

APPLICATION OF THE **RISK METHODOLOGY** USED FOR MEASURING MUNICIPAL RESIDENTIAL DRINKING WATER SYSTEM INSPECTION RESULTS



The Ministry of the Environment (MOE) has a rigorous and comprehensive inspection program for municipal residential drinking water systems (MRDWS). Its objective is to determine the compliance of MRDWS with requirements under the *Safe Drinking Water Act, 2002*, associated regulations and MOE Certificates of Approval. It is the responsibility of the municipal residential drinking water system owner to ensure their drinking water systems are in compliance with all applicable legal requirements.

This document describes the risk rating methodology, which will be applied to the findings of the Ministry's MRDWS inspection results starting in fiscal year 2008/2009. The primary goals of this assessment are to encourage ongoing improvement of these systems and to establish a way to measure this progress.

MOE reviews the risk rating methodology every three years to account for legislative and societal changes to acceptable risk levels. As a result of the

most recent review, the methodology has been modified to present an improved metric for the evaluation of the risk/safety of MRDWS operations.

The Ministry's Municipal Residential Drinking Water Inspection Protocol contains up to 14 inspection modules and consists of up to 122 regulatory questions. Those protocol questions are also linked to definitive guidance that Ministry inspectors use when conducting MRDWS inspections. The questions address a wide range of regulatory issues, from administrative procedures to drinking water quality monitoring. Additionally, the inspection protocol contains many other non-regulatory questions.

A team of drinking water specialists in the Ministry have assessed each of the inspection protocol regulatory questions to determine the risk of having a response in the negative (i.e., not complying with the regulatory framework) that would compromise the delivery of safe drinking water. This assessment was based on established provincial risk assessment principles, with each question receiving an assigned risk rating. Based on the number of areas where a system is deemed to be non-compliant during the inspection, and the significance of these areas to administrative, environmental, and health consequences, a risk-based inspection rating is calculated by the Ministry for each drinking water system.

A low inspection rating would not necessarily mean that the drinking water provided by that system is unsafe; however, it does indicate the degree to which there is room for improvement in meeting the province's regulatory requirements.

The inspection rating for a drinking water system will reflect the inspection results of the specific drinking water system for the reporting year. When the methodology is applied consistently over a period of years, it can serve as a comparative measure both provincially and in relation to the individual system. Both the drinking water system and the public will be able to track the performance over time, which will encourage continuous improvement and allow systems to identify specific areas requiring attention.

This methodology for assessing inspection findings will be used as a tool to track progress towards the Chief Drinking Water Inspector's goal of achieving 100 per cent compliance with the regulatory framework on a province-wide basis.

Determining Potential to Compromise the Delivery of Safe Water

Each inspection protocol question was assessed by MOE drinking water specialists to determine the potential to compromise the delivery of safe water. These specialists used a risk management approach that is aligned with the Government of Ontario's Inspections, Investigations and Enforcement (II&E) Risk Management Framework which, in turn, is built on a universally accepted risk assessment method. Risk management is a systematic approach to identifying potential hazards; understanding the likelihood and consequences of the hazards; and taking steps to reduce their risk if necessary and as appropriate.

The Government of Ontario mandated the II&E Secretariat to address the specific challenges of managing risk in the context of Ontario's regulatory environment and across a variety of ministry program areas. The work of the II&E Secretariat resulted in the development of the II&E Risk Management Framework, which has subsequently been adopted as the definitive risk management tool in the Ontario Public Service.

The II&E Risk Management Framework provides a formula to be used in the determination of risk:

$$\text{RISK} = \text{LIKELIHOOD} \times \text{CONSEQUENCE}$$

(of the consequence)

Every regulatory question in the inspection protocol possesses a likelihood value (L) for an assigned consequence value (C) as described in **Table 1** and **Table 2**.

The consequence values (0 through 8) are selected to align with other risk-based programs and projects currently under development or in use within the Ministry as outlined in **Table 2**.

The question risk rating for each legislative inspection question is derived from an evaluation of every possible consequence and its corresponding likelihood of occurrence:

- All levels of consequence are evaluated for their potential to occur
- Greatest of all the combinations is selected.

TABLE 1:	
Likelihood of Consequence Occurring	Likelihood Value
0% - 0.99% (Possible but Highly Unlikely)	L = 0
1 – 10% (Unlikely)	L = 1
11 – 49% (Possible)	L = 2
50 – 89% (Likely)	L = 3
90 – 100% (Almost Certain)	L = 4

The question risk rating quantifies the risk of non-compliance of each question relative to the others. Questions with higher values are those with a potentially more significant impact on drinking water safety and a higher likelihood of occurrence. The highest possible value would be 32 (4×8) and the lowest would be 0 (0×1).

Table 3 presents a sample question showing the risk rating determination process.

TABLE 2:	
Consequence	Consequence Value
Medium Administrative Consequence	C = 1
Major Administrative Consequence	C = 2
Minor Environmental Consequence	C = 3
Minor Health Consequence	C = 4
Medium Environmental Consequence	C = 5
Major Environmental Consequence	C = 6
Medium Health Consequence	C = 7
Major Health Consequence	C = 8

TABLE 3:							
Does the Operator in Charge ensure that the equipment and processes are monitored, inspected and evaluated?							
Risk = Likelihood × Consequence							
C=1	C=2	C=3	C=4	C=5	C=6	C=7	C=8
Medium Administrative Consequence	Major Administrative Consequence	Minor Environmental Consequence	Minor Health Consequence	Medium Environmental Consequence	Major Environmental Consequence	Medium Health Consequence	Major Health Consequence
L=4 (Almost Certain)	L=1 (Unlikely)	L=2 (Possible)	L=3 (Likely)	L=3 (Likely)	L=1 (Unlikely)	L=3 (Likely)	L=2 (Possible)
R=4	R=2	R=6	R=12	R=15	R=6	R=21	R=16

Application of the Methodology to Inspection Results

Based on the results of a MRDWS inspection, an overall inspection risk rating is calculated. During an inspection, inspectors answer the questions that relate to regulatory compliance and input their responses as “yes”, “no” or “not applicable” into the Ministry’s Laboratory and Waterworks Inspection System (LWIS) database. A “no” response indicates non-compliance. The maximum number of

regulatory questions asked by an inspector varies by: system (i.e., distribution, stand-alone), type of inspection (i.e., focused, detailed), and source type (i.e., groundwater, surface water).

The question risk ratings of all non-compliant answers are summed (total question rating) and divided by the sum of the question risk ratings of all questions asked (maximum question rating). The resulting inspection risk rating (as a percentage) is subtracted from 100 per cent to arrive at the final inspection rating.

Application of the Proposed Methodology for Public Reporting

The individual MRDWS Total Inspection Ratings will be published, as a banded result, in the Ministry's Chief Drinking Water Inspector's Annual Report covering the current fiscal inspection year.

Figure 1 presents the results of the Fiscal 2006-2007 annual inspections using the 5% bands. Using this method, individual drinking water systems can determine how they compare against all the other inspected facilities without being exposed to individual facility results.

Reporting Results to MRDWS Owners/Operators

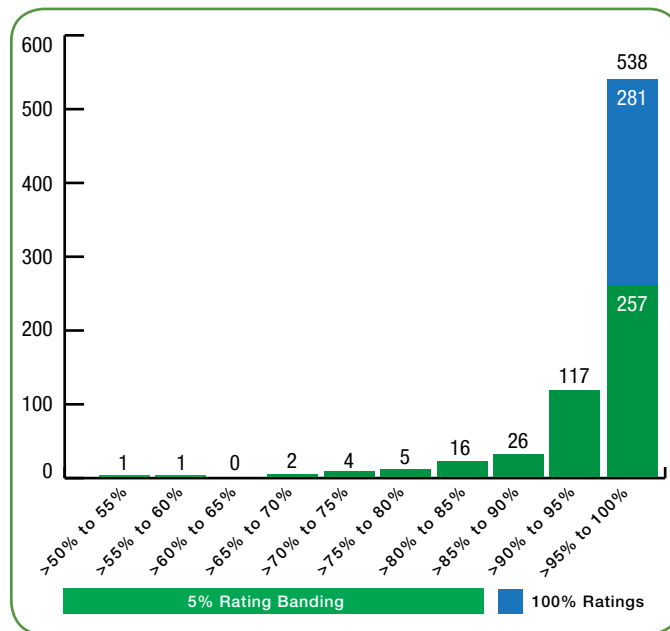
A summary of inspection findings for each system is generated in the form of a Inspection Rating Record (IRR). The findings are grouped into the 14 possible modules of the inspection protocol, which would provide the system owner/operator with information on the areas where they need to improve. The 14 modules are:

- | | |
|---------------------------------------|--|
| 1. Source | 10. Consumer Relations |
| 2. Permit to Take Water | 11. Certification and Training |
| 3. Capacity Assessment | 12. Water Quality Monitoring |
| 4. Treatment Processes | 13. Reporting, Notification and Corrective Actions |
| 5. Process Wastewater | 14. Other Inspection Findings |
| 6. Distribution System | |
| 7. Operations Manuals | |
| 8. Logbooks | |
| 9. Contingency and Emergency Planning | |

Changes to the IRR Methodology Relative to Previous Fiscal Inspection Years

The Ministry of the Environment assured stakeholders that the rating methodology would be reviewed every three years. This three-year period concludes with the beginning of the current 2008/09 inspection year.

Figure 1: Fiscal Year 2006/07 Distribution of Ratings



A comprehensive evaluation of the inspection rating model used to date revealed numerous areas for improvement:

- Chronic administrative issues and high ratings
- Specific situations (“grey areas”) required supervisor/manager intervention
- Inspection ratings did not fully integrate detailed risk management principles.

The consequence values that were assigned to each relevant regulatory question remained unchanged from April 1, 2005 to March 31, 2008. The rating methodology used over those three years has been modified based on continuous improvements to the program by the Ministry and now represents an improved metric for the evaluation the risk/safety of operations at MRDWS.

For further information, please contact your

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