Manure Management Guidelines

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NOVA SCOTIA
Agriculture

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Foreword

The purpose of the Manure Management Guidelines is to promote the effective use of animal manure as a valuable fertilizer source and soil amendment, while providing instruction in environmental protection. Improperly handled manure can leach through soil and contaminate ground water supplies or run into water courses, possibly contaminating drinking water or irrigation supplies, or adversely affecting fish and fish habitat. Livestock producers who follow these guidelines will gain the best advantage from their manure resource, while reducing the potential for soil and water contamination and nuisance odours.

These Manure Management Guidelines apply to all livestock operations of beef, dairy, sheep, goat, turkey, layer, broiler, hogs, horses and mink where the storage, handling and use of animal manure constitutes a significant component of the farm operation. All new, renovated or existing farming operations are encouraged to follow the recommendations provided in the guidelines.

This document describes the components of manure storage and establishes guidelines for developing a sound manure management plan, and for putting the plan into action. It is the successor to the "Guidelines For The Management and Use of Animal Manure in Nova Scotia (1991)." This updated document provides more current information on relevant legislation, nutrient management planning, safety factors, and hauling of manure.

These guidelines do not apply to biosolids, nor should they be used for the purpose of managing other biological or industrial wastes.

For additional information on hog farms, refer to the publication *"Guidelines For Siting and Management of Hog Farms in Nova Scotia (Revised September 2000)."*

1. INTRODUCTION

Proper management of manure storage and manure spreading can decrease the potential for odour generation and environmental pollution. Nova Scotia farmers face increased numbers of non-farm residents moving to traditional farming communities. Changes in agriculture have led to fewer farms, but larger farming operations with concentrated production, increased livestock numbers per farm, imported feed and larger livestock facilities located on less land. Livestock producers are challenged to enhance some farm practices, including manure management.

Livestock are inefficient in extracting nutrients from feedstuffs; 75 to 90 per cent of the major nutrients fed to livestock pass directly through the animal into the manure. Manure storage is a necessary part of livestock production, since incorporation of manure into the soil or spreading on fields should only be done at certain times of the year. The extent to which these nutrients can be returned to the soil and made available to crops depends on how the manure is stored and handled. It is important to maximize the efficient use of manure since it is a valuable soil resource.

2. STATEMENT OF INTENT

The objectives of these guidelines are:

1. *To recommend management practices that minimize the risk of surface and groundwater contamination from livestock manure.*
2. *To recommend management practices that minimize complaints of nuisance concerning livestock manure.*
3. *To promote the effective use of livestock manure as a nutrient source and provide information on the limitations of manure as a soil amendment.*

3. REGULATORY CONSIDERATIONS

Improper storage and handling of livestock manure may be cause for legal action. The three most relevant statutes to be aware of, summarized below, are the *Farm Practices Act*, the *Environment Act*, and the federal *Fisheries Act*.

The provincial *Farm Practices Act* (2001) provides a mechanism for the establishment of normal farm practices, and protects farmers who follow normal farm practices from civil action in nuisance or negligence. The act provides a fair process to resolve farm practice complaints between farmers and their neighbours; and enables municipal governments to apply municipal planning strategies or land-use by-laws to farm land. A “normal farm practice” is defined in the act. When the Farm Practices Board determines that a farm practice is not a normal farm practice, the Board may issue an order to modify or cease the farm practice. Failure to comply with an order would be a violation of this act, and subject to a fine, imprisonment, or both.

The provincial *Environment Act* (1995) supports and promotes the protection, enhancement, and prudent use of the environment. Nova Scotians have a responsibility for stewardship and making efficient use of resources. The act, and regulations, promote environmental management and encourage due diligence of individuals to prevent pollution of land, air, and water. Violations may result in a fine, imprisonment, or both. Actions that result in release of a substance, such as manure, that results in impairment of water quality, may invoke an order by the Minister of Environment and Labour against an individual to control or eliminate the release.

Release of a substance into a water course, that is deleterious to fish in any stage of their life cycle, or that causes harmful damage or destruction to fish habitat may result in charges being laid by the Department of Fisheries and Oceans (DFO) under the federal *Fisheries Act*. In addition to a fine, anyone found guilty under this act may be required to restore fish habitat, at their own expense.

3.1 Permit Approvals

Prior to construction, any approvals necessary must be obtained from the appropriate regulatory agencies. Under the National Farm Building Code, a manure storage is defined as a farm building requiring a design by an engineer to account for such concerns as loading, reinforced concrete, etc.

4. SITING OF MANURE STORAGE FACILITIES

The best site selection for a new manure storage is determined by several factors. As a measure of due diligence on the part of a landowner, storage facilities should be located to minimize the risk of surface or groundwater contamination and complaints about nuisance. Traditionally farms were located close to water courses and over the years these farms have expanded. In this case proximity to a water course impacts on the design options available for manure storages . One way to minimize these risks is to establish minimum separation distances.

Separation distances provide an adequate buffer from water courses, wells and property lines so that the location of barns or manure storages minimizes the risk of pollution or nuisance.

Separation distances provided in Table 1 apply to additions or upgrades made to existing buildings and storages as well as the construction of new facilities. If it is not possible to meet the recommended separation distances, the distances may vary, if determined by a qualified engineer, based on a careful site assessment, that the risks of pollution and odour will not increase.

Table 1 - Recommended Minimum Separation Distances for New Livestock Facilities
(excluding hog production units and facilities*)

Public Building	200 m	(660 ft)
Property Line	50 m	(165 ft)
Existing Off-Farm Dwelling	100 m	(330 ft)
Provincial Highway	50 m	(165 ft)
Off-Farm Well	100 m	(330 ft)
Lake, River, Brook		
A. Non-contained storage (solid manure)	100 m	(330 ft)
B. Fully contained storage (liquid, semi-solid manure)	50 m	(165 ft)
Ditch/Intermittent Stream or Wetland	20 m	(66 ft)

Note: * Anaerobic hog lagoons do not seal on the surface like other manure storage types. Therefore, guidelines concerning separation distances have been developed specifically for hog facilities. Refer to the publication "Guidelines For Siting and Management of Hog Farms in Nova Scotia (Revised September 2000)."

Table 1 serves adjacent landowners as well as the owners of manure storage facilities. That is, facilities constructed in compliance with the recommended separation distances would not be expected to relocate in the event that future development may be planning to occur on adjacent non-agricultural land within the recommended separation distances.

Note that the recommended separation distances may be superseded in regulated areas, such as a Protected Water Area designated under the Environment Act. This should be determined beforehand by contacting the municipal office in which the facility is, or will be, located.

5. MANURE STORAGE DESIGN CONSIDERATIONS

Design of livestock manure storages is subject to the latest edition of the *Canadian Farm Building Code*. Manure storage construction may require a Building Permit under the *Nova Scotia Building Code Regulation, 1995*. Consult a municipal building inspector for information concerning these codes, and a qualified engineer concerning the design of a manure storage.

The following four steps should be considered before constructing a manure storage facility:

- A system and site evaluation
- Establishing the size of the storage required
- Determining the type of storage
- Getting necessary permits and approvals

5.1 System and Site Evaluation

The design and location of a manure storage facility is influenced by the following parameters:

5.1.1 Type and Characteristics of Manure

Manure consistency is the primary factor that determines the methods used to collect, transfer and store manure. Manure is generally classified under the following three categories: liquid, semi-solid, and solid.

Liquid manure generally has a moisture content of over 95 per cent and has little bedding material in it. Semi-solid manure has a moisture content between 84 to 95 per cent. Solid manure has a moisture content less than 84 per cent and has varying amounts of bedding material in it. It is important to select the proper manure storage system for the type of manure being produced.

5.1.2 Collection, Transfer and Loading Systems

Several collection, transfer and loading methods are possible. System considerations include facility type, labour requirements, and overall management system. There is no single best system; each has advantages and disadvantages. A manure management system should meet the needs of each individual livestock operation. Consult with an engineer, manure equipment dealer and other experts early in the project planning to determine the best system.

Collection options include: barn cleaners, pumps, tractors, mechanical alley scrapers, slatted floor, gravity flow channels and alley flush. Each of these have specific design criteria and should be explored. Manure is transferred to a storage by tractor scraping, gravity flow or pumping. Loading options are usually limited to pumping, tractor loading and ramp loading. System selection depends on the characteristics of the manure, bedding practices, type of available labour, elevation of the barn above the storage and storage system.

5.1.3 Site Conditions

5.1.3.1 Soil Type

Soil type may limit the options available for selecting certain manure storages. Soils that are well drained affect the design criteria for several types of storage (earthen, open pads, etc.). The percentage of clay and hydraulic conductivity of the soil will help determine the type of storage suited for the farm. The underlying geology must also be considered; avoid gypsum deposits, for example.

5.1.3.2 Topography and Drainage

A manure storage facility should be located on a level site for ease of agitating and loading. Preventing surface and groundwater from entering a storage is essential. This reduces the volume of unwanted water and increases the capacity of the storage.

5.1.3.3 Wind Direction

When manure is agitated and being loaded, an odour is unavoidable. By considering the prevailing wind direction, attempts can be made to reduce inconvenience on neighbouring properties.

5.1.3.4 Aesthetics

Roofs or covers will improve the appearance of manure storages. Consider selecting areas which keep the storage out of view.

5.2 Storage Volume

Manure production volumes for common livestock can be obtained from standard tables developed by the American Society of Agricultural and Biological Engineers. An example is provided in Table 2. which shows volumes of manure produced by animals which are on farm for less than one year, as well as, Table 3., which shows daily volumes of manure produced by some common livestock types. During design, engineers should use all available resources, which include, but are not limited to the following; Canadian Farm Building Code, Canadian Farm Buildings Handbook and the ASAE Standards for manure storage design and volume calculations. Note that the volumes for manure storage may vary depending on the actual management practices used, e.g. wash water added to the storage, type and amount of bedding, feeding program, and whether livestock are housed indoors at all times.

Table 2. Comparison of Manure Production per Animal (Total per finishing period): Meat producing livestock and poultry.

Animal Type and Production Grouping	kg/ finished animal	lb/ finished animal	liters/ finished animal	ft^3/ finished animal	Assumed Finishing Time Period (days)
Beef – Finishing cattle	4,500	9,800	4,500	160	153
Poultry – Broiler	4.9	11	4.9	0.17	48
Poultry – Turkey (males)	36	78	36	1.3	133
Poultry – Turkey (females)	17	38	17	0.61	105
Swine – Nursery pig (12.5 kg)	48	87	48	1.4	36
Swine – Grow-finish (70 kg)	560	1200	560	20	120

Data adapted from ASAE D384.2 March 2005, *Manure Production and Characteristics*

Table 3. Comparison of Manure Production per Animal per Day: Other livestock and poultry.

Animal Type and Production Grouping	kg/day/ animal	lb/day/ animal	liters/day/ animal	ft^3/day/ animal
Beef – Cow (confinement)	55	121	55	1.94
Beef – Calf (confinement)	22	50	22	0.81
Dairy – Lactating Cow	68	150	68	2.40
Dairy – Dry Cow	38	83	38	1.30
Dairy – Calf 150 kg	8.5	19	8.5	0.30
Dairy – Heifer 440 kg	22	48	22	0.78
Dairy – Veal – 118 kg	3.5	7.8	3.5	0.12
Layer	0.088	0.19	0.088	0.0031
Swine – Gestating Sow – 200 kg	5	11	5	0.18
Swine – Lactating Sow – 192 kg	12	25	12	0.41
Swine – Boar – 200 kg	3.8	8.4	3.8	0.13

Data adapted from ASAE D384.2 March 2005, *Manure Production and Characteristics*

Example (A): Liquid manure could be managed using a three-month storage capacity in the primary facility before transporting it to a satellite storage which has an additional four-month capacity.

Example (B): A farm operation is considered to be a high-risk situation if its solid manure storage has less than one month capacity, the manure is spread on frozen ground, and there is no run-off control provided. The farm can achieve reduced risk of pollution and odour by utilizing a combined seven-month storage through a manure management plan incorporating the following options:

a. controlling run-off from the operation;

b. constructing a storage pad for the handling and storage of the solid manure for land application at a more optimum time of year; and

c. stockpiling manure in fields where the manure can eventually be spread.

5.3 Types of Storage

Once the site has been selected with all considerations analyzed and the storage volume determined, the proper manure storage system should be selected. In some circumstances manure can provide an ideal environment for the production of flies. Various types of manure storages are described in the following sections.

5.3.1 Liquid Manure Storages

Within Nova Scotia, there are two common methods of storing liquid manure. These are fully contained facilities which prevent manure runoff.

Non-Earthen Liquid Manure Storages (including concrete, metal or wooden): must be designed and constructed in accordance with the latest editions of the *National Building Code of Canada and the National Farm Building Code of Canada*.

Non-earthen Liquid Manure Storage

Earthen Manure Storage

Earthen Manure Storages: A qualified engineer should do the preliminary soil investigation and design of the storage before any construction begins.

5.3.2 Solid Manure Storages

Solid manure storages are non-contained facilities, so measures are needed to divert roof water from nearby buildings and surface water drainage away from the manure storage area. A solid manure storage should be built on a concrete pad or on soil with sufficient low permeability specified by the design engineer to prevent leaching. Collect run-off from a solid manure storage or livestock yard in a separate holding structure or a flow-through treatment system such as a vegetative strip or constructed wetland. A covered facility would help in decreasing the amount of run-off from the manure storage itself.

Concrete Solid Storage

There are six common methods of storing solid manure. The method used depends on the facility design and the type of livestock being raised.

5.3.2.1 Manure Pack

Manure is stored with bedding materials in close proximity to where it is produced (e.g., when cattle or dairy heifers are raised in a confined, manure pack housing system or poultry are raised in a solid manure poultry housing system). This manure is later collected and removed to a separate storage facility, or stockpiled, or may be applied to land.

5.3.2.2 Roofed Storage

Manure is removed from where it is produced to a covered storage (e.g., in a dairy cow tie-stall barn where large amounts of bedding materials are used, or broiler or turkey barns where manure is removed between batches of birds).

Roofed Storage

5.3.2.3 Open Manure Storage

Manure is removed from where it is produced (e.g., a tie-stall barn where manure is removed by a barn cleaner) to a non-contained storage such as an open concrete storage pad.

Solid Storage Concrete Pad

Livestock Yard

5.3.2.4 Livestock Yard

A livestock yard is classified as a manure storage when the stocking density exceeds 10 livestock units (see Section 6) per hectare for a period of one month or more. As a result, these yards should follow separation distances recommended in preceding sections.

5.3.2.5 Stockpiling

Stockpiling involves removing the solid manure from a storage facility and storing it in piles along the edge of a field where the manure is to be eventually spread within the current or next growing season. The storage area requires year-round accessibility. The separation distances in Section 4 must be followed. This manure should not be placed over subsurface drains, very permeable soils, or in flood risk areas.

Stockpiling

5.3.2.6 Composting

Composting is a manure treatment which can be used to produce a stabilized product that is free from odour, harmful coliforms, and fly problems. Permits are not required for manure composting if the manure used in the composting originated on-farm. Otherwise, an approval is required from the Nova Scotia Department of Environment and Labour for any composting of materials, which exceeds 60 m^3 annually. An approval is also required if the compost is sold as a commercial activity. The site chosen for a compost pile should conform to the separation distances described in Section 4. Leachate from the compost

should be contained. This can be done if the pile is located near a slight slope with a receptor pit to catch the run-off. Otherwise, use level land and do not use the same spot each year. Heavy soil is the best choice as it prevents any leachate from reaching the water table.

There are a number of composting techniques available including turning a pile, windrow, and in-cell. Composted manure slowly releases nutrients into the soil and can improve the biological, chemical, and physical properties of the soil. Frequent turning and addition of a carbon source (such as wood shavings, straw or sawdust) is essential to composting. A common source of carbon in Nova Scotia is sawdust and shavings. If frequent mixing does not occur, the process will become anaerobic.

Composting

This condition is usually not reversible and results in the production of manure gases. The moisture content of the compost determines if turning is necessary. Generally, the optimal moisture content for composting is 50 - 60 per cent, however if the compost is turned frequently, manure will compost with a moisture content of up to 75 per cent. The carbon to nitrogen ratio is very important and should be in the range of 20:1 to 30:1.

5.3.3 Satellite Storage

A satellite storage is a liquid manure storage located away from the primary storage facility and near fields where the manure is to be spread. Satellite storages are for temporary storage and the manure should be spread within the year.

Advantages:

- Manure can be transported with a truck instead of a tractor.
- The fields closer to the barn do not receive excessive manure application.
- Fields further away will get the nutrients required for crop development.
- The storage provides extra capacity and an option of using smaller spreaders, resulting in less soil compaction on fields.

Disadvantages:

- Requires the management of two storage facilities.
- The cost of construction.

The separation distances shown in Table 1, design considerations described in preceding sections, and safety factors described in Section 5.4 apply to satellite storages. Storages should be located on sites where there is no risk of flooding and where all surface water drainage can be diverted away from the storage.

Satellite storages are for temporary storage of manure.

5.4 Safety Factors

Precautions must be taken with liquid manure storage to ensure the safety of people and livestock. A concrete manure storage should be designed in accordance with the latest editions of the *National Building Code of Canada* and the *National Farm Building Code of Canada*. Safety precautions must be taken to prevent accidental entry into the liquid manure storage. Some of the most important requirements and information from these codes and other sources are noted below:

- A permanent safety fence or wall at least 1.5m (5ft) high should be constructed around **open liquid storages** without fixed covers. Often some liquid storage forms a crust at the surface, providing a solid appearance which is dangerously unstable.
- In the case of **covered concrete storages**, access opening covers should be locked and secured with a safety chain. Steel plates may be used, provided they weigh more than 23kgs (50 lbs) and require a hook to open. Covers should also have a chain attached to prevent the cover from falling into the storage.
- **Ladders** shall **not** be installed in closed liquid manure tanks.
- Dangerous manure gases can be produced during the breakdown of solids in liquid manure. This includes such toxic gases as:
  - **Hydrogen Sulfide** (H_2S) smells like rotten eggs, and is easy to detect at low concentrations. However, at high concentrations, it paralyzes the sense of smell and gives a person a false sense of security. It is heavier than air and it will accumulate at the bottom of the manure tank.
  - **Ammonia** (NH_6) has a sharp pungent odour and irritates the eyes. As a rule, if eye irritation occurs, the ventilation in the barn needs to be improved.
  - **Methane** is the principal gas produced by manure. It is considerably lighter than air so it will not accumulate in open tanks.
  - **Carbon Dioxide** ($C0_2$) is colorless and odourless. It is heavier than air and like H2S it will accumulate at the bottom of the manure tank. A victim will be affected by H2S long before $C0_2$.

These gases replace oxygen and cause suffocation. A gas trap between the barn and any connected long-term manure storage reduces risk of injury. For more information, consult *The Canada Plan Service Fact Sheet M-8710, Manure Gas*.

- Farm owners are required to have a written safety procedure for entering a manure storage. Refer to the Nova Scotia Occupational Health and Safety Act, Occupational Safety General Regulation, Part 12 - Confined Space Entry.
- All access points must have proper safety signs warning of the noxious gas hazard.

Safety Signs are Essential

6. LAND APPLICATION OF MANURE

Land application of manure on farmland should not be considered in isolation of a plan for managing all nutrients on the farm. Manure is a valuable source of organic matter as well as macro soil nutrients such as nitrogen (N), phosphorous (P), potassium (K), calcium (Ca), sulphur (S), and magnesium (Mg). It is also a source of micronutrients such as boron (B), copper (Cu), chlorine (Cl), nickel (Ni), cobalt (Co), iron (Fe), manganese (Mn), zinc (Zn), and molybdenum (Mo). The nutrient value of manure varies depending on the type of animal and its diet. To obtain maximum benefits for the soil and crop, manure application rates should be based on a manure analysis, on soil characteristics, and nutrient requirements of the crop to be grown.

Nutrient management involves the balancing of available soil nutrients, nutrient inputs from manure, fertilizer, and crops to the amount of nutrients removed by the crop to be grown. Proper manure management requires the development of a written nutrient management plan based on soil analyses, manure analysis, spreader calibration and knowledge of crop inputs and requirements.

Nutrient management planners will recommend changes in cropping practices, types and amounts of manure to be spread, and figure out a blend and amount of chemical fertilizer required. Substantial cost savings can occur if a farmer no longer needs phosphorous or potassium in his chemical fertilizer mix or gives a nutrient value to his manure. Nutrient management planners can also recommend the time of year when manure should be spread, so that it is of most benefit to the crop to be grown. A reduction in environmental risk can occur if manure is spread during the growing season and not in the fall. This is easier to accomplish if the farmer has a manure storage time in excess of seven months.

The following management practices should be considered in consultation with a nutrient management plan specialist when using manure as a nutrient source or soil amendment.

6.1 Regular Soil and Manure Testing

The actual amount of manure applied to agricultural land should be determined by testing both soil and manure for nutrients available in each. For every new crop, it is advisable to perform a soil test. Soils should be tested every two to three years.

Soil testing is the only reliable way to determine the available nutrient status of a field and specific fertilizer requirements of a crop. Manure spreading should be avoided on soils that have excessive phosphorous and potassium readings.

Manure should be tested for nutrient value at least once every three years. Liquid manure should be sampled after the manure in the storage has been agitated, which creates a more homogeneous mixture.

Loamy or clay soils have higher nutrient retention capacity and are less permeable. Therefore, higher rates of manure can be applied to these types of soil. Sandy or gravelly

soils tend to have lower nutrient holding capacity and are more prone to leaching. Low rates of manure (20 per cent) should be applied to these soils to avoid groundwater contamination. However, these soils can support more frequent applications as long as maximum rates recommended by a nutrient management planner are not exceeded.

6.2 Manure Application Practices

- Avoid spreading manure between December 1 and April 1.
- Avoid applying manure on frozen or snow covered ground. Manure applied under these conditions provides little nutrient value and may contribute to surface water contamination.
- Avoid application of manure on excessively wet soils.
- Avoid spreading manure on areas of exposed bedrock.
- Manure should only be applied on land with less than 10 per cent slope. A greater degree of due diligence is required to prevent run-off losses when manure is spread on steeper slopes.
- All manure spreaders should be calibrated and the spread pattern should be as uniform as possible.
- Adhere to the minimum separation distances shown in Table 4.

Manure spreaders should be calibrated and the spread pattern should be as uniform as possible.

Table 4. Minimum Separation Distances for Spreading Manure

Water Sources	Separation Distance[1]	
Dug or drilled wells[2]	Clay loam soil	30 m
	Sand and gravel	60 m
Ditches		3 m
Brooks, rivers & lakes		5 m

[1] These separation distances may be superseded in regulated areas, such as Protected Water Areas designated under the *Environment Act*, or in municipal districts with applicable zoning by-laws.

[2] Surface water flow is to be directed away from wells by a berm located upslope of the well. All wells in a pasture shall be fenced with a minimum 3m buffer surrounding the well.

6.3 Land Base Required

A Nutrient Management Plan (NMP) is the only accurate method of determining the minimum land base requirements for manure utilization. If a farm has a NMP then the conditions set out in Table 5 do not apply. If the field has excessive nutrients then new sites may have to be evaluated in the NMP so that manure can be utilized elsewhere.

A **Livestock Unit** is the number of animals or poultry whose manure production requires 1 hectare (2.5 acres) of available farmland for manure application to ensure minimal risk of surface or groundwater pollution. An example calculation follows.

Land Base Requirement Calculation
Take the number of animals or poultry of each type on the farm.
Divide by the livestock unit (LU) number in Table 5.
Multiply by 1 (for hectares) or 2.5 (for acres).

EXAMPLE:

Dairy: 60 dairy cows and 50 heifers
60 cows ÷ 1.5 dairy cows/LU = 40 LU
50 dairy heifers ÷ 2 dairy heifers/LU = 25 LU
60 dairy cows will require:
40 LU x 1 ha = 40 ha or (100 acres)
50 dairy heifers require:
25 LU x 1 ha = 25 ha (62.5 acres)

Poultry: 60,000 broiler barn capacity
60,000 chickens ÷ 1000 chickens/LU = 60 LU

60,000 chickens will require:
60 LU x 1 ha = 60 ha or (150 acres)

This calculation indicates that in total, a minimum of 125 ha (312.5 acres) of available farmland would be required to effectively use the dairy and poultry manure.

A NMP will accurately determine the minimum land base requirements for this particular farm or alternatives for manure disposal, taking into account the soil analysis and other factors outlined above, as well as separation distances shown in Table 4 and other considerations listed in section 5.3.

Table 5 Animals Required to Equal One Livestock Unit Requiring 1 ha (2.5 acres) of Land for Manure Application

Livestock Type	Number of Animals Equivalent to one Livestock Unit
Dairy Cow	1.5
Dairy Heifers	2
Beef Cow	2
Beef Feeders 150-500 kgs.	4
Sheep	10
Sows Breeding/Gestation	5
Sows (Farrow to Finish *includes all feeder pigs belonging to sow*)	1
Sows (Farrow to Wean)	4
Weaners	50
Hogs (Feeders)	10
Laying Hens	500
Broiler Chickens - barn capacity	1000
Turkey Broilers (5 kg) - barn capacity	300
Mink	200
Veal Calves	25

7. MANURE ODOUR MANAGEMENT

In Nova Scotia, manure odours account for 50 per cent of all environmental complaints related to agriculture. There are three common sources of odours: barn, storage and field application. Sensitivity to odour varies from person to person. As a consequence, it is extremely difficult to establish acceptable thresholds for odours.

Odours originate from livestock manure as a result of a broad range of odour-producing compounds. Complaints most often occur because of hydrogen sulphide odours (a rotten egg smell) and ammonia (a sharp pungent odour). Most offensive odors are created by the anaerobic decay of manure.

Periodic release of manure odours does happen, but measures can be taken to minimize the occurrence.

7.1 Ventilation Systems

Proper indoor air quality in the barn is a necessity to maintain the health and productivity of both the farm workers and the animals. Ventilation is required in livestock buildings to remove moisture, gasses, dust and excess heat produced by animals. Fresh air inlets are the most important part of the ventilation system since they control most of the distribution and mixing of air. If the inlet is not working properly, poor air distribution with uneven temperatures and drafts will occur. Cold, damp, foul smelling buildings are usually caused by: lack of insulation in walls and ceilings, absence of or incorrectly installed inlets, lack of a vapor barrier, fans that are not working properly, the barn is not filled to capacity or is too full, or lack of artificial heat. It is recommended that ventilation systems be designed by a qualified engineer.

7.2 Roofs or Covers

Some liquid manures do not develop a crust which will seal the surface and prevent anaerobic gases from escaping. These gasses produce odour. Roofs or covers can reduce odours by 90 per cent.

7.3 Manure Handling and Spreading

Spreading manure on land should be done when the crop condition is suitable for nutrient use and soil conditions are suitable to avoid run-off to surface waters. The best time to spread, to minimize odour problems, is on a sunny, windy day. However, the best time to spread to limit ammonia loss is on a humid day. It is preferable to have manure spread in the early fall instead of late fall as the manure is more valuable to a crop and there is less chance of compaction of the soil and run-off. Wherever feasible incorporate manure within 48 hours of land application. Manure that is incorporated can decrease ammonia losses by 50 per cent. Direct incorporation is not practical on untilled land. Toolbars on the back of spreaders decrease losses by 25 per cent.

8. MANURE TRANSPORTATION GUIDELINES

Farm vehicles, when operating on highways, are regulated by the Nova Scotia Motor Vehicle Act. While operating on a highway, the Act states, *"every commercial motor vehicle or combination of motor vehicle and trailer shall have a body so constructed as to be securely attached to the vehicle and be strong enough to assure that the load will not shift or fall from the vehicle."* All vehicles transporting loosely packed bulk materials or liquid or semi-liquid materials shall be constructed in such a manner so as to prevent the contents from dropping, shifting, leaking or otherwise escaping from the vehicle. Avoid overloading manure spreaders.

All farm tractors must display a slow moving emblem. A trailer or manure spreader being hauled by a farm tractor must display a slow moving triangle as well.

Further information and recommendations regarding the hauling of manure is available in the pamphlet published by Agriculture and Agri-Food Canada referenced in Section 9.

9. REFERENCES

Canada Plan Service, *Manure Gas*, Fact Sheet M-8710, 1985

Nova Scotia Department of Agriculture and Marketing, *Siting and Management of Hog Farms in Nova Scotia*, 2000

Nova Scotia Farm and Health and Safety Committee, *Standards of Practice for Farms in Nova Scotia*, 2000

Nova Scotia Farm Practices Act, 2000

Agriculture and Agri-Food Canada, *Transportation Guidelines for Nova Scotia Farmers,* 1998

ASAE (American Society of Agricultural Engineers) Standards Guidelines, 2005

Nova Scotia Department of Agriculture and Fisheries, *Integrated Fly Management Fact Sheet for Livestock Farms,* 2005

Nova Scotia Department of Agriculture and Marketing, *Constructed Wetlands for the Treatment of Agricultural Wastewater in Atlantic Canada, 1998*

10. Glossary

anaerobic - biological breakdown of manure without the presence of oxygen

composting - a designed and managed system to facilitate the process of aerobic decomposition of organic matter by biological action

ditch - an excavated channel for the purpose of draining water

earthen manure storage - a structure built primarily from soil, constructed by excavating a hole in the ground with spoil used to form dikes, and used to retain liquid and semi-solid livestock manure

facility - barns and manure storage, including additions

highway -

(a) a public highway, street, lane, road, alley, park, beach, or place including bridges thereon, and

(b) private property that is designed to be and is accessible to the general public for operation of a motor vehicle

intermittent stream - a stream which is normally dry at least four months of the year

lake, river, brook - a body of water that continuously has a flow of water and aquatic life

liquid manure - livestock manure that generally has a moisture content of over 95 per cent

livestock - animals or poultry not kept exclusively as pets, excluding bees

livestock facility - a combination of building housing livestock and required manure storages

livestock units - the number of animals whose manure production requires 1 ha (2.5 acres) of available land for spreading to ensure minimal risk of surface or groundwater pollution

permeable soils - sands and gravels

pollution - in relation to surface water or groundwater, means the presence in the water of substances or contaminants that are foreign to or in excess of the natural constituents of the water, or that adversely affects the uses of the water

public building - a church, hospital, school, government or municipal building or a place such as a museum or park, which is open daily for public access

qualified engineer - a person who has all of the following qualifications:

(a) has education, training, knowledge and experience in agricultural systems

(b) is registered by the Association of Professional Engineers of Nova Scotia (APENS)

(c) has insurance to cover liability

run-off - water which flows over the surface of the land after a rainfall event or snow melt

satellite storage - a liquid manure storage which is located away from the main farm and close to fields where the liquid manure is to be spread

semi-solid manure - livestock manure that generally has a moisture content between 84 to 95 per cent

solid manure - livestock manure that has a moisture content less than 84 per cent and has varying amounts of bedding material incorporated in it

stockpiling - storing manure from a solid storage along the edge of a field where the manure will eventually be spread

well - a hole, drilled or dug into the ground for the purpose of obtaining groundwater for consumption