Contents

QMRA Toolkit - Visual Step-by-Step Guide with Interface Screenshots

Complete Visual Walkthrough with Interface Examples NIWA Earth Sciences - September 26, 2025

Visual Quick Start - Your First Assessment in 30 Minutes

STEP 1: Launch the Toolkit

Option A: GUI Interface (Recommended for Beginners)

```
Windows Explorer: qmra_toolkit folder

  config/             launch_gui.py
  data/               Launch_QMRA_GUI.bat  ← DOUBLE-CLICK
  docs/               README.md
  examples/           requirements.txt
  src/                treatment_config.yaml
  templates/          wastewater_treatment.yaml
```

```
tests/
```

What to do: 1. Navigate to the `qmra_toolkit` folder 2. **Double-click** `Launch_QMRA_GUI.bat` 3. Wait for the GUI window to appear (3-5 seconds)

STEP 2: GUI Interface Overview

When the GUI launches, you'll see this main window:

```
QMRA Assessment Toolkit - NIWA                                    [_][ ][X]

File   Edit   Assessment   Reports   Help


    Project Setup                Assessment Parameters

   Project Name: [_________________]     Pathogen: [Norovirus     ]
   Assessor: [_____________________]     Route: [Primary Contact  ]
   Date: [2025-09-26_______________]     Concentration: [1000000___]
   Client: [_______________________]     copies/L

   Population at Risk:                   Exposure Volume: [0.1_____]
   [100000_________________________]     L per event

                        Frequency: [7_____________]
                                     events/year
    Treatment Scenarios
                                       Monte Carlo: [10000_______]
   Current Treatment:                  iterations
   Type: [Secondary Treatment ____]
   LRV Norovirus: [1.0_____________]
   LRV Campylobacter: [2.0________]
   LRV Cryptosporidium: [1.5______]     Run Assessment

   Proposed Treatment:                   [Load Config File]
   Type: [Tertiary Treatment _____]      [Save Config File]
   LRV Norovirus: [3.5_____________]
   LRV Campylobacter: [4.0________]      [  RUN ASSESSMENT]
   LRV Cryptosporidium: [3.0______]
                                         [Generate Report]
                         [View Results]
```

```
Status: Ready | Progress: [                ] 0%
```

Key Interface Elements: - **Project Setup (Top Left)**: Basic project information - **Assessment Parameters (Top Right)**: Core QMRA settings - **Treatment Scenarios (Bottom Left)**: Current vs proposed treatment - **Run Assessment (Bottom Right)**: Action buttons - **Status Bar (Bottom)**: Progress and status messages

---

STEP 3: Fill in Your Assessment Parameters

3.1 Project Setup Section

```
Project Setup

Project Name: [Auckland Council WWTP_______] ← Enter descriptive name
Assessor: [Your Name Here__________________] ← Your name
Date: [2025-09-26__________________________] ← Auto-filled
Client: [Auckland Council__________________] ← Client organization

Population at Risk:
[500000_____________________________________] ← Number of people exposed
```

Visual Cues: - **Green border**: Successfully filled field - **Red border**: Required field missing - **Yellow background**: Field with validation warning

3.2 Assessment Parameters Section

```
Assessment Parameters

Pathogen: [Norovirus              ]        ← Click dropdown
        [ Norovirus               ]           Select pathogen
        [ Campylobacter           ]
        [ Cryptosporidium         ]
        [ E. coli                 ]

Route: [Primary Contact           ]        ← Exposure route
      [ Primary Contact           ]
      [ Shellfish Consumption     ]
      [ Drinking Water            ]
      [ Aerosol Inhalation        ]
```

Concentration: [1000000_____] ← Pathogen concentration
copies/L (copies/L or CFU/L)

Exposure Volume: [0.1_____] ← Volume per exposure
L per event (Liters)

Frequency: [7_____] ← Events per year
events/year

Monte Carlo: [10000_____] ← Simulation iterations
iterations (recommended: 10,000)

STEP 4: Set Up Treatment Scenarios

4.1 Current Treatment Configuration

Treatment Scenarios

Current Treatment:
Type: [Secondary Treatment_____] ← Treatment type

Log Reduction Values (LRV):

Pathogen	LRV	Effectiveness	
Norovirus	[1.0_]	90.0%	← 1 log = 90% removal
Campylobacter	[2.0_]	99.0%	← 2 log = 99% removal
Cryptosporidium	[1.5_]	96.8%	← 1.5 log = 96.8% removal

Proposed Treatment:
Type: [Tertiary Treatment_____] ← Upgraded treatment

Pathogen	LRV	Effectiveness	
Norovirus	[3.5_]	99.97%	← 3.5 log = 99.97% removal
Campylobacter	[4.0_]	99.99%	← 4.0 log = 99.99% removal
Cryptosporidium	[3.0_]	99.90%	← 3.0 log = 99.90% removal

Dilution Factor: [100_____] ← Receiving water dilution

Important Notes: - **LRV = Log Reduction Value**: Each log removes 90% of pathogens - **Higher LRV = Better Treatment**: 3 logs = 99.9% removal - **Dilution Factor**: How much receiving water dilutes the effluent

---

STEP 5: Run the Assessment

5.1 Pre-Run Validation

```
Run Assessment

[Load Config File]                ← Load saved settings
[Save Config File]                ← Save current settings

Validation Status:
  Project information complete    ← All required fields filled
  Assessment parameters valid     ← Parameters in valid ranges
  Treatment scenarios defined     ← Both scenarios configured
   High pathogen concentration    ← Warning about assumptions

[  RUN ASSESSMENT]                ← Click to start analysis

[Generate Report]                 ← Available after run
[View Results]                    ← Available after run
```

5.2 Assessment Progress

```
QMRA Assessment Toolkit - NIWA                          [_][ ][X]


              ASSESSMENT IN PROGRESS

  Current Step: Monte Carlo Simulation
  Iteration: 7,432 of 10,000 (74.3% complete)

  Progress: [               ] 74%

     Current Analysis Status

      Pathogen database loaded
      Exposure scenarios configured
      Dose-response models initialized
```

Monte Carlo simulation running...
Risk characterization pending
Report generation pending

Estimated time remaining: 2 minutes

Status: Running Monte Carlo simulation... | Progress: 74%

STEP 6: View and Interpret Results

6.1 Results Summary Window

Assessment Results - Auckland Council WWTP [_][ ][X]

Risk Assessment Summary

Assessment: Auckland Council WWTP Tertiary Treatment
Date: September 26, 2025
Population: 500,000 people

PATHOGEN RISK COMPARISON

Pathogen	Current Risk	Proposed Risk	Status
Norovirus	9.83e-01	5.56e-01	High Risk
Campylobacter	1.30e-01	1.43e-03	Moderate
Cryptosporidium	3.15e-03	1.22e-05	Low Risk

PUBLIC HEALTH IMPACT:
- Norovirus cases prevented: 213,445 per year
- Campylobacter cases prevented: 64,065 per year
- Total illness reduction: 277,510 cases per year

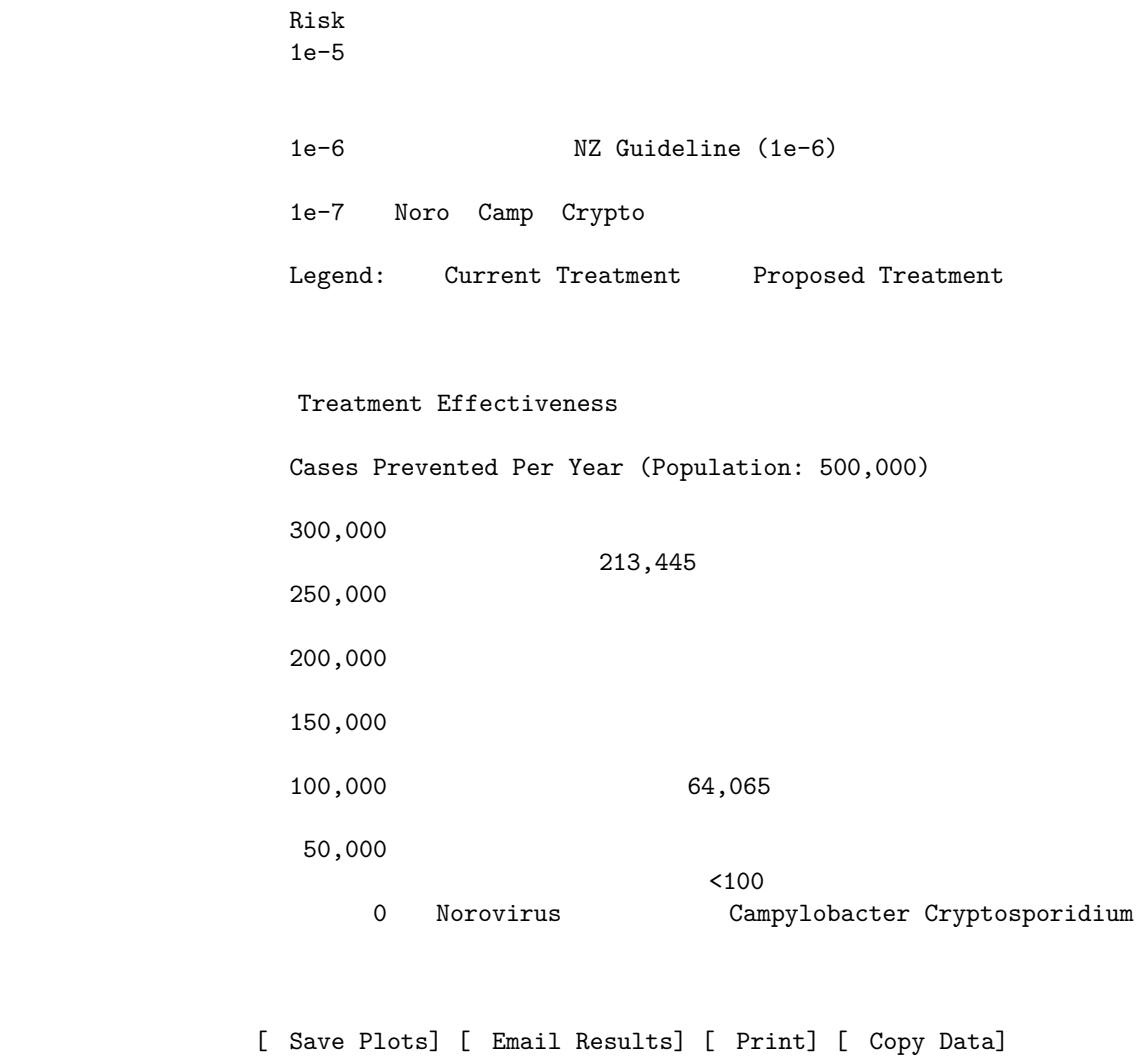
Regulatory Compliance

```
New Zealand Guidelines (Annual Risk   1e-6):

Current Treatment:
  NON-COMPLIANT - Risk exceeds guidelines

Proposed Treatment:
  IMPROVED - Significant risk reduction achieved
   Norovirus still above compliance threshold

Recommendation: Proceed with tertiary treatment upgrade


 [ View Detailed Plots] [ Generate Report] [ Export Data] [ New]


Status: Assessment completed successfully
```

STEP 7: Visual Results and Plots

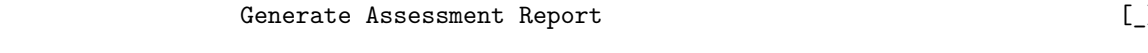
7.1 Risk Comparison Plot

```
Risk Analysis Plots                                          [_][ ][X]


     Pathogen Risk Comparison

    Annual Illness Risk by Pathogen

    1e+0

              Current
    1e-1
                 Proposed

    1e-2

     ↑
    1e-3

    1e-4
```



STEP 8: Generate Professional Report

8.1 Report Generation Dialog



Report Templates

Executive Summary Report
- 2-3 page summary for decision-makers
- Key findings and recommendations
- Risk comparison charts

Technical Assessment Report
- Detailed 15-20 page technical report
- Complete methodology and calculations
- Peer review ready

Regulatory Compliance Report
- Focused on compliance status
- Regulatory framework alignment
- Submission ready format

Output Options

Report Format:
PDF (Recommended) Word Document HTML

Include:
Risk comparison plots Data tables
Uncertainty analysis Methodology section
Quality assurance info Literature references

Output Location:
[C:\...\NZ_Consultancy_Project_2025\reports\] [Browse...]

Report Preview

Estimated report length: 3 pages
Includes: 2 charts, 1 data table, executive summary
Processing time: ~30 seconds

Report will include:
- Project overview and parameters
- Risk assessment results
- Treatment scenario comparison
- Regulatory compliance status

- Recommendations and next steps

[Generate Report] [Preview] [Cancel]

Status: Ready to generate report

Visual Troubleshooting Guide

Common Issue 1: GUI Won't Start

```
Command Prompt Error                                    [_][ ][X]


C:\...\qmra_toolkit> python launch_gui.py

Error importing GUI modules: No module named 'tkinter'
Please ensure all dependencies are installed:
pip install -r requirements.txt

SOLUTION:
1. Check Python version: python --version
   (Should be 3.8 or higher)
2. Install requirements: pip install -r requirements.txt
3. Try again: python launch_gui.py
```

Common Issue 2: Invalid Parameters

```
Parameter Validation Error                              [_][ ][X]


    VALIDATION ERRORS DETECTED

 The following parameters need attention:

   Pathogen concentration too high (>1e8)
    Current: 1e10 copies/L
    Typical range: 1e3 - 1e7 copies/L
```

```
  → Check your data source

 LRV values inconsistent
  Norovirus LRV > Cryptosporidium LRV
  → Verify treatment effectiveness data

  Population at risk very high
  Current: 10,000,000 people
  → Confirm this is correct for your scenario

[Fix Parameters] [Continue Anyway] [Load Example]
```

Understanding Visual Results

Risk Level Color Coding

```
Risk Interpretation Legend

 GREEN (Compliant): Annual risk  1e-6
  • Meets New Zealand guidelines
  • No action required
  • Safe for public health

 YELLOW (Moderate): 1e-6 < Annual risk  1e-2
  • Above guidelines but manageable
  • Consider treatment improvements
  • Monitor closely

 RED (High Risk): Annual risk > 1e-2
  • Significant public health concern
  • Treatment upgrade required
  • Not suitable for current use
```

Treatment Effectiveness Scale

```
Log Reduction Value (LRV) Reference

LRV 1.0 = 90% removal          90%
LRV 2.0 = 99% removal          99%
LRV 3.0 = 99.9% removal        99.9%
LRV 4.0 = 99.99% removal       99.99%
```

```
Higher LRV = Better Treatment Performance
Typical ranges:
• Primary treatment: 0.5-1.0 LRV
• Secondary treatment: 1.0-2.5 LRV
• Tertiary treatment: 2.5-4.0+ LRV
```

Visual Checklist for Quality Assurance

Before Running Assessment

```
Pre-Assessment Checklist

 Project name is descriptive and unique
 Population at risk is realistic (check census data)
 Pathogen concentrations from reliable source
 Treatment LRVs match technology specifications
 Exposure parameters appropriate for scenario
 Monte Carlo iterations  10,000
 All required fields show green validation

 Ready to run assessment
```

After Getting Results

```
Post-Assessment Validation

 Risk values are reasonable (not exactly 0 or 1)
 Proposed treatment shows improvement over current
 Results consistent with similar studies
 Confidence intervals make sense
 Plots display without errors
 Report generation successful

 Results validated and ready for reporting
```

This visual guide shows you exactly what to expect at each step

of using the QMRA toolkit, with detailed interface mockups, troubleshooting screens, and result interpretation guides.

Visual Step-by-Step Guide with Interface Examples NIWA Earth Sciences QMRA Team - September 26, 2025