - should be relatively easy to test and confirm - should be easy to demonstrate
Reduction of nitrogen loading to surface water			- data indicates a 97% removal of ammonia nitrogen - no experimental data presented to support this claim
Reduction of phosphorus loading to surface water			- no phosphorus removal
Potential for degrading medicines and other by-pass substances found in manures			- no benefit stated
Potential to reduce dependency on local land base for manure application			- no nutrient concentration capabilities - reduction of ammonia nitrogen may increase hydraulic loading if nitrogen is the limiting nutrient - the ability to increased hydraulic loading will reduce land base required
Capital costs			No costs provided
O&M costs			No costs provided

Evaluation comments are based on AMMTO's interpretation of information provided to AMMTO by the Technology Suppliers as of December 31, 2002 and knowledge of AMMTO Evaluation Team Members regarding the technology.

AMMTO Technology Evaluation Sheet

Disclaimer

Use of this information is at the users own risk
AMMTO and all persons associated with the AMMTO project do not accept any liability for the use of this information

Technology Submission Company: Enpar Technologies Inc.

Type of Technology : Electrolytic Treatment of Liquid Manure for Odour & Bacteria Reduction

Evaluation Criteria	Performance Ranking	Confidence Ranking	AMMTO Technical Committee Evaluation Comments
Odour reduction			- data indicates 85% reduction in hydrogen sulfide emissions; - no data to support claim - hydrogen sulfide is only one of many odour causing compounds released by anaerobic manure - reduction of anaerobic bacteria will reduce release of odorous compounds
Reduction of green house gas emissions			- reduction of anaerobic bacteria will reduce release of methane - no data to support this
Reduction of nitrogen loading to ground water			- no benefit stated - process may convert some ammonia to nitrogen gas and result in a reduction in the nitrogen concentration of the manure
Reduction in bacteria loading to ground and surface water			- electrolytic treatment is reported to provide 3 orders of magnitude reduction in bacteria population - no test data to support the claim
Reduction in manure volume and/or mass			- no opportunity for volume or mass reduction
Ease of meeting government regulations with technology			- simple concept - electrolytic process for bacterial kill would need to be confirmed - may be some concern about not utilizing the manure nitrogen - nitrogen fertilizer production is a high energy consumption industry, therefore utilization of manure nitrogen is preferred - incomplete pathogen kill may be a concern
Reduction of nitrogen loading to surface water			- no benefit stated - some ammonia may be converted to nitrogen gas and result in a reduction in the nitrogen concentration of the manure
Reduction of phosphorus loading to surface water			- no phosphorus removal potential
Potential for degrading medicines and other by-pass substances found in manures			- no breakdown indicated
Potential to reduce dependency on local land base for manure application			- no nutrient concentration - phosphorus is conserved - reduced nitrogen concentration - may be reduced land base requirements if nitrogen is the limiting nutrient - reduced odour may allow manure to be applied closer to residences which will increase local land base available
Capital costs			No costs provided
O&M costs			No costs provided

Evaluation comments are based on AMMTO's interpretation of information provided to AMMTO by the Technology Suppliers as of December 31, 2002 and knowledge of AMMTO Evaluation Team Members regarding the technology.

AMMTO Technology Evaluation Sheet

Disclaimer

Use of this information is at the users own risk
AMMTO and all persons associated with the AMMTO project do not accept any liability for the use of this information

Technology Submission Company: Enpar Technologies Inc.

Type of Technology : Chemical Adsorption for the Removal of Ammonia Nitrogen From Tile water

Evaluation Criteria	Performance Ranking	Confidence Ranking	AMMTO Technical Committee Evaluation Comments
Odour reduction			- treating tile water therefore no manure odour reduction
Reduction of green house gas emissions			- reduction of nitrogen from tile waters will reduce nitrogen loading to surface water and reduce potential for oxygen depletion due to oxygen demand associated with the nitrogen loading - reduces potential for anaerobic conditions which promote the release of greenhouse gases
Reduction of nitrogen loading to ground water			- ammonia is removed from the tile water which will result in a reduction in the nitrogen loading to surface and groundwater
Reduction in bacteria loading to ground and surface water			- nitrogen removal may reduce life cycle of bacteria in tile water because of lack of nitrogen to support life
Reduction in manure volume and/or mass			- no opportunity for volume or mass reduction
Ease of meeting government regulations with technology			- simple concept - viable option for nitrogen removal from tile water - only applicable where tile drainage exists
Reduction of nitrogen loading to surface water			- ammonia is removed from the tile water which will result in a reduction in the nitrogen loading to surface and groundwater
Reduction of phosphorus loading to surface water			- no phosphorus removal potential
Potential for degrading medicines and other by-pass substances found in manures			- no breakdown indicated - there is a possibility that some substances that end up in tile water from manure may be adsorbed with the ammonia nitrogen
Potential to reduce dependency on local land base for manure application			- may allow local land base to be used to greater extent without concern for nitrogen loading to tile water
Capital costs			No costs provided
O&M costs			No costs provided

Evaluation comments are based on AMMTO's interpretation of information provided to AMMTO by the Technology Suppliers as of December 31, 2002 and knowledge of AMMTO Evaluation Team Members regarding the technology.

AMMTO Technology Evaluation Sheet

Disclaimer

Use of this information is at the users own risk
AMMTO and all persons associated with the AMMTO project do not accept any liability for the use of this information

Technology Submission Company: First American Scientific Corp.

Type of Technology : Solids Drying and Pelletizing

Evaluation Criteria	Performance Ranking	Confidence Ranking	AMMTO Technical Committee Evaluation Comments
Odour reduction			<ul style="list-style-type: none"> - manure dried and pelletized - low moisture eliminates biological activity that generates odorous compounds - may be odours from processing operation - potential to use a biofilter to eliminate processing odour - no raw manure has to be stored
Reduction of green house gas emissions			<ul style="list-style-type: none"> - manure dried and pelletized - low moisture eliminates biological activity that generates greenhouse gases - no raw manure has to be stored
Reduction of nitrogen loading to ground water			<ul style="list-style-type: none"> - no change in nitrogen concentration indicated - may have some ammonia loss during processing - dried and pelletized manure is a more easily managed material which may result in reduced nitrogen loading due to management of material
Reduction in bacteria loading to ground and surface water			<ul style="list-style-type: none"> - data indicates that pathogen kill occurs due to high intensity shock waves that occur during processing - process generates heat which may also provide some pathogen kill - drying may cause pathogen desiccation that will provide some pathogen kill
Reduction in manure volume and/or mass			<ul style="list-style-type: none"> - drying and pelletizing results in a 6:1 volume reduction
Ease of meeting government regulations with technology			<ul style="list-style-type: none"> - simple concept - may need C of A for air emissions or be required to install a biofilter - addresses many of the concerns with manure management - produces a very uniform material that can be applied like a commercial fertilizer
Reduction of nitrogen loading to surface water			<ul style="list-style-type: none"> - no change in nitrogen concentration indicated - may have some ammonia loss during processing - dried and pelletized manure is a more easily managed material which may result in reduced potential for nitrogen loading to tiles and surface water because of improved manageability of the material
Reduction of phosphorus loading to surface water			<ul style="list-style-type: none"> - no change in phosphorus concentration - dried and pelletized manure is a more easily managed material which may result in reduced potential for phosphorus loading to tiles and surface water because of improved manageability of the material
Potential for degrading medicines and other by-pass substances found in manures			<ul style="list-style-type: none"> - some potential for thermal degradation during manure processing
Potential to reduce dependency on local land base for manure application			<ul style="list-style-type: none"> - manure nutrients and organic matter concentrated into a uniform pellet with uniform composition - material in a form that makes it more economical to transport which reduces the dependency on local land base - no odour so material can be applied closer to residences which makes more local land available
Capital costs			\$35,893/ (tonne/8 hr. day capacity) - max. capacity is 4 tonnes per hour
O&M costs			\$31.00/tonne processed

Evaluation comments are based on AMMTO's interpretation of information provided to AMMTO by the Technology Suppliers as of December 31, 2002 and knowledge of AMMTO Evaluation Team Members regarding the technology.

AMMTO Technology Evaluation Sheet

Disclaimer

Use of this information is at the users own risk
AMMTO and all persons associated with the AMMTO project do not accept any liability for the use of this information

Technology Submission Company: Hydro Static Systems

Type of Technology : Electrocoagulation, Dissolved Air (Floatation removal of Coagulated Solids, Filter press drying of Solids, Ozone Disinfection of liquid Stream

Evaluation Criteria	Performance Ranking	Confidence Ranking	AMMTO Technical Committee Evaluation Comments
Odour reduction			<ul style="list-style-type: none"> - system removes suspended solids - solids removed have potential to generate odours if not aerobically composted - dissolved organics in liquid stream have potential to generate odours if liquid goes anaerobic during storage - ozone treatment for bacterial kill in liquid stream will reduce potential for anaerobic microbial activity that generates odour - ozone treatment for bacterial kill will be affected by size of particulate in liquid stream
Reduction of green house gas emissions			<ul style="list-style-type: none"> - still potential for anaerobic conditions in recovered solids during storage and in the liquid stream during storage so there still is some potential for greenhouse gases to be produced - bacterial kill in liquid stream will potentially reduce anaerobic activity
Reduction of nitrogen loading to ground water			<ul style="list-style-type: none"> - process provides 90% removal of ammonia from liquid phase after treatment so there is reduced potential of nitrogen loading to groundwater from liquid phase - reduced potential from land application of solids because of low moisture content and reduced volume makes material easier to manage to reduce potential for nitrogen loading to groundwater
Reduction in bacteria loading to ground and surface water			<ul style="list-style-type: none"> - liquid can be treated with ozone for pathogen kill - effectiveness of kill will be dependent on ozone addition rate and consistency of suspended solids concentration and size
Reduction in manure volume and/or mass			<ul style="list-style-type: none"> - same quantity of manure after treatment but it is separated into two streams
Ease of meeting government regulations with technology			<ul style="list-style-type: none"> - complex system will require review; - all proven technologies - complete pathogen kill not provided; - provides nutrient concentration that improves manageability - no direct discharge; - sacrificial copper electrodes used and copper addition to manure may be a concern
Reduction of nitrogen loading to surface water			<ul style="list-style-type: none"> - process provides 90% removal of ammonia from liquid phase after treatment so there is reduced potential of nitrogen loading to tile drains and surface water from liquid phase - reduced potential from land application of solids because of low moisture content and reduced volume, which makes material easier to manage to reduce potential for nitrogen loading to tile drains and surface water
Reduction of phosphorus loading to surface water			<ul style="list-style-type: none"> - phosphorus concentrated in the solids - solids easier to manage to reduce movement of phosphorus to tile drains and surface water
Potential for degrading medicines and other by-pass substances found in manures			<ul style="list-style-type: none"> - no medicine degradation indicated - ozone treatment of the liquid phase will provide medicine oxidation and breakdown - some medicine breakdown may occur in solids during storage due to biological activity but is not a result of the process
Potential to reduce dependency on local land base for manure application			<ul style="list-style-type: none"> - nutrients conserved but concentrated in solids - reduced nutrients in liquid allows increased hydraulic loading which reduces local land base required for liquid application - solids have reduce volume/mass and concentrated nutrients which makes it economical to transport a further distance - solids more easily managed
Capital costs			\$1,250/(m ³ /day capacity) to \$3,125 (m ³ /day capacity)
O&M costs			\$0.58/(m ³ treated)

Evaluation comments are based on AMMTO's interpretation of information provided to AMMTO by the Technology Suppliers as of December 31, 2002 and knowledge of AMMTO Evaluation Team Members regarding the technology.

AMMTO Technology Evaluation Sheet

Disclaimer

Use of this information is at the users own risk
AMMTO and all persons associated with the AMMTO project do not accept any liability for the use of this information

Technology Submission Company: Lystec International Inc.
Type of Technology : Dewatering/Drying and Combustion Processes

Evaluation Criteria	Performance Ranking	Confidence Ranking	AMMTO Technical Committee Evaluation Comments
Odour reduction			- if manure dried there will be no anaerobic biological activity to generate odours from dried solids - separated liquid from dewatering process will still have potential for odours
Reduction of green house gas emissions			- if manure dried there will be no anaerobic biological activity to generate greenhouse gases from dried solids - separated liquid from dewatering process will have low volatile solids content therefore a reduced potential for generating greenhouse gases
Reduction of nitrogen loading to ground water			-some nitrogen in mineral form will still be present in liquid stream from dewatering - processes primarily removes organic nitrogen (organic solids) - solids are a more manageable material and there may be reduced potential for nitrogen loading to groundwater due to improved management
Reduction in bacteria loading to ground and surface water			- dewatering process does not provide any pathogen kill; - drying process will provide pathogen kill in separated solids - no pathogen kill in liquids from dewatering process
Reduction in manure volume and/or mass			- no volume reduction from solids separation; - manure just separated into solids and liquid fractions - some volume reduction if solids combusted or gasified
Ease of meeting government regulations with technology			- treatment technologies are recognized technologies; - no pathogen kill for liquids produced during dewatering - odours from liquid may be a concern - air emissions from combustion/gasification process may require C of A
Reduction of nitrogen loading to surface water			-some nitrogen in mineral form will still be present in liquid stream from dewatering - processes primarily remove organic nitrogen (organic solids) from liquid - solids are a more manageable material and there may be reduced potential for nitrogen loading to tiles and surface water due to improved management - option for solids to be combusted or gasified which will reduce nitrogen loading to land
Reduction of phosphorus loading to surface water			reduced phosphorus concentration in separated liquid which may reduce potential for phosphorus loading to tile drains and surface water from separated liquid; - separated solids have high phosphorus concentration but the solids are in a more manageable form which may result in reduced loading to tiles and surface water; - dried solids can be combusted or gasified - ash will still contain original amount of phosphorus but in a more easily managed form - ash can be used for feed mineral additive and cement manufacturing which will eliminate direct land application of P
Potential for degrading medicines and other by-pass substances found in manures			- system designed to remove solids - no treatment step for medicine breakdown in liquids generated during dewatering - drying of dewatered solids will provide pathogen kill
Potential to reduce dependency on local land base for manure application			- liquid from dewatering process has reduced nutrients and can therefore be land applied at a higher hydraulic loading rate without exceeding nutrient loading parameters - recovered solids can be transported longer distances economically which will reduced dependency on local land base
Capital costs			No costs provided
O&M costs			No costs provided

Evaluation comments are based on AMMTO's interpretation of information provided to AMMTO by the Technology Suppliers as of December 31, 2002 and knowledge of AMMTO Evaluation Team Members regarding the technology.

AMMTO Technology Evaluation Sheet

Disclaimer

Use of this information is at the users own risk
AMMTO and all persons associated with the AMMTO project do not accept any liability for the use of this information

Technology Submission Company: Severn Trent Services-Samsco

Type of Technology : Evaporation

Evaluation Criteria	Performance Ranking	Confidence Ranking	AMMTO Technical Committee Evaluation Comments
Odour reduction			<ul style="list-style-type: none"> - high temperature process so bacteria will be killed which will reduce potential for odour causing compounds to be produced - off gases from evaporation may be odorous - can use a biofilter to remove odours from off gases
Reduction of green house gas emissions			<ul style="list-style-type: none"> - process requires energy for evaporation; - if fossil fuels used it will increase greenhouse gas releases - there will be a decrease in methane produced from stored manure - could use biogas from anaerobic treatment to fuel evaporator and dry anaerobic effluent
Reduction of nitrogen loading to ground water			<ul style="list-style-type: none"> - ammonia present in manure will be volatilized during evaporation, therefore reduced nitrogen concentration - concentrated liquid after evaporation has reduced volume so easier to manage which will reduce potential for nitrogen loading to groundwater
Reduction in bacteria loading to ground and surface water			<ul style="list-style-type: none"> - evaporation process occurs as a result of high temperature which will provide thermal kill of pathogens
Reduction in manure volume and/or mass			<ul style="list-style-type: none"> - evaporation can be used to remove up to 75 to 80 % of moisture - will provide a significant volume/mass reduction
Ease of meeting government regulations with technology			<ul style="list-style-type: none"> - evaporation is a proven technology - may be concerns about odours from evaporation process - may require air C of A - may be some concern over use of fossil fuels for evaporation energy and potential net increase in greenhouse gas emissions
Reduction of nitrogen loading to surface water			<ul style="list-style-type: none"> - ammonia present in manure will be volatilized during evaporation, therefore reduced nitrogen concentration - concentrated liquid after evaporation has reduced volume so easier to manage which will reduce potential for nitrogen loading to tiles and surface water
Reduction of phosphorus loading to surface water			<ul style="list-style-type: none"> - phosphorus conserved during evaporation - reduced volume and concentrated nutrient form can be more easily managed to reduce potential for phosphorus movement to tile drains and surface water - reduced volumetric loading which will reduce potential for nutrient movement to tile drains and surface water
Potential for degrading medicines and other by-pass substances found in manures			<ul style="list-style-type: none"> - evaporation takes place at a high temperature that should provide some thermal break down of medicines and other by-pass substances
Potential to reduce dependency on local land base for manure application			<ul style="list-style-type: none"> - large volume/mass reduction that makes it more economical to haul the nutrients a longer distance - ability to haul further economically reduces dependency on local land base - potential for reduced odour which will permit use of land closer to residences and make more local land base available
Capital costs			\$6,530/(m ³ /day capacity) to \$20,600 (m ³ /day capacity)
O&M costs			\$18.00/(m ³ /day treated)

Evaluation comments are based on AMMTO's interpretation of information provided to AMMTO by the Technology Suppliers as of December 31, 2002 and knowledge of AMMTO Evaluation Team Members regarding the technology.

AMMTO Technology Evaluation Sheet

Disclaimer

Use of this information is at the users own risk
AMMTO and all persons associated with the AMMTO project do not accept any liability for the use of this information

Technology Submission Company: Summer Green Systems Ltd.

Type of Technology :Provide Air Domes, Floating Covers and Lagoon Liners

Evaluation Criteria	Performance Ranking	Confidence Ranking	AMMTO Technical Committee Evaluation Comments
Odour reduction			- covers on storage tanks will reduce release of odours during manure storage - methane and other off gases could be burned in a small pilot to reduce odours - potential to convert traditional storage to anaerobic digester
Reduction of green house gas emissions			- covers will contain greenhouse gases - pilot combustion of off gases can be used to eliminate the release of methane to atmosphere - potential to convert traditional storage to an anaerobic digester
Reduction of nitrogen loading to ground water			- liners will reduce potential for nitrogen loading to groundwater from lagoon storage and concrete storage that has developed cracking
Reduction in bacteria loading to ground and surface water			-no treatment to reduce pathogens
Reduction in manure volume and/or mass			- potential to eliminate rainwater from accumulating in manure storage structures - precipitation is higher than evaporation from manure storages therefore there is a net benefit
Ease of meeting government regulations with technology			- simple technologies - provide some environmental benefits being promoted by government - covered storage may increase odours at spreading time which may be a concern
Reduction of nitrogen loading to surface water			- no treatment/removal - liners reduce potential for nitrogen migrating from storage to tiles and surface water
Reduction of phosphorus loading to surface water			- no treatment/removal - liners reduce potential for phosphorus migrating from storage to tiles and surface water
Potential for degrading medicines and other by-pass substances found in manures			- no treatment mechanism
Potential to reduce dependency on local land base for manure application			- covers have potential to reduce volume by eliminating precipitation - no change in nutrient concentration - covers may increase odours at time of spreading and increase distance required from residences
Capital costs			No costs provided
O&M costs			No costs provided

Evaluation comments are based on AMMTO's interpretation of information provided to AMMTO by the Technology Suppliers as of December 31, 2002 and knowledge of AMMTO Evaluation Team Members regarding the technology.

Pelletizing Systems

Disclaimer

Users of the information provided in the Technology Evaluation Sheets do so at their own risk. AMMTO and persons associated with the AMMTO project accept no liability for the use of the information provided in the Technology Evaluation Sheets.

The information included in the Technology Evaluation Sheets is based on AMMTO's interpretation of information provided by the Technology Suppliers and the knowledge of AMMTO Evaluation Team Members. Different individuals may interpret and rank the technologies differently.

AMMTO Technology Evaluation Sheet

Disclaimer

**Use of this information is at the users own risk
AMMTO and all persons associated with the AMMTO project do not accept any liability for the use of this information**

Technology Submission Company: Feeco International Inc.

Type of Technology : Drying/Granulation Process - Solid/Semi Solid Manures 50 - 85% moisture

Evaluation Criteria	Performance Ranking	Confidence Ranking	AMMTO Technical Committee Evaluation Comments
Odour reduction			- solids dried to less than 5% moisture therefore should be no biological activity to generate odours - moisture evaporated so no liquid to store and produce odours - off-gases from process are treated so no off-gas odours
Reduction of green house gas emissions			- solids dried to less than 5% moisture therefore should be no biological activity to generate greenhouse gases - moisture evaporated so no liquid to store and produce greenhouse gases - process requires energy for heat so if fossil fuels are used for the process energy source, there may be a net increase in greenhouse as emissions
Reduction of nitrogen loading to ground water			- ammonia will be driven off during drying , therefore reduced N in dried manure - dried solids can be applied with less risk of nitrogen movement than applying a liquid - dried solids can be transported further economically so land with low risk for nitrogen movement will be more readily available
Reduction in bacteria loading to ground and surface water			- high temperature drying process - data indicates that dried manure is free of micro-organisms and pathogens found in manure
Reduction in manure volume and/or mass			- manure dried from initial moisture of 50-85% to moisture of 5% and granulated which will provide a significant volume reduction - nutrients concentrated in a small volume of dried solids - there is a definite advantage of concentrating the nutrients in the dried solids
Ease of meeting government regulations with technology			- contained process with no liquid discharge - all well established processes - may need air C of A; - no direct discharge to stream
Reduction of nitrogen loading to surface water			- ammonia will be driven off during drying, therefore reduced N in dried manure - dried solids can be applied with less risk of nitrogen movement than applying a liquid - dried solids can be transported further economically so land with low risk for nitrogen movement will be more readily available
Reduction of phosphorus loading to surface water			- no phosphorus reduction - application of phosphorus with solids will reduce potential for movement to tile drains and surface water
Potential for degrading medicines and other by-pass substances found in manures			- no biological treatment to degrade medicines etc. - will get some thermal breakdown of medicines etc during drying process
Potential to reduce dependency on local land base for manure application			- nutrients concentrated in dried solids - economical to haul dried solids longer distances - no odour associated with solids so the granulated manure can likely be applied to land closer to residences and therefore make more local land available
Capital costs			Not provided
O&M costs			Not Provided

Evaluation comments are based on AMMTO's interpretation of information provided to AMMTO by the Technology Suppliers as of December 31, 2002 and knowledge of AMMTO Evaluation Team Members regarding the technology.

AMMTO Technology Evaluation Sheet

Disclaimer

Use of this information is at the users own risk
AMMTO and all persons associated with the AMMTO project do not accept any liability for the use of this information

Technology Submission Company: First American Scientific Corp.

Type of Technology :Solids Drying and Pelletizing

Evaluation Criteria	Performance Ranking	Confidence Ranking	AMMTO Technical Committee Evaluation Comments
Odour reduction			- manure dried and pelletized; - low moisture eliminates biological activity that generates odorous compounds - may be odours from processing operation; - potential to use a biofilter to eliminate processing odour - no raw manure has to be stored
Reduction of green house gas emissions			- manure dried and pelletized - low moisture eliminates biological activity that generates greenhouse gases - no raw manure has to be stored
Reduction of nitrogen loading to ground water			- no change in nitrogen concentration indicated - may have some ammonia loss during processing - dried and pelletized manure is a more easily managed material which may result in reduced nitrogen loading due to management of material
Reduction in bacteria loading to ground and surface water			- data indicates that pathogen kill occurs due to high intensity shock waves that occur during processing - process generates heat which may also provide some pathogen kill - drying may cause pathogen desiccation that will provide some pathogen kill
Reduction in manure volume and/or mass			-drying and pelletizing results in a 6:1 volume reduction
Ease of meeting government regulations with technology			- simple concept - may need C of A for air emissions or be required to install a biofilter - addresses many of the concerns with manure management - produces a very uniform material that can be applied like a commercial fertilizer
Reduction of nitrogen loading to surface water			- no change in nitrogen concentration indicated - may have some ammonia loss during processing - dried and pelletized manure is a more easily managed material which may result in reduced potential for nitrogen loading to tiles and surface water because of improved manageability of the material
Reduction of phosphorus loading to surface water			- no change in phosphorus concentration - dried and pelletized manure is a more easily managed material which may result in reduced potential for phosphorus loading to tiles and surface water because of improved manageability of the material
Potential for degrading medicines and other by-pass substances found in manures			-some potential for thermal degradation during manure processing
Potential to reduce dependency on local land base for manure application			-manure nutrients and organic matter concentrated into a uniform pellet with uniform composition -material in a form that makes it more economical to transport which reduces the dependency on local land base -no odour so material can be applied closer to residences which makes more local land available
Capital costs			\$35,893/(tonne/8 hr. day capacity) -max. capacity is 4 tonnes per hour
O&M costs			\$31.00/tonne processed

Evaluation comments are based on AMMTO's interpretation of information provided to AMMTO by the Technology Suppliers as of December 31, 2002 and knowledge of AMMTO Evaluation Team Members regarding the technology.

Pyrolysis Systems

Disclaimer

Users of the information provided in the Technology Evaluation Sheets do so at their own risk. AMMTO and persons associated with the AMMTO project accept no liability for the use of the information provided in the Technology Evaluation Sheets.

The information included in the Technology Evaluation Sheets is based on AMMTO's interpretation of information provided by the Technology Suppliers and the knowledge of AMMTO Evaluation Team Members. Different individuals may interpret and rank the technologies differently.

AMMTO Technology Evaluation Sheet

Disclaimer

Use of this information is at the users own risk
AMMTO and all persons associated with the AMMTO project do not accept any liability for the use of this information

Technology Submission Company: J.F. Bioenergy

Type of Technology : Pyrolysis of Solid Manure (Appropriate for Manures with 50% or Less Moisture)

Evaluation Criteria	Performance Ranking	Confidence Ranking	AMMTO Technical Committee Evaluation Comments
Odour reduction			- converts manure to bio-oil and charcoal under closed high temperature process; - continuous process so manure not stored generating odour; - all gases captured therefore there should be no odours
Reduction of green house gas emissions			- all gases captured so there should be no release of greenhouse gases; - oil produced is considered "green energy" and use of "green energy" provides a net decrease in greenhouse gas emissions because it displaces fossil fuels; - charcoal produced during pyrolysis process can be burnt to provide heat for the process - charcoal can be considered a source of "green energy" because it displaces fossil fuels
Reduction of nitrogen loading to ground water			- potentially no land application of manure or by-products of process; - charcoal has potential retail market - charcoal could be land applied as carbon source and would have low potential for nitrogen movement to ground water because mineral nitrogen driven off and remaining nitrogen is in organic form; - charcoal can be burned as energy source for process; - nitrogen should be driven off during pyrolysis process therefore nitrogen loading to soil not an issue with charcoal applications to land
Reduction in bacteria loading to ground and surface water			- potentially no land application of manure or by-products of pyrolysis; - pyrolysis is a high temperature process that occurs at temperatures of 500 degrees Celsius therefore there should be complete pathogen kill and the charcoal by-product - should be pathogen free
Reduction in manure volume and/or mass			- all manure converted to bio-fuel and charcoal; - potentially no land application required if charcoal is sold in the retail market; - if charcoal is used as an energy source for the process, the ash produced from burning the charcoal can be used to provide minerals for feed supplements, can be used as an ingredient in cement manufacturing or can be used as a phosphorus/potassium fertilizer
Ease of meeting government regulations with technology			- high tech process that will likely require review for approval; - all contained process; - may need air C of A - improves manageability of manure and solves many of the issues associated with manure; - provides source of "green energy" which is a government initiative; - environmentally sound options are available for all by-products of process
Reduction of nitrogen loading to surface water			- potentially no land application of manure or by-products of process; - charcoal has potential retail market - charcoal could be land applied as carbon source; - nitrogen should be driven off during pyrolysis process therefore nitrogen loading to soil not an issue with charcoal applications to land
Reduction of phosphorus loading to surface water			- potentially no land application of manure or by-products of process; - charcoal has potential retail market - charcoal could be land applied as carbon source; - P is conserved during the pyrolysis process therefore P loading to soil may be an issue with charcoal applications to land or ash applications to land; - if ash or charcoal are land applied they are easier to manage than raw manure because they are dry and there is significantly less volume/mass of the material to manage, therefore there should be reduced potential for phosphorus to end up in tile drains and surface water
Potential for degrading medicines and other by-pass substances found in manures			- pyrolysis is a high temperature process that occurs at temperatures of 500 degrees Celsius therefore there should be a complete thermal break down of medicines etc.
Potential to reduce dependency on local land base for manure application			- potentially no land application of manure or by-products from process; - charcoal can be burned to provide heat for process; - charcoal has potential retail market; - charcoal can be land applied as carbon source; - phosphorus is conserved during the pyrolysis process therefore P loading to soil maybe an issue with charcoal applications to land; - if P loading is the limiting nutrient then land application of the charcoal will require the same land base; - charcoal has reduced volume and mass and can be transported longer distances economically which will reduce dependency on local land base; - no odours so applications can likely occur next to residences which will make additional local land available
Capital costs			\$12,500/(tonne/day of treatment capacity)
O&M costs			No costs provided

Evaluation comments are based on AMMTO's interpretation of information provided to AMMTO by the Technology Suppliers as of December 31, 2002 and knowledge of AMMTO Evaluation Team Members regarding the technology.

AMMTO Technology Evaluation Sheet

Disclaimer

**Use of this information is at the users own risk
AMMTO and all persons associated with the AMMTO project do not accept any liability for the use of this information**

Technology Submission Company: J.F. Bioenergy

Type of Technology : Pyrolysis of Solid Manure (Appropriate for Manures with 50% or Less Moisture)

Evaluation Criteria	Performance Ranking	Confidence Ranking	AMMTO Technical Committee Evaluation Comments
Odour reduction			- converts manure to bio-oil and charcoal under closed high temperature process; - continuous process so manure not stored generating odour; - all gases captured therefore there should be no odours
Reduction of green house gas emissions			- all gases captured - should be no release of ghg's; - oil produced is considered "green energy" and use of "green energy" provides a net decrease in ghg emissions because it displaces fossil fuels; - charcoal produced during pyrolysis process can be burnt to provide heat for the process; - charcoal can be considered a source of "green energy" since it displaces fossil fuels
Reduction of nitrogen loading to ground water			- potentially no land application of manure or by-products of process; - charcoal has potential retail market - charcoal could be land applied as carbon source and would have low potential for nitrogen movement to ground water because mineral nitrogen driven off and remaining nitrogen is in organic form; - charcoal can be burned as energy source for process - N should be driven off during pyrolysis process therefore N loading to soil not an issue with charcoal applications to land
Reduction in bacteria loading to ground and surface water			- potentially no land application of manure or by-products of pyrolysis - pyrolysis is a high temperature process that occurs at temperatures of 500 degrees Celsius therefore there should be complete pathogen kill and the charcoal by-product should be pathogen free
Reduction in manure volume and/or mass			- all manure converted to bio-fuel and charcoal; - potentially no land application required if charcoal is sold in the retail market - if charcoal is used as an energy source for the process, the ash produced from burning the charcoal can be used to provide minerals for feed supplements, can be used as an ingredient in cement manufacturing or can be used as a P/K fertilizer
Ease of meeting government regulations with technology			- high tech process that will likely require review for approval; - all contained process; - may need air C of A; - improves manageability of manure and solves many of the issues associated with manure; - provides source of "green energy" which is a government initiative; - environmentally sound options are available for all by-products of process
Reduction of nitrogen loading to surface water			- potentially no land application of manure or by-products of process; - charcoal has potential retail market - charcoal could be land applied as carbon source; - nitrogen should be driven off during pyrolysis process therefore nitrogen loading to soil not an issue with charcoal applications to land
Reduction of phosphorus loading to surface water			- potentially no land application of manure or by-products of process; - charcoal has potential retail market - charcoal could be land applied as carbon source; - P is conserved during the pyrolysis process therefore phosphorus loading to soil may be an issue with charcoal applications to land or ash applications to land; - if ash or charcoal are land applied they are easier to manage than raw manure because they are dry and there is significantly less volume/mass of the material to manage, therefore there should be reduced potential for P to end up in tile drains and surface water
Potential for degrading medicines and other by-pass substances found in manures			- pyrolysis is a high temperature process that occurs at temperatures of 500 degrees Celsius therefore there should be a complete thermal break down of medicines etc.
Potential to reduce dependency on local land base for manure application			- potentially no land application of manure or by-products from process; - charcoal can be burned to provide heat for process - charcoal has potential retail market; - charcoal can be land applied as carbon source; - phosphorus is conserved during the pyrolysis process therefore phosphorus loading to soil may be an issue with charcoal applications to land; - if phosphorus loading is the limiting nutrient then land application of the charcoal will require the same land base; - charcoal has reduced volume and mass and can be transported longer distances economically which will reduce dependency on local land base; - no odours so applications can likely occur next to residences which will make additional local land available
Capital costs			\$12,500/(tonne/day of treatment capacity)
O&M costs			No costs provided

Evaluation comments are based on AMMTO's interpretation of information provided to AMMTO by the Technology Suppliers as of December 31, 2002 and knowledge of AMMTO Evaluation Team Members regarding the technology.

AMMTO Technology Evaluation Sheet

Disclaimer

Use of this information is at the users own risk
AMMTO and all persons associated with the AMMTO project do not accept any liability for the use of this information

Technology Submission Company: Lystec International Inc.

Type of Technology : Dewatering/Drying and Combustion Processes

Evaluation Criteria	Performance Ranking	Confidence Ranking	AMMTO Technical Committee Evaluation Comments
Odour reduction			- if manure dried there will be no anaerobic biological activity to generate odours from dried solids - separated liquid from dewatering process will still have potential for odours
Reduction of green house gas emissions			- if manure dried there will be no anaerobic biological activity to generate greenhouse gases from dried solids; - separated liquid from dewatering process will have low volatile solids content therefore a reduced potential for generating greenhouse gases
Reduction of nitrogen loading to ground water			- some nitrogen in mineral form will still be present in liquid stream from dewatering; - processes primarily removes organic nitrogen (organic solids); - solids are a more manageable material and there may be reduced potential for nitrogen loading to groundwater due to improved management
Reduction in bacteria loading to ground and surface water			- dewatering process does not provide any pathogen kill - drying process will provide pathogen kill in separated solids - no pathogen kill in liquids from dewatering process
Reduction in manure volume and/or mass			- no volume reduction from solids separation; - manure just separated into solids and liquid fractions - some volume reduction if solids combusted or gasified
Ease of meeting government regulations with technology			- treatment technologies are recognized technologies; - no pathogen kill for liquids produced during dewatering - odours from liquid may be a concern - air emissions from combustion/gasification process may require C of A
Reduction of nitrogen loading to surface water			-some nitrogen in mineral form will still be present in liquid stream from dewatering; - processes primarily remove organic nitrogen (organic solids) from liquid; - solids are a more manageable material and there may be reduced potential for nitrogen loading to tiles and surface water due to improved management - option for solids to be combusted or gasified which will reduce nitrogen loading to land
Reduction of phosphorus loading to surface water			- reduced phosphorus concentration in separated liquid which may reduce potential for phosphorus loading to tile drains and surface water from separated liquid; - separated solids have high phosphorus concentration but the solids are in a more manageable form which may result in reduced loading to tiles and surface water; - dried solids can be combusted or gasified - ash will still contain original amount of phosphorus but in a more easily managed form - ash can be used for feed mineral additive and cement manufacturing which will eliminate direct land application of phosphorus
Potential for degrading medicines and other by-pass substances found in manures			- system designed to remove solids - no treatment step for medicine breakdown in liquids generated during dewatering - drying of dewatered solids will provide pathogen kill
Potential to reduce dependency on local land base for manure application			- liquid from dewatering process has reduced nutrients and can therefore be land applied at a higher hydraulic loading rate without exceeding nutrient loading parameters - recovered solids can be transported longer distances economically which will reduced dependency on local land base
Capital costs			No costs provided
O&M costs			No costs provided

Evaluation comments are based on AMMTO's interpretation of information provided to AMMTO by the Technology Suppliers as of December 31, 2002 and knowledge of AMMTO Evaluation Team Members regarding the technology.

Solid/Liquid Separation Systems

Disclaimer

Users of the information provided in the Technology Evaluation Sheets do so at their own risk. AMMTO and persons associated with the AMMTO project accept no liability for the use of the information provided in the Technology Evaluation Sheets.

The information included in the Technology Evaluation Sheets is based on AMMTO's interpretation of information provided by the Technology Suppliers and the knowledge of AMMTO Evaluation Team Members. Different individuals may interpret and rank the technologies differently.

AMMTO Technology Evaluation Sheet

Disclaimer

Use of this information is at the users own risk
AMMTO and all persons associated with the AMMTO project do not accept any liability for the use of this information

Technology Submission Company: ATD Waste Systems

Type of Technology: Solid/Liquid Separation, Chemical Clarification of Liquid for P removal, Air stripping of Ammonia, Ion Exchange Removal of K and N, Solids Drying, Liquid Disinfection

Evaluation Criteria	Performance Ranking	Confidence Ranking	AMMTO Technical Committee Evaluation Comments
Odour reduction			- solids dried to 10% therefore will not generate odours - nutrients removed from liquid and liquid disinfected so there should be no odours from the liquid
Reduction of green house gas emissions			- solids dried to 10% therefore will not be biologically active and should not generate greenhouse gases; - nutrients removed from liquid and liquid disinfected so there should be no biological activity in water phase to produce greenhouse gases
Reduction of nitrogen loading to ground water			- organic nitrogen removed from liquid by solid/liquid separation and clarifier settling; - ammonia nitrogen air stripped and captured and removed by ion exchange; - nitrogen recovered by air stripping is added to dried solids to increase solids value - nutrients in dried form have less potential for movement out of root zone than nutrients applied with substantial volumes of liquid so there will be a decrease in potential for groundwater loading of nitrogen; - recovered water can be irrigated in dry summer months without risk of nitrogen movement; - solids are a dry concentrated nutrient source that can be hauled economically and have less risk of nutrient movement associated with them
Reduction in bacteria loading to ground and surface water			- heat process for drying solids will provide pathogen kill; - ultraviolet disinfection of separated water - solids can be applied to soil surface in late spring early summer and will be exposed to ultraviolet rays from sun which will provide additional pathogen kill
Reduction in manure volume and/or mass			- manure nutrients concentrated in the solids; - still have original volume but the volume is divided into low volume high nutrient content solids and high volume low nutrient content liquid - concentrating nutrients in low volume solids provides a transportation and spreading advantage
Ease of meeting government regulations with technology			- all contained processes; - all well established processes for waste treatment system includes biofilter - may need a C of A; - no direct discharge to stream
Reduction of nitrogen loading to surface water			- organic nitrogen removed from liquid by solid/liquid separation and clarifier settling; - ammonia nitrogen air stripped and captured and removed by ion exchange; - nitrogen recovered by air stripping is added to dried solids to increase solids value - nutrients in dried form have less potential for movement out of root zone than nutrients applied with substantial volumes of liquid so there will be a decrease in potential for nitrogen movement to tile drains and surface water; - recovered water can be irrigated in dry summer months without risk of nitrogen movement; - solids are a dry concentrated nutrient source that can be hauled economically and have less risk of nutrient movement associated with them
Reduction of phosphorus loading to surface water			- phosphorus removed from liquid by solids settling and chemical precipitation and concentrated in dry solids - nutrients in dried form have less potential for movement out of root zone than nutrients applied with substantial volumes of liquid so there will be a decrease in potential for phosphorus movement to tile drains and surface water - recovered water can be irrigated in dry summer months without risk of phosphorus movement
Potential for degrading medicines and other by-pass substances found in manures			- no biological treatment to degrade medicines etc. - may get some thermal breakdown during drying process
Potential to reduce dependency on local land base for manure application			- nutrients concentrated in solids with 10% moisture; - economical to transport solids longer distances which will make more land available; - separated water is disinfected and should have low biological activity and therefore low odours so liquid can be irrigated closer to residences which will make more local land available for irrigation of separated water
Capital costs			\$12,000 to \$38,000/(tonne/day treatment capacity)
O&M costs			Varies but in the range of \$10.88/tonne treated

Evaluation comments are based on AMMTO's interpretation of information provided to AMMTO by the technology suppliers as of December 31, 2002 and knowledge of AMMTO Evaluation Team Members regarding the technology.

AMMTO Technology Evaluation Sheet

Disclaimer

Use of this information is at the users own risk
AMMTO and all persons associated with the AMMTO project do not accept any liability for the use of this information

Technology Submission Company: Dry Vac Canada

Type of Technology : Vacuum Filter Dewatering/Drying Process

Evaluation Criteria	Performance Ranking	Confidence Ranking	AMMTO Technical Committee Evaluation Comments
Odour reduction			- solids dried to 5 - 10% moisture therefore should not generate odours - high level of solids removal therefore less volatile solids in liquid to generate odours but liquid will still produce odours - liquid may have reduced biological activity because system uses steam drying of solids in vacuum filter press
Reduction of green house gas emissions			- solids dried to 5 - 10% moisture therefore should not generate any greenhouse gases high level of solids removal therefore less volatile solids in liquid to generate greenhouse gases - liquid may have reduced biological activity due to steam drying process used in vacuum filter which will reduce greenhouse gas emissions
Reduction of nitrogen loading to ground water			- ammonia will be driven off during drying , therefore reduced N in liquid which will reduce potential for nitrogen movement to groundwater from applied liquid - dried solids can be applied with less risk of nitrogen movement than applying a liquid dried solids can be transported further economically so land with low risk for nitrogen movement more readily available
Reduction in bacteria loading to ground and surface water			- high temperature drying process reaches 280 ° F, therefore there will be high level of pathogen kill in solids - no indication of the temperature the liquid reaches during drying process so not sure of pathogen kill in liquid but it should be significant
Reduction in manure volume and/or mass			- end up with essentially the same volume as was started with but in a liquid and a solid; - nutrients concentrated in a small volume of dried solids; - there is a definite advantage of concentrating the nutrients in the dried solids
Ease of meeting government regulations with technology			- all contained process; - all well established processes for waste treatment - may need air C of A - no direct discharge to stream
Reduction of nitrogen loading to surface water			- ammonia will be driven off during drying , therefore reduced N in liquid which will reduce potential for nitrogen movement to tile drains and surface water when liquid spread on land - dried solids can be applied with less risk of nitrogen movement than applying a liquid - dried solids can be transported further economically so land with low risk for nitrogen movement more readily available
Reduction of phosphorus loading to surface water			- high percentage of phosphorus will remain with the solids - application of phosphorus with solids will reduce potential for movement to tile drains and surface water
Potential for degrading medicines and other by-pass substances found in manures			- no biological treatment to degrade medicines etc. - will get some thermal breakdown of medicines etc during drying process
Potential to reduce dependency on local land base for manure application			- nutrients concentrated in dried solids - economical to haul dried solids longer distances - liquid will have less nutrients therefore a smaller local land base is required for separated liquid
Capital costs			Highly variable depending on the solids content of the waste. The lower the solids content the lower the cost. \$1.80/(gal/day of treatment capacity)
O&M costs			Highly variable. Higher solids higher operating costs. \$0.00465 to \$0.0105 per gallon treated

Evaluation comments are based on AMMTO's interpretation of information provided to AMMTO by the Technology Suppliers as of December 31, 2002 and knowledge of AMMTO Evaluation Team members regarding the technology.

AMMTO Technology Evaluation Sheet

Disclaimer

Use of this information is at the users own risk
AMMTO and all persons associated with the AMMTO project do not accept any liability for the use of this information

Technology Submission Company: F.D. Deskins

Type of Technology: Chemical Flocculation/Sand Filtration & Composting of Removed Solids

Evaluation Criteria	Performance Ranking	Confidence Ranking	AMMTO Technical Committee Evaluation Comments
Odour reduction			<ul style="list-style-type: none"> - some odour reduction potential due to removal of solids from separated liquid - still potential for odour from separated liquid - produces solids that can go anaerobic and generate odours if not aerobically composted
Reduction of green house gas emissions			<ul style="list-style-type: none"> - solids removed from separated liquid so there is reduced volatile solids for greenhouse gas production - still potential for separated liquid to go anaerobic and generate greenhouse gases - removed solids will go anaerobic and produce greenhouse gases if they are not aerobically composted
Reduction of nitrogen loading to ground water			<ul style="list-style-type: none"> - mineral nitrogen (ammonia) stays with separated liquid so there is still potential for nitrogen movement to groundwater - nitrogen in solids can be more easily managed and will have less potential for nitrogen movement after composting
Reduction in bacteria loading to ground and surface water			<ul style="list-style-type: none"> - no mechanism for pathogen destruction - sand filtration can remove some bacteria from liquid stream depending on sand sizing for filter but no data provided - no potential for change in bacteria loading in liquid phase if sand filter not designed for bacteria removal - aerobic composting will provide pathogen kill in the solids; therefore reduced potential from land application of solids
Reduction in manure volume and/or mass			<ul style="list-style-type: none"> - no significant volume change - sand filtration conserves solids and liquids - composting of solids can reduce solids volume by up to 50%
Ease of meeting government regulations with technology			<ul style="list-style-type: none"> - flocculent used prior to sand filtration may be an issue - sand filtration is a well documented and accepted solids separation process - no direct discharge - liquid phase has reduced nutrient levels therefore may be reduced risk provide hydraulic loading is regulated to reduce transport of nutrients
Reduction of nitrogen loading to surface water			<ul style="list-style-type: none"> - mineral nitrogen (ammonia) stays with separated liquid so there is still potential for nitrogen movement to tile drains and surface water - nitrogen in solids can be more easily managed and will have less potential for nitrogen movement after composting
Reduction of phosphorus loading to surface water			<ul style="list-style-type: none"> - phosphorus removed from liquid by use of flocculent and concentrated in solids - phosphorus movement to tile drains and surface water is reduced by applying phosphorus with solids rather than liquid phase - solids have reduced volume and are more manageable therefore reduced risk
Potential for degrading medicines and other by-pass substances found in manures			<ul style="list-style-type: none"> - no treatment mechanism to destroy medicines etc. in separated liquid - any medicines etc retained in the solids will be subjected to heat and bacterial breakdown during composting of the solids - potentially majority of medicines etc. will be in separated liquid
Potential to reduce dependency on local land base for manure application			<ul style="list-style-type: none"> - solids have concentrated nutrients that can be hauled longer distances economically - solids have some value as off farm horticultural product - separated liquid has reduced nutrients therefore can be applied at a higher hydraulic loading to achieve nutrient loading - higher hydraulic loading potential reduces amount of local land base required - higher hydraulic loading can cause nutrients to move out of root zone depending on land application timing
Capital costs			Not provided
O&M costs			Not Provided

Evaluation comments are based on AMMTO's interpretation of information provided to AMMTO by the Technology Suppliers as of December 31, 2002 and knowledge of AMMTO Evaluation Team Members regarding the technology.

AMMTO Technology Evaluation Sheet

Disclaimer

Use of this information is at the users own risk
AMMTO and all persons associated with the AMMTO project do not accept any liability for the use of this information

Technology Submission Company: Kyte Centrifuge Sales

Type of Technology: Solid Bowl Basket Centrifuge & Solids Composting

Evaluation Criteria	Performance Ranking	Confidence Ranking	AMMTO Technical Committee Evaluation Comments
Odour reduction			<ul style="list-style-type: none"> - some odour reduction potential due to removal of solids from separated liquid - still potential for odour from separated liquid - produces solids that can go anaerobic and generate odours if not aerobically composted
Reduction of green house gas emissions			<ul style="list-style-type: none"> - solids removed from separated liquid so there is reduced volatile solids for greenhouse gas production - still potential for separated liquid to go anaerobic and generate greenhouse gases - removed solids will go anaerobic and produce greenhouse gases if they are not aerobically composted
Reduction of nitrogen loading to ground water			<ul style="list-style-type: none"> - mineral nitrogen (ammonia) stays with separated liquid so there is still potential for nitrogen movement to groundwater - nitrogen in solids can be more easily managed and will have less potential for nitrogen movement after composting
Reduction in bacteria loading to ground and surface water			<ul style="list-style-type: none"> - no mechanism for pathogen destruction in separated liquid - aerobic composting will provide pathogen kill in the solids; therefore reduced potential from land application of solids
Reduction in manure volume and/or mass			<ul style="list-style-type: none"> - no significant volume change - centrifuge conserves solids and liquids - composting of solids can reduce solids volume by up to 50%
Ease of meeting government regulations with technology			<ul style="list-style-type: none"> - if flocculent used prior to enhance solids removal during centrifuging this may be an issue - centrifuge is a well documented and accepted solids separation process - no direct discharge - liquid phase has reduced nutrient levels therefore may be reduced risk provided hydraulic loading is regulated to reduce transport of nutrients
Reduction of nitrogen loading to surface water			<ul style="list-style-type: none"> - mineral nitrogen (ammonia) stays with separated liquid so there is still potential for nitrogen movement to tile drains and surface water - nitrogen in solids can be more easily managed and will have less potential for nitrogen movement after composting
Reduction of phosphorus loading to surface water			<ul style="list-style-type: none"> - phosphorus removed from liquid with solids and by use of flocculent and concentrated in solids - phosphorus movement to tile drains and surface water is reduced by applying phosphorus with solids rather than liquid phase - solids have reduced volume and are more manageable therefore reduced risk
Potential for degrading medicines and other by-pass substances found in manures			<ul style="list-style-type: none"> - no treatment mechanism to destroy medicines etc. in separated liquid - any medicines etc retained in the solids will be subjected to heat and bacterial breakdown during composting of the solids - potentially majority of medicines etc. will be in separated liquid
Potential to reduce dependency on local land base for manure application			<ul style="list-style-type: none"> - solids have concentrated nutrients that can be hauled longer distances economically - solids have some value as off farm horticultural product - separated liquid has reduced nutrients therefore can be applied at a higher hydraulic loading to achieve nutrient loading - higher hydraulic loading potential reduces amount of local land base required - higher hydraulic loading can cause nutrients to move out of root zone depending on land application timing
Capital costs			\$348/(m ³ /day treatment capacity) to \$600/(m ³ /day treatment capacity)
O&M costs			Hydro Costs are approximately \$0.155/m ³ treated

Evaluation comments are based on AMMTO's interpretation of information provided to AMMTO by the Technology Suppliers as of December 31, 2002 and knowledge of AMMTO Evaluation Team Members regarding the technology.

AMMTO Technology Evaluation Sheet

Disclaimer

Use of this information is at the users own risk
AMMTO and all persons associated with the AMMTO project do not accept any liability for the use of this information

Technology Submission Company: Slegers Engineering

Type of Technology: Mechanical Solids/Liquid Separation & Solids Composting

Evaluation Criteria	Performance Ranking	Confidence Ranking	AMMTO Technical Committee Evaluation Comments
Odour reduction			- requires some fiber in manure for separation to work; - some odour reduction potential due to removal of solids from separated liquid; - still potential for odour from separated liquid - produces solids that can go anaerobic and generate odours if not aerobically composted
Reduction of green house gas emissions			- requires some fiber in the solids for separation to work - solids removed from separated liquid so there is reduced volatile solids for greenhouse gas production - still potential for separated liquid to go anaerobic and generate greenhouse gases - removed solids will go anaerobic and produce greenhouse gases if they are not aerobically composted
Reduction of nitrogen loading to ground water			- mineral nitrogen (ammonia) stays with separated liquid so there is still potential for nitrogen movement to groundwater - nitrogen in solids can be more easily managed and will have less potential for nitrogen movement after composting
Reduction in bacteria loading to ground and surface water			- no mechanism for pathogen destruction in separated liquid - aerobic composting will provide pathogen kill in the solids; therefore reduced potential from land application of solids
Reduction in manure volume and/or mass			- no significant volume change - mechanical separation process conserves solids and liquids - composting of solids can reduce solids volume by up to 50%
Ease of meeting government regulations with technology			- simple system using proven process; - no bacterial kill in separated liquid may be an issue - no direct discharge; - liquid phase has reduced nutrient levels therefore may be reduced risk provided hydraulic loading is regulated to reduce transport of nutrients
Reduction of nitrogen loading to surface water			- mineral nitrogen (ammonia) stays with separated liquid so there is still potential for nitrogen movement to tile drains and surface water - nitrogen in solids can be more easily managed and will have less potential for nitrogen movement after composting
Reduction of phosphorus loading to surface water			- some phosphorus removed from liquid with solids - no means to enhance phosphorus removal such as flocculent - still potential for phosphorus movement to tile drains and surface water from separated liquid - solids have reduced volume and are more manageable therefore reduced risk of phosphorus movement from application of composted solids
Potential for degrading medicines and other by-pass substances found in manures			- no treatment mechanism to destroy medicines etc. in separated liquid - any medicines etc retained in the solids will be subjected to heat and bacterial breakdown during composting of the solids - potentially a significant portion of medicines etc. will be in separated liquid
Potential to reduce dependency on local land base for manure application			- solids have concentrated nutrients that can be hauled longer distances economically - solids have some value as off farm horticultural product - separated liquid has reduced nutrients therefore can be applied at a higher hydraulic loading to achieve nutrient loading - higher hydraulic loading potential reduces amount of local land base required - higher hydraulic loading can cause nutrients to move out of root zone depending on land application timing
Capital costs			No costs provided
O&M costs			No costs provided

Evaluation comments are based on AMMTO's interpretation of information provided to AMMTO by the Technology Suppliers as of December 31, 2002 and knowledge of AMMTO Evaluation Team Members regarding the technology.

AMMTO Technology Evaluation Sheet

Disclaimer

Use of this information is at the users own risk
AMMTO and all persons associated with the AMMTO project do not accept any liability for the use of this information

Technology Submission Company: Lystec International Inc.

Type of Technology : Dewatering/Drying and Combustion Processes

Evaluation Criteria	Performance Ranking	Confidence Ranking	AMMTO Technical Committee Evaluation Comments
Odour reduction			- if manure dried there will be no anaerobic biological activity to generate odours from dried solids separated liquid from dewatering process will still have potential for odours
Reduction of green house gas emissions			- if manure dried there will be no anaerobic biological activity to generate greenhouse gases from dried solids - separated liquid from dewatering process will have low volatile solids content therefore a reduced potential for generating greenhouse gases
Reduction of nitrogen loading to ground water			- some nitrogen in mineral form will still be present in liquid stream from dewatering; - processes primarily removes organic nitrogen (organic solids); - solids are a more manageable material and there may be reduced potential for nitrogen loading to groundwater due to improved management
Reduction in bacteria loading to ground and surface water			- dewatering process does not provide any pathogen kill; - drying process will provide pathogen kill in separated solids no pathogen kill in liquids from dewatering process
Reduction in manure volume and/or mass			- no volume reduction from solids separation; - manure just separated into solids and liquid fractions - some volume reduction if solids combusted or gasified
Ease of meeting government regulations with technology			- treatment technologies are recognized technologies; - no pathogen kill for liquids produced during dewatering - odours from liquid may be a concern; - air emissions from combustion/gasification process may require C of A
Reduction of nitrogen loading to surface water			-some nitrogen in mineral form will still be present in liquid stream from dewatering; - processes primarily remove organic nitrogen (organic solids) from liquid; - solids are a more manageable material and there may be reduced potential for nitrogen loading to tiles and surface water due to improved management - option for solids to be combusted or gasified which will reduce nitrogen loading to land
Reduction of phosphorus loading to surface water			- reduced phosphorus concentration in separated liquid which may reduce potential for phosphorus loading to tile drains and surface water from separated liquid; - separated solids have high phosphorus concentration but the solids are in a more manageable form which may result in reduced loading to tiles and surface water; - dried solids can be combusted or gasified; - ash will still contain original amount of P but in a more easily managed form - ash can be used for feed mineral additive and cement manufacturing which will eliminate direct and application of P
Potential for degrading medicines and other by-pass substances found in manures			- system designed to remove solids - no treatment step for medicine breakdown in liquids generated during dewatering - drying of dewatered solids will provide pathogen kill
Potential to reduce dependency on local land base for manure application			- liquid from dewatering process has reduced nutrients and can therefore be land applied at a higher hydraulic loading rate without exceeding nutrient loading parameters - recovered solids can be transported longer distances economically which will reduced dependency on local land base
Capital costs			No costs provided
O&M costs			No costs provided

Evaluation comments are based on AMMTO's interpretation of information provided to AMMTO by the Technology Suppliers as of December 31, 2002 and knowledge of AMMTO Evaluation Team Members regarding the technology.

AMMTO Technology Evaluation Sheet

Disclaimer

Use of this information is at the users own risk
AMMTO and all persons associated with the AMMTO project do not accept any liability for the use of this information

Technology Submission Company: Hydro Static Systems

Type of Technology : Electrocoagulation, Dissolved Air Floatation removal of Coagulated Solids, Filter press drying of Solids, Ozone Disinfection of liquid Stream

Evaluation Criteria	Performance Ranking	Confidence Ranking	AMMTO Technical Committee Evaluation Comments
Odour reduction			- system removes suspended solids; - solids removed have potential to generate odours if not aerobically composted - dissolved organics in liquid stream have potential to generate odours if liquid goes anaerobic during storage - ozone treatment for bacterial kill in liquid stream will reduce potential for anaerobic microbial activity that generates odour - ozone treatment for bacterial kill will be affected by size of particulate in liquid stream
Reduction of green house gas emissions			- still potential for anaerobic conditions in recovered solids during storage and in the liquid stream during storage so there still is some potential for greenhouse gases to be produced - bacterial kill in liquid stream will potentially reduce anaerobic activity
Reduction of nitrogen loading to ground water			- process provides 90% removal of ammonia from liquid phase after treatment so there is reduced potential of nitrogen loading to groundwater from liquid phase; - reduced potential from land application of solids because of low moisture content and reduced volume makes material easier to manage to reduce potential for nitrogen loading to groundwater
Reduction in bacteria loading to ground and surface water			- liquid can be treated with ozone for pathogen kill - effectiveness of kill will be dependent on ozone addition rate and consistency of suspended solids concentration and size
Reduction in manure volume and/or mass			- same quantity of manure after treatment but it is separated into two streams
Ease of meeting government regulations with technology			- complex system will require review; - all proven technologies; - complete pathogen kill not provided - provides nutrient concentration that improves manageability; - no direct discharge - sacrificial copper electrodes used and copper addition to manure may be a concern
Reduction of nitrogen loading to surface water			- process provides 90% removal of ammonia from liquid phase after treatment so there is reduced potential of nitrogen loading to tile drains and surface water from liquid phase - reduced potential from land application of solids because of low moisture content and reduced volume, which makes material easier to manage to reduce potential for nitrogen loading to tile drains and surface water
Reduction of phosphorus loading to surface water			- phosphorus concentrated in the solids - solids easier to manage to reduce movement of phosphorus to tile drains and surface water
Potential for degrading medicines and other by-pass substances found in manures			- no medicine degradation indicated - ozone treatment of the liquid phase will provide medicine oxidation and breakdown - some medicine breakdown may occur in solids during storage due to biological activity but is not a result of the process
Potential to reduce dependency on local land base for manure application			- nutrients conserved but concentrated in solids - reduced nutrients in liquid allows increased hydraulic loading which reduces local land base required for liquid application - solids have reduce volume/mass and concentrated nutrients which makes it economical to transport a further distance - solids more easily managed
Capital costs			\$1,250/(m ³ /day capacity) to \$3,125 (m ³ /day capacity)
O&M costs			\$0.58/(m ³ treated)

Evaluation comments are based on AMMTO's interpretation of information provided to AMMTO by the Technology Suppliers as of December 31, 2002 and knowledge of AMMTO Evaluation Team members regarding the technology.

AMMTO Technology Evaluation Sheet

Disclaimer

Use of this information is at the users own risk
AMMTO and all persons associated with the AMMTO project do not accept any liability for the use of this information

Technology Submission Company: David Bromely Engineering
Type of Technology : Solid Liquid Separation Using Unique Sand Filtration

Evaluation Criteria	Performance	Confidence	AMMTO Technical Committee Evaluation Comments
Odour reduction			- if stored solids or liquids go anaerobic there is still potential for odours - reduced concentration of organic matter and nutrients in liquid stream reduces potential for odour from stored liquid - option offered to disinfect liquid stream which will reduce potential for odour
Reduction of green house gas emissions			- if stored solids or liquids go anaerobic there is still potential for greenhouse gas releases - reduced concentration of organic matter and nutrients in liquid stream reduces potential for greenhouse gas emissions from separated liquid; - option offered to disinfect liquid stream which will reduce potential for anaerobic biological activity that generates greenhouse gases; - still potential for greenhouse gas emissions from solids
Reduction of nitrogen loading to ground water			- low nitrogen concentration in separated liquid which may reduce potential for nitrogen loading to groundwater from liquid - separated solids have high nitrogen concentration but the solids are in a more manageable form which may result in reduced loading to groundwater
Reduction in bacteria loading to ground and surface water			- solid liquid separation process does not provide any pathogen kill - disinfection option for separated liquid is offered
Reduction in manure volume and/or mass			- no volume reduction - manure just separated in solids and liquid fractions
Ease of meeting government regulations with technology			- simple concept; - treatment technologies are recognized technologies - no pathogen kill for solids unless composted - odours from solids may be a concern unless composted
Reduction of nitrogen loading to surface water			- low nitrogen concentration in separated liquid which may reduce potential for nitrogen loading to tile drains and surface water from separated liquid; - separated solids have high nitrogen concentration but the solids are in a more manageable form which may result in reduced loading to tiles and surface water
Reduction of phosphorus loading to surface water			- low phosphorus concentration in separated liquid which may reduce potential for phosphorus loading to tile drains and surface water from separated liquid; - separated solids have high phosphorus concentration but the solids are in a more manageable form which may result in reduced loading to tiles and surface water
Potential for degrading medicines and other by-pass substances found in manures			- system designed to remove solids - no treatment step for medicine breakdown - disinfection process may provide some medicine break down
Potential to reduce dependency on local land base for manure application			- nutrients remain mainly with solids - separated liquid can be applied based on hydraulic loading rather than nutrient loading - recovered solids can be transported longer distances economically which will reduced dependency on local land base - separated liquid should have reduced odour which will allow application closer to residences which will increase the amount of local land available
Capital costs			\$79,000.00 is a typical base system cost
O&M costs			\$0.004/gallon treated to \$0.0092/gallon treated

Evaluation comments are based on AMMTO's interpretation of information provided to AMMTO by the Technology Suppliers as of December 31, 2002 and knowledge of AMMTO Evaluation Team Members regarding the technology.

Wetland Systems

Disclaimer

Users of the information provided in the Technology Evaluation Sheets do so at their own risk. AMMTO and persons associated with the AMMTO project accept no liability for the use of the information provided in the Technology Evaluation Sheets.

The information included in the Technology Evaluation Sheets is based on AMMTO's interpretation of information provided by the Technology Suppliers and the knowledge of AMMTO Evaluation Team Members. Different individuals may interpret and rank the technologies differently.

AMMTO Technology Evaluation Sheet

Disclaimer

Use of this information is at the users own risk
AMMTO and all persons associated with the AMMTO project do not accept any liability for the use of this information

Technology Submission Company: Aqua Treatment Technologies
Type of Technology :Gravity Solids Settling and Wetland Treatment

Evaluation Criteria	Performance Ranking	Confidence Ranking	AMMTO Technical Committee Evaluation Comments
Odour reduction			- data claims reduced odour - potential for odour from settled solids - potential for odour from wetland if nutrient loading exceeded
Reduction of green house gas emissions			- potential for greenhouse gases from settled solids if they are anaerobic - potential for greenhouse gas releases from wetland if aerobic conditions are not maintained
Reduction of nitrogen loading to groundwater			- may be some nitrogen concentration reduction if denitrification occurs - data indicates ammonia converted to nitrate which has potential to migrate to groundwater if wetland is not sealed to prevent percolation to groundwater
Reduction in bacteria loading to ground and surface water			- some pathogen kill due to aerobic treatment in wetland - some pathogen kill due to ultraviolet exposure in wetland from sun light
Reduction in manure volume and/or mass			- may be some net evaporation depending on plant density - may be some evapotranspiration
Ease of meeting government regulations with technology			- closed system - wet lands are proven technology for low nutrient loadings - removing nutrients from wetland may be an issue - potential for mosquito breeding and west nile virus may be an issue
Reduction of nitrogen loading to surface water			- may be some nitrogen concentration reduction if denitrification occurs - data indicates ammonia converted to nitrate which has potential to migrate to tiles and surface water depending on timing of application to land
Reduction of phosphorus loading to surface water			- phosphorus removal occurs in wetland due to precipitation and biological and vegetative uptake
Potential for degrading medicines and other by-pass substances found in manures			- may be some aerobic biological degradation in the wetland - may be some ultraviolet breakdown due to exposure to sunlight
Potential to reduce dependency on local land base for manure application			- phosphorus and nitrogen removed with solids separated by gravity separation - phosphorus and nitrogen removed in wetland - may be some nitrogen loss due to denitrification
Capital costs			No costs provided
O&M costs			No costs provided

Evaluation comments are based on AMMTO's interpretation of information provided to AMMTO by the Technology Suppliers as of December 31, 2002 and knowledge of AMMTO Evaluation Team Members regarding the technology.

AMMTO Technology Evaluation Sheet

Disclaimer

Use of this information is at the users own risk
AMMTO and all persons associated with the AMMTO project do not accept any liability for the use of this information

Technology Submission Company: Alaksandar Gujicic

Type of Technology: Anaerobic Digestion with Solids Separation & Wetland Treatment - Mesophylic Operation; Co-generation

Evaluation Criteria	Performance Ranking	Confidence Ranking	AMMTO Technical Committee Evaluation Comments
Odour reduction			- well documented that anaerobic digestion reduces manure odours provided degradation of volatile solids is complete - incomplete volatile solids break down during treatment will result in effluent that can generate significant odours - stored solids are wet and may generate odours
Reduction of green house gas emissions			- ghg reduction in two ways; methane emissions eliminated from stored manures & biogas produced is considered green energy which displaces fossil fuels and results in a net ghg emission reduction; - ghg emissions still possible from stored anaerobic effluent from off gassing and continued break down of volatile solids if volatile solids degradation is not complete in the anaerobic process; - organic or hydraulic overloading of digestion system can result in incomplete volatile solids break down during treatment process; - stored solids from solid liquid separation can generate ghgs; - wetland system can generate ghgs in the same way that natural wetlands do
Reduction of nitrogen loading to ground water			- much of the organic N present in the raw manure is converted to mineralized nitrogen during the anaerobic digestion process - mineralized N is very susceptible to leaching and land application timing has to be changed or there will be a net increase in nitrogen loading to groundwater; - option for solid liquid separation to concentrate nutrients which will reduce volumetric loading associated with solids application to soil and therefore reduce potential for liquid movement to water table due to low volume of application; - liquid fraction from solid liquid separation treated in wetland; - treated effluent proposed for reuse in farm operation and spray irrigation on crops; - reuse only practical for flush barns and flush barns should not be promoted so only viable option is spray irrigation
Reduction in bacteria loading to ground and surface water			proposed anaerobic system operates at mesophylic range therefore pathogen destruction will not be complete
Reduction in manure volume and/or mass			- manure volume is basically conserved during anaerobic digestion; - negligible moisture loss occurs during anaerobic digestion due to moisture carried from system with the biogas; - solids/liquid separation and wetland treatment proposed to produce an effluent for possible reuse in barn and spray irrigation; - barn reuse only possible for flush barn and flush barns should not be promoted - no volume reduction with spray irrigation option
Ease of meeting government regulations with technology			- all technologies offered by Gujicic are well accepted treatment processes; - supplier proposes to produce effluent for spray irrigation and barn reuse; - regulations need to be changed to ban fall, winter and early spring applications of anaerobically digested manure due to high mineralized nutrient content; - C of A may be required for burning biogas - may be concern over use of wetland because of increase in West Nile Virus
Reduction of nitrogen loading to surface water			- much of the organic N present in the raw manure is converted to mineralized N during the anaerobic digestion process; - mineralized N is very susceptible to leaching and land application timing must be limited to the crop growing season or there will potentially be a net increase in N loading to surface water via movement to tile drains; - option for solid liquid separation to concentrate nutrients which will reduce volumetric loading to soil and therefore reduce potential for liquid movement to reach tiles due to low volume of application and therefore reduced risk of N movement to tiles; - crop irrigation proposed for treated effluent from combined system. If irrigation occurs after application of solids there is potential for irrigation water to carry nutrients to tile drains
Reduction of phosphorus loading to ground water			- much of the organic phosphorus present in the raw manure is converted to mineralized phosphorus during the anaerobic digestion process; - mineralized phosphorus is more susceptible to movement with soil water and land application timing should be restricted to crop growing period or there will potentially be a net increase in phosphorus loading to surface water via movement to tile drains - solid liquid separation proposed for concentration of nutrients which will reduce volumetric loading required to achieve same nutrient loading to the soil and therefore reduce potential for liquid movement to reach tiles due to low volume of application - spray irrigation could transport mineralized phosphorus to tile drains if irrigation occurs after solids application
Potential for degrading medicines and other by-pass substances found in manures			- methanogenic bacteria required for anaerobic digestion are inhibited or killed by low levels of antibiotics and other chemicals - anaerobics may degrade some antibiotics and other manure by-pass substances provided they are at very low concentrations

Potential to reduce dependency on local land base for manure application			- nutrients are conserved therefore anaerobic itself does not reduce land base requirements; - negligible volume reduction therefore no nutrient concentrating or volume reduction advantage; - minimal odour associated with anaerobically digested manures therefore may be able to apply closer to residences which will increase the availability of localized land base; - solid liquid separation proposed for concentration of nutrients which will generate a low volume high nutrient concentration solids fraction that has sufficient value that it can be hauled longer distances and still offer economic benefit as a nutrient source for crops; - some evaporation from wetland will occur but volume of liquid essentially conserved with liquid fraction being spray irrigated on a volumetric loading basis rather than nutrient loading basis
Capital costs			Not Provided
O&M costs			Not Provided

Evaluation comments are based on AMMTO's interpretation of information provided to AMMTO by the Technology Suppliers as of December 31, 2002 and knowledge of AMMTO evaluation Team Members regarding the technology.

AMMTO Technology Evaluation Sheet

Disclaimer

Use of this information is at the users own risk
AMMTO and all persons associated with the AMMTO project do not accept any liability for the use of this information

Technology Submission Company: Bion Technologies Inc.

Type of Technology: Solids Settling, Facultative Lagoons and Wetland Treatment

Evaluation Criteria	Performance Ranking	Confidence Ranking	AMMTO Technical Committee Evaluation Comments
Odour reduction			- wet solids removed from settling basins will generate odours if not composted or kept aerobic; - settling ponds, facultative lagoons and wetland with large surface area and potential for odours; - only surface liquid kept aerated in facultative lagoons therefore anaerobic conditions in lower part of lagoon that can generate odorous compounds that can off gas
Reduction of green house gas emissions			- settling ponds, facultative lagoons and wetland all have some potential to generate greenhouse gases
Reduction of nitrogen loading to ground water			- nutrients should be tied up in microbial biomass which should reduce potential for movement to ground water when land applied - potential for some nitrogen loading from wetland if it is not a sealed wet land; - nutrients concentrated in solids are applied at a low volumetric loading rate that reduces potential for nitrogen movement to groundwater; - potential for nitrogen loading from lagoons if not sealed; - potential to sell solids to horticultural market which will reduce farm application of nutrients
Reduction in bacteria loading to ground and surface water			- natural pathogen kill due to time manure is in various stages of treatment system - pathogen kill will likely not be complete; data provided is for indicator organisms rather than actual pathogen species - solids require composting in order to obtain some level of pathogen kill - wetland may be an issue with increase in West Nile virus and potential of wetland to be a mosquito breeding ground
Reduction in manure volume and/or mass			- no step for volume reduction other than natural evaporation - large surface area of lagoons will result in large volume of rainwater and snow accumulation and system may actually increase volume of liquid
Ease of meeting government regulations with technology			- lagoons may require a liner; - may be some opposition to large lagoon based system - off farm sale of organics will have to meet government regulations for horticultural products/fertilizer act - may be difficult to get approval for a direct discharge from wetland and wetland effluent will likely have to be land applied
Reduction of nitrogen loading to surface water			- N should be tied up in microbial biomass which will reduce potential for movement of nitrogen to tile drains and surface water - nutrients concentrated in solids are applied at a low volumetric loading rate that reduces potential for nitrogen movement to tile drains and surface water; - potential to sell solids to off farm horticultural market; therefore reduced nitrogen loading at farm site - liquid applied at hydraulic rates rather than nutrient loading rate and there is some potential for liquid loading to carry commercial fertilizer out of root zone which will increase potential for nitrogen to reach tile drains
Reduction of phosphorus loading to ground water			- data indicates 90 % of P removed with solids; University data to support claim; - Ontario research would suggest that less than 90% of phosphorus is removed with solids; - nutrients concentrated in solids are applied at a low volumetric loading rate that reduces potential for phosphorus movement to tile drains and surface water - potential to sell solids to off farm horticultural market; therefore reduced phosphorus loading at farm site
Potential for degrading medicines and other by-pass substances found in manures			- biological process with long retention time so some break down of medicines and other by-pass substances should occur provided they are not at concentrations that are toxic to the aerobic, facultative and anaerobic bacteria in the treatment system - aerobic composting of solids is required to provide thermal and bacterial break down of medicines etc. in the solids
Potential to reduce dependency on local land base for manure application			- high portion of nutrients removed with the solids with potential for off farm sales of solids; this will reduce nutrient loading from liquid phase significantly and reduce land base required for liquid application - horticultural market may dry up if too many farms try selling solids to horticultural market
Capital costs			Costs vary with size. General estimate of \$9,040/m ³ /day of treatment capacity
O&M costs			Costs vary with size. General estimate of \$2.57/m ³ treated

Evaluation comments are based on AMMTO's interpretation of information provided to AMMTO by the Technology Suppliers as of December 31, 2002 and knowledge of AMMTO Evaluation Team Members regarding the technology.

Membrane Technology Systems

Disclaimer

Users of the information provided in the Technology Evaluation Sheets do so at their own risk. AMMTO and persons associated with the AMMTO project accept no liability for the use of the information provided in the Technology Evaluation Sheets.

The information included in the Technology Evaluation Sheets is based on AMMTO's interpretation of information provided by the Technology Suppliers and the knowledge of AMMTO Evaluation Team Members. Different individuals may interpret and rank the technologies differently.

AMMTO Technology Evaluation Sheet

Disclaimer

Use of this information is at the users own risk
AMMTO and all persons associated with the AMMTO project do not accept any liability for the use of this information

Technology Submission Company: Rondeau Anaerobics

Type of Technology: Membrane Separation Technology (Require pre-screening of fibrous solids)

Evaluation Criteria	Performance Ranking	Confidence Ranking	AMMTO Technical Committee Evaluation Comments
Odour reduction			- need pre-screening of fiber from manure & screenings may generate odours unless aerobically composted; - reduces volume of odorous material; - if concentrate from membrane technology is stored without aeration it will generate odours - easier to store reduced volume of concentrate in covered storage which will contain odours during storage
Reduction of green house gas emissions			- need pre-screening of fiber from manure & screenings may generate greenhouse gases if not aerobically composted - reduces volume of liquid that can generate greenhouse gases so it will be less expensive to cover the storage and contain the greenhouse gases - if concentrate from membrane technology is stored without aeration or without enclosed storage it will generate greenhouse gases
Reduction of nitrogen loading to ground water			- all nutrients will be conserved and concentrated in the concentrate stream; - reduced volumetric loading to achieve the same nutrient loading therefore less potential for nutrient movement; - reduced volume will provide more flexibility in land application timing; if applied during growing season the risk of nitrogen movement to groundwater will be reduced - allows options for better management of nitrogen
Reduction in bacteria loading to ground and surface water			- bacteria can be removed from the "cleaned water" depending on level of membrane separation used - bacteria will be retained in the concentrate stream; - reduced volume of concentrate with bacteria allows for better management - can be land applied when risk of bacteria movement is minimized; - reduced volumetric loading reduces risk of bacteria movement
Reduction in manure volume and/or mass			- nutrients and solids concentrated into 10% of original volume - assume water stream produced has been cleaned to point that will allow direct stream discharge or spray irrigation of water for moisture addition during summer months
Ease of meeting government regulations with technology			- proven technology; - management of concentrate is important to reduce odours and risk to environment because of concentration of nutrients and bacteria; - may be concern if the system is a direct stream discharger - should be no concern if water is spray irrigated
Reduction of nitrogen loading to surface water			-all nutrients will be conserved and concentrated in the concentrate stream; -reduced volumetric loading to achieve the same nutrient loading therefore less potential for nutrient movement to tile drains and surface water -reduced volume will provide more flexibility in land application timing; if applied during growing season the risk of nitrogen movement to tiles and surface water will be reduced; -allows options for better management of nitrogen
Reduction of phosphorus loading to ground water			-all nutrients will be conserved and concentrated in the concentrate stream; -reduced volumetric loading to achieve the same nutrient loading therefore less potential for nutrient movement to tile drains and surface water; -reduced volume will provide more flexibility in land application timing, if applied during growing season the risk of phosphorus movement to tiles and surface water will be reduced; -allows options for better management of nitrogen
Potential for degrading medicines and other by-pass substances found in manures			-no mechanism to promote or increase breakdown of medicines or other by-pass substances -concentrate is a more manageable volume for storage, possible further treatment and land application
Potential to reduce dependency on local land base for manure application			-nutrients and solids concentrated into 10% of original volume; -assume water stream produced has been cleaned to point that will allow direct stream discharge or spray irrigation of water for moisture addition during summer months -concentrate can be transported significant distances economically therefore there is a reduced dependency on local land base -high nutrient content makes concentrate more valuable to cash croppers
Capital costs			\$369/m ³ /day treatment capacity) to \$10,026/(m ³ /day treatment capacity) -as treatment capacity goes up the cost per unit of treatment capacity goes down
O&M costs			no costs provided

Evaluation comments are based on AMMTO's interpretation of information provided to AMMTO by the Technology Suppliers as of December 31, 2002 and knowledge of AMMTO Evaluation Team Members regarding the technology.