



# Solid waste sites in northern communities: From planning to post-closure



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# Contents

Technical Committee on Northern Water and Waste	6
Subcommittee on Solid Waste Management (Northern Communities)	8
Preface	10
<b>0 Introduction</b>	<b>12</b>
<b>1 Scope</b>	<b>13</b>
1.1 Purpose	13
1.2 Users	14
1.3 Application	15
1.3.1 General	15
1.3.2 Types of infrastructure	15
1.4 Terminology	15
<b>2 Reference publications</b>	<b>16</b>
<b>3 Definitions</b>	<b>21</b>
<b>4 How this Standard applies</b>	<b>40</b>
4.1 Adopting or referencing the Standard	40
4.2 What the language of this Standard means	40
<b>5 Risk management for municipal solid waste management facilities</b>	<b>41</b>
5.1 General	41
5.1.1 Waste management planning	41
5.1.2 Risk assessment	42
5.1.3 Size-based requirements	42
5.2 Classification of sites according to size	43
5.3 Overview of hazards, consequences, and risks for prioritization	44
5.4 Requirements for small sites	44
5.4.1 Criteria for “small” sites	44
5.4.2 Waste acceptance plan	45
5.4.3 Review of applications for designation as a small site	45
<b>6 Siting</b>	<b>46</b>
6.1 All facilities	46
6.1.1 Framework for community processes	46
6.1.2 Setbacks and buffer zones	47
6.1.3 Criteria, regulations, and guidelines	47
6.1.4 Climate change and siting requirements	47
6.2 Climate change considerations	47
6.3 Buffer zones, setbacks, or separation distances	48
6.3.1 General	48
6.3.2 Buffer zones and setback implementation	49
6.3.3 Risk mitigation using land use planning	50

6.4	Disposal facilities	50
6.4.1	Best practices for site selection	50
6.4.2	Further considerations for site characteristics	55
6.5	Transfer stations — Siting	60
6.6	Public drop-off facilities — Siting	60
6.7	Composting facilities — Siting	61
6.8	Incinerators — Siting	62
6.9	Existing site not satisfying best practices for site requirements	62
<b>7</b>	<b>Site Investigation</b>	<b>63</b>
7.1	Best practices	63
7.2	Desktop reviews	63
7.3	Site inspection and evaluation	64
7.4	Geotechnical site investigation	64
7.4.1	General	64
7.4.2	Subsurface investigation at MSW site	64
7.4.3	Borrow source investigation	65
7.4.4	Additional tasks required to accommodate climate considerations	65
7.5	Hydrogeological investigation	66
7.5.1	Objectives of investigation	66
7.5.2	Groundwater monitoring	66
7.6	Evaluation of findings	67
<b>8</b>	<b>Facility design</b>	<b>67</b>
8.1	Determining design parameters	67
8.1.1	General	67
8.1.2	Designing for hazards	68
8.1.2.5	Reducing design-related issues	72
8.2	Design plan and specification requirements	73
8.3	Design criteria	79
8.3.1	All facility design criteria	79
8.3.2	Buildings and facilities to support the facility's operations	79
8.3.3	Additional considerations	79
8.4	Landfill design criteria	81
8.5	Design for natural attenuation for landfills	82
8.5.1	Design considerations	82
8.5.2	Required site conditions	83
8.6	Public drop off-design criteria	83
8.7	Transfer station design criteria	83
8.8	Compost facility design criteria	83
8.9	Incinerator design criteria	84
<b>9</b>	<b>Facility construction</b>	<b>85</b>
9.1	General	85
9.2	Construction quality assurance and control	85
9.3	Commissioning and training	86
<b>10</b>	<b>Operator training</b>	<b>86</b>
10.1	Certification	86

10.1.1	General	86
10.1.2	Large sites	87
10.1.3	Small sites	87
10.2	Key operating personnel	87
<b>11</b>	<b>Facility operations — All sites</b>	<b>88</b>
11.1	Operations and maintenance manual and safety plans	88
11.1.1	General	88
11.1.2	General requirements	88
11.1.3	Identifying hazards related to operations	90
11.1.4	Emergency response plan	91
11.1.5	Site safety plan	92
11.1.6	Fire safety plan	92
11.1.7	Nuisance management	92
11.1.8	Surface water management plan	94
11.1.9	Erosion and sedimentation management	95
11.2	Operations — Screening and diverting materials for all facilities	95
11.2.1	Waste screening	95
11.2.2	Managing divertible materials to preserve landfill airspace	96
11.3	Placement and management of waste groupings within the facility	97
11.3.1	Waste segregation	97
11.3.2	EPR for recyclables and divertibles	98
11.3.3	Scrap metal	98
11.3.4	Appliances with refrigerants and/or mercury	99
11.3.5	Household hazardous materials	99
11.3.6	Separating waste for incineration	99
<b>12</b>	<b>Landfill operations for large sites</b>	<b>100</b>
12.1	General	100
12.2	Cell sequencing and progressive closure	100
12.3	Waste placement and compaction	100
12.4	Asbestos management	101
12.5	Cover materials	101
12.5.1	Regular placement of cover	101
12.5.2	Soil recovery methods	101
12.5.3	Alternative cover	101
12.6	Soil recovery	102
12.6.1	Soil recovery strategy	102
12.6.2	Soil recovery implementation	102
12.7	Placement and stockpiling of soil cover within the facility	102
12.8	Protection of liners	103
12.9	Management of leachate	103
12.10	Detection and management of subsurface landfill gas	103
12.10.1	Monitoring and limits for landfill gas	103
12.10.2	Collection, management, and safety	103
<b>13</b>	<b>Monitoring for large sites</b>	<b>104</b>
13.1	General	104
13.2	Environmental monitoring	104

13.2.1	Groundwater and ground temperature monitoring	104
13.2.2	Environmental monitoring system	106
13.2.3	Locations for sampling	106
13.2.4	Required data collection and reporting	107
13.3	Landfill and waste monitoring during operations	107
13.3.1	Requirements for waste disposal tracking	107
13.3.2	Visual inspection requirements	107
13.4	Compost monitoring during operations	107
13.4.1	Requirements for compostable materials tracking	107
13.4.2	Screening and monitoring	107
13.4.3	Inspection of facility infrastructure	108
13.5	Slope and permafrost monitoring	108
13.6	Meteorological and climate monitoring	108
13.7	Sampling and testing	108
13.8	Best practices for periodic inspection and follow-up procedures	109
13.8.1	Existing and legacy facilities	109
13.8.2	New facilities	109
13.9	Standards for reporting on different types of waste or events	109
13.10	Corrective or remedial actions	109
<b>14</b>	<b>Operations of small sites</b>	<b>110</b>
14.1	General	110
14.2	Operations plan	110
14.3	Signage, access, segregation, and storage	110
14.3.1	Signage and access	110
14.3.2	Segregation and storage	110
14.4	Cover systems and fencing	111
14.4.1	Requirements for cover systems	111
14.4.2	Requirements for daily cover and fencing	111
14.5	Inspections and monitoring	111
<b>15</b>	<b>Protocols for environmental protection at landfill facilities</b>	<b>112</b>
15.1	General	112
15.2	Cover materials	112
15.2.1	Placement of cover	112
15.2.2	Alternative cover	112
15.3	Leachate management systems	112
15.4	Assessing potential landfill gas	112
15.5	Measures to reduce greenhouse gas emissions from the solid waste facility	113
15.6	Consideration of alternative systems of reducing waste volumes	113
<b>16</b>	<b>Closure and decommissioning</b>	<b>114</b>
16.1	Best practices for closure and decommissioning	114
16.2	Best practices for existing or legacy facilities	114
16.3	Closure plans	115
16.4	Best practices and selection for final cover	115
<b>17</b>	<b>Post-closure monitoring, inspection, and management</b>	<b>116</b>
17.1	Post-closure plan	116

17.2	Monitoring and inspection methods and practices during and post-closure	116
17.2.1	General	116
17.2.2	Minimum post-closure monitoring period	117
17.2.3	Minimum post-closure responsibilities	117
17.3	Corrective or remedial actions	117
<b>18</b>	<b>Emergency response and contingency planning</b>	<b>117</b>
18.1	General	117
18.2	Leachate or dangerous material-related emergencies	118
18.3	Access to waste by animals or birds	118
18.4	Erosion- and sedimentation-related emergencies	118
18.5	Fire-related emergencies	119
18.6	Reporting protocols	119

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Annex A (informative)	— Alternative cover solutions	120
Annex B (informative)	— Glossary of translated terms	123
Annex C (informative)	— Acts, Regulations, and Guidelines applicable to each jurisdiction	126
Annex D (informative)	— Bibliography	149
Annex E (informative)	— Illustrative operators guide	154

# Preface

This is the first edition of CSA R111, *Solid waste sites in northern communities: From planning to post-closure*.

This Standard draws on industry expertise and best practices in Canada and internationally to address the requirements for solid waste management in the North, including the entire lifecycle of solid waste sites beginning with siting, to design, construction, operations, and management, and, finally, closure and decommissioning, and post-closure of municipal solid waste facilities.

Users of this Standard are reminded that additional and site-specific requirements could be specified by federal, territorial or provincial, regional, municipal, or other authorities or agencies, or by an owner. This Standard should not be considered a replacement for the requirements contained in any

- a) applicable federal, territorial, or provincial statute;
- b) regulation, licence, or permit issued pursuant to an applicable statute; or
- c) contract that an owner has with a contractor.

CSA Group acknowledges that the development of this Standard was made possible, in part, by the financial support of Standards Council of Canada, as part of the Northern Infrastructure Standardization Initiative.

This Standard was prepared by the Subcommittee on Solid Waste Management (Northern Communities) under the jurisdiction of the Technical Committee on Northern Water and Waste and the Strategic Steering Committee on Natural Resources, and has been formally approved by the Technical Committee.

This Standard has been developed in compliance with Standards Council of Canada requirements for National Standards of Canada. It has been published as a National Standard of Canada by CSA Group.

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# *CSA R111:21*

## *Solid waste sites in northern communities: From planning to post-closure*

### **0 Introduction**

This Standard addresses measures for the management and mitigation of risks to human health and the environment associated with solid waste management, specifically, the management of municipal solid waste (MSW). The Standard includes consideration of the varied climate and ground conditions that are present in the North, including the likelihood of permafrost in many of Canada's northern communities.

The Standard considers the significant challenges associated with operating in the North, including issues with ongoing operations and maintenance, communities in remote locations, lack of operator capacity and training, cost of hauling, regulatory management, historic dumping, lack of background data, etc. Of particular importance, and considered specifically in this Standard, is that many of the smallest municipal solid waste sites in remote locations are experiencing the greatest number of challenges and have some of the worst conditions. The focus is to try to assist smaller communities to work towards improved conditions at their sites, while still recognizing their limitations in capacity. It is anticipated that many of the operational requirements for larger sites might, for the moment, remain aspirational for the smaller sites but, gradually, improvements will be implemented at the smaller sites. Of primary importance at existing sites will be an effort to implement best practices in operations, e.g., waste reduction, sorting, and cover.

Because proper siting and design are so important to the successful management of MSW facilities, considerable emphasis is placed on these considerations in the Standard. Siting and design will become progressively more important as existing MSW facilities become full and new sites are sought. Siting can be controversial where competing land uses are in close proximity, or in communities where suitable terrain is in short supply. Where siting cannot be optimized due to the lack of suitable locations, design can often be used to mitigate siting issues. Similarly, where existing or legacy sites are not ideally located, remedial designs can sometimes be useful in mitigating siting deficiencies. If mitigations are not possible, a risk-based decision can be made whether a site should remain operational or should be closed and reestablished in a better location.

The present and ongoing impact of climate change is also considered. Climate change is accelerating numerous land-based processes in Canada's North (ACIA 2013, IPCC 2014, NRC 2016, CSA PLUS 4011). Though all regions of Canada are experiencing environmental impacts that can be attributed to climate change, warming in Canada's North is taking place at a faster rate than the rest of Canada and more rapidly than many climate models predicted. Northern adaptations for changes in ground stability are likely to require the consideration of rapidly changing ice regimes and permafrost soils, particularly in regions with already-warm permafrost and/or ice-rich soils. These issues coincide with progressively increasing exposure to open-water erosive processes, and decreased sea-ice cover in most of northern Canada. Intensification of the hydrological cycle and associated changes to the groundwater regime is another climate change implication that is likely to affect landfilling in the northern regions.

Northern communities are also generally located in geographically-isolated and climatically-harsh regions, resulting in high construction and maintenance costs, as well as challenging logistics. Therefore, efficiency and resiliency are critical elements of built infrastructure in the North, mitigating the effects

of changes in ground stability whether related to natural processes, construction-related changes, or climate change-related processes. Planning MSW facilities for resilience in siting, design, operations, monitoring, and maintenance will help communities manage those processes more successfully.

Because poor MSW poses a threat to human health and the environment, proper solid waste management is an essential measure in managing the risks related to MSW. This Standard is organized according to the progression of steps that, if adopted in the legislation as the Standard in the jurisdiction, or by referencing the Standard (or parts thereof) in project specifications, must be undertaken to address the risks associated with the planning, siting, design, operations, and closure of solid waste management facilities, so that impacts to human health and the environment can be mitigated whenever possible. This Standard thereby encourages risk-based decision-making which prioritizes mitigating the greatest risks first with the resources available. This approach is consistent with the guidance provided in ECCC (2017), which identifies high-, medium- and lower-priority actions to reduce risks.

While there are numerous non-compulsory guidelines available to help the user design and manage municipal solid waste sites in the North, no unified compulsory Standard has yet been prepared specifically to address the issues in Canada's North. This Standard is intended to provide one specific document for solid waste management in the North, while also directing the reader as needed to existing guidelines and other Standards that provide additional information and direction. As noted in the Preface, each jurisdiction might also have additional requirements. The strategies available to proactively reduce the incidence and mitigate the effects of natural and human-produced hazards, to monitor, and to respond to the risks as required, depend on site-specific conditions and resources available to northern communities and facilities. The use of this Standard therefore requires a flexible approach and aims to provide solutions that can help improve solid waste management even in remote northern communities.

## 1 Scope

### 1.1 Purpose

This Standard applies to the management of northern MSW facilities, including the evaluation, planning, siting, design, implementation, monitoring, and maintenance of MSW facilities and includes pollution risk management strategies and mitigation measures for new and existing infrastructure in northern communities. This Standard provides

- a) procedures for planning, siting, designing, constructing, operating, inspecting, monitoring, and maintaining solid waste management facilities as well as mitigation measures as applicable;
- b) an outline of procedures for conducting an overall risk assessment, including infrastructure vulnerability;
- c) factors to be considered in land use and infrastructure planning;
- d) an overview of the typical drivers of natural and human-made hazards to which this Standard is applicable, including climate change;
- e) closure and decommissioning requirements and best practices;
- f) post-closure inspection, monitoring, maintenance, and management;
- g) emergency response and contingency planning protocols;
- h) a framework for community-based processes for addressing solid waste issues, human health, and environmental considerations; and

- i) background information and relevant reference material.

**Notes:**

- 1) *Compliance with this Standard will allow users to demonstrate that the design and implementation of risk management strategies and mitigation measures take into consideration, and are compatible with, the preservation of permafrost or reduction of the disruptive effects of permafrost thaw. Because the performance of permafrost is often integral to the success of risk management strategies intended to protect human health and the environment at solid waste management facilities, compliance with this Standard will help mitigate impacts to infrastructure and the environment within and surrounding the project site.*
- 2) *Permafrost is not the only challenge faced by those who design and operate waste management facilities in the North, however. Often, the remote location of the communities mean that it is hard to hire and retain staff to manage the complex activities that underlie the safe operation of modern waste management sites. Communities might also find it expensive to undertake many of the measures described in this Standard. Those who embark on the development and operation of waste management facilities must be confident that they can access the monetary and non-monetary resources that the site will require throughout a facility life that could span several decades.*
- 3) *This Standard does not replace existing legislation or regulations (see Preface and Clause 4). It can be used in whole or in part to supplement existing regulations, or it can be adopted as jurisdictions see fit. The intent of the Standard is to help each jurisdiction improve the management of municipal solid waste. Annex C provides a list of existing legislation, guidelines, and other documents from each jurisdiction*

## 1.2 Users

This Standard is intended for use in Yukon Territory, Northwest Territories, Nunavut, and Nunavik, but other northern and remote jurisdictions might wish to adopt it as well. Furthermore, although this Standard was written specifically for communities, other generators of municipal-type waste might also find it useful, including privately-operated waste management facilities, such as mine sites, construction camps, or other generators that do not have access to an established municipal facility. This Standard is voluntary unless adopted by a jurisdiction. Users are intended to include

- a) the owners and operators of MSW facilities;
- b) the owners and operators of other community infrastructure for which the safe operation of the MSW facility is important;
- c) contract administrators who oversee a MSW facility project;
- d) site investigators (scientists and engineers) who evaluate the site conditions (existing and projected) and estimate the risks related to the development of the project;
- e) design professionals and reviewers (consulting engineers and territorial, provincial, or regional technical services staff) who design, assess and approve, and oversee the implementation of engineering-based solutions;
- f) contractors working on MSW facilities;
- g) regulatory authorities, such as land and water boards and review boards;
- h) compliance authorities, such as qualified building inspectors and qualified environmental inspectors;
- i) land use planners and community planning officials;
- j) educators, for the purposes of knowledge transfer; and
- k) others with a vested interest in risk management or mitigative elements of MSW planning and/or construction projects, design and construction, and inspection of mitigation measures and plan implementation.

**Note:** *Very small generators of waste would ideally make use of the nearest MSW facility to dispose of their waste, e.g., small communities of a few houses, or as related to highway travel services (gas stations, motels). However, it is recognized that not all such localities might have the capacity to either transport their waste, or to manage it correctly on site. Where possible, local, regional, and territorial governments should encourage the adequate management of solid waste.*

## 1.3 Application

### 1.3.1 General

The management of municipal solid waste facilities requires the management of the risks that these facilities create. In this Standard, the management of risks is addressed by the use of two primary strategies: by requiring risk assessments as applicable to the various stages of the life cycle of a municipal solid waste facility, and in the specification and implementation of best practices to mitigate those risks throughout the lifecycle.

The requirements provided in this Standard are intended to address risks to

- a) human health and the environment, due to proposed, existing, or closed MSW facilities; and
- b) proposed, existing, or closed MSW facilities.

Risks to be considered can be generated by natural hazards and by the waste types in the community and within the facility itself. Risk is partly mitigated by assigning appropriate requirements to facilities according to their size classification (Clause [5](#)). Requirements for the evaluation and management of risks include the potential impacts of climate change and other factors that are to be considered in the planning, siting, design, construction, operations, closure, and post-closure of a MSW facility (Clauses [6](#) through [17](#)). This Standard applies to the entire life cycle of the infrastructure project or strategic planning cycles, including planning, siting, construction, operation and maintenance, closure and decommissioning, and post-closure, or until residual risk levels are deemed acceptable

### 1.3.2 Types of infrastructure

This Standard applies to the evaluation, planning and design, implementation, operations, maintenance, and monitoring of solid waste management facilities, as well as mitigation measures, during all phases of planning, design, construction, service life, closure and decommissioning, and post-closure of

- a) MSW with segregated categories of waste;
- b) landfills;
- c) transfer stations;
- d) public drop-off facilities;
- e) composting facilities;
- f) incinerators; and
- g) expansions of any of these types of facilities or structures.

## 1.4 Terminology

In this Standard, “shall” is used to express a requirement, i.e., a provision that the user is obliged to satisfy in order to comply with the Standard; “should” is used to express a recommendation or that which is advised but not required; and “may” is used to express an option or that which is permissible within the limits of the Standard.

Notes accompanying clauses do not include requirements or alternative requirements; the purpose of a note accompanying a clause is to separate from the text explanatory or informative material.

Notes to tables and figures are considered part of the table or figure and may be written as requirements.

Annexes are designated normative (mandatory) or informative (non-mandatory) to define their application.