Winnipeg

The City of Winnipeg

Water & Waste Department

Wastewater
Historical Data Retention Standard

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1 INTRODUCTION

This Water and Waste Department Historical Data Retention Standard is intended to serve as a reference for ensuring consistent retention and archival of data produced by the control systems at City of Winnipeg owned wastewater facilities. This document provides guidance to department personnel, as well as external consultants, regarding historical data retention requirements.

1.1 Scope of the Standard

This document is intended to convey general guidance regarding the historical retention of data produced by the control system at wastewater facilities. It is not meant to provide guidance on the legal or regulatory requirements of the various Acts and regulations governing wastewater treatment facilities. However, these documents were used in the development of this standard, and references are provided for information.

This document does not address specifics related to equipment type, selection, and configuration. It is not within the scope of this document to provide detailed design direction, and it will be the responsibility of the respective system designers to fully develop the control system historian with general conformance to the concepts presented herein.

Data produced by means other than the control system is not addressed by this document. This includes offline laboratory analysis, operator measurements, and data from local controllers not connected to the plant historian.

This standard shall not be construed as comprehensive engineering design requirements or negate the requirement for professional engineering involvement. Any design must be executed under the responsibility and seal of the respective engineer in each instance, and must be performed in conformance with all applicable codes and standards, as well as good engineering practice.

1.2 Application

These design requirements will apply to all City of Winnipeg wastewater treatment plants. Where significant deviations from this standard are deemed to be appropriate by the design engineer, these shall be approved by the City.

As technology evolves and new application requirements are identified, it is recommended that this document is updated to ensure that it remains relevant and applicable.

Existing facilities do not necessarily comply with this standard. The expectations regarding application of this standard to new designs at existing facilities must be assessed on a case-by-case basis, however general guidelines for application are presented as follows:

- All new designs, not related to an existing facility, are expected to comply with this standard.
- All major upgrades to a facility, or a larger facility's process area, are expected to comply with this standard, however in some cases compromise with the configuration of the existing facility design may be required.
- All minor upgrades should utilize this standard as far as practical for new equipment, however in some cases compromise with the configuration of the existing facility design may be required.

1.3 Reference Documents

- The Environment Act (Province of Manitoba) - C.C.S.M. c. E125
- Limitation of Actions Act (Province of Manitoba) - C.C.S.M. c. L150
- Canada Water Act (R.S.C., 1985, c. C-11)
- Canadian Environmental Protection Act (S.C. 1999, c. 33)
- Wastewater Systems Effluent Regulations (The Fisheries Act) - SOR/2012-139

2 GENERAL PRINCIPLES

2.1 Availability of Data

The control systems at City of Winnipeg wastewater facilities are capable of monitoring and generating extremely large amounts of data concerning the operation, maintenance, and performance of the wastewater treatment process. This data is available to be archived in a historian database for access at a later date. The archived data may later be used to re-create trends and observe operating conditions from a given timeframe for a variety of purposes including maintenance, troubleshooting, performance monitoring, and regulatory approval.

2.2 Archival Principles

The amount of data archived by a historian can quickly grow to a very large volume if left unmanaged. Although modern storage devices are capable of storing extremely large amounts of data, it is poor design practice to archive more data than is necessary. As an archive is allowed to grow in size, the associated hardware and maintenance costs required to store the data also increase substantially. Backup copies of the archives similarly take longer to create and require additional storage media. Excessively large historical archives also decrease the efficiency of queries and retrieval.

To help ensure the efficiency and effectiveness of the control system historian, archival retention guidelines corresponding to the expected useful life of various types of data are specified in Section 3.1. In addition to configuring the historian software to conform to these guidelines, provisions must be made to ensure that the hardware and software required to access the historical data is maintained throughout the lifetime of the historical records. Alternatively, as the historian hardware and software nears the end of its lifespan, the historical data may be exported to a format that is easily accessed and widely supported at that time.

3 REQUIREMENTS FOR TYPICAL APPLICATIONS

3.1 Recording Interval Requirements

The majority of modern historian software packages are able to dynamically adjust the recording interval of analog data to more rapidly capture rapid changes in values. Similarly, data that does not vary within a pre-defined deadband is sampled at a much slower rate. This allows rapid changes in value to be captured with higher resolution, while avoiding unnecessary logging of points that do not substantially change for long periods of time. In general, deadband and sampling settings must be configured to allow for re-construction of significant spikes and deviations in data.

As with analog data, discrete data is typically recorded at a variable rate wherein only changes in state are recorded. Thus, the logging interval will vary directly in proportion to the number of state and event changes observed.

Because of these dynamic logging capabilities for both discrete and analog data, the Recording Intervals shown in Table 3-1 through Table 3-8 are an order-of-magnitude estimation of the average interval between consecutive samples for each type of data, rather than a pre-set recording interval.

3.2 Retention Periods

The minimum retention periods for various types of information recorded by the control system are shown in Table 3-1 through Table 3-8. Each type of data is categorized as either discrete or analog data. It is anticipated that analog data will require a larger amount of storage per point than the discrete data primarily due to more frequent variation in value. As such, the retention period of analog data is generally shorter than that of discrete data. Despite this, certain analog data that is important for regulatory and environmental protection purposes, such as effluent flow and field-mounted analytical instrumentation data, shall be maintained for an extended period of time. Additionally, the majority of the most important data for many analog points may be captured by recording the average, minimum, or maximum value over a longer time period (hourly or daily), resulting in fewer samples.

The minimum retention period selected for most operational and process data is 2 years. This is based on the Limitation of Actions Act for the Province of Manitoba, which generally requires that most types of legal action take place a maximum of 2 years following an incident. The Canada Water Act and the Canadian Environmental Protection Act similarly have a limitation period of 2 years. Additionally, the Environment Act for the Province of Manitoba requires that data be retained for at least 2 years in the event of any deviations from normal operating procedures, along with any details of equipment failure or maintenance.

A brief survey of guidelines for data retention in other provincial and state wastewater jurisdictions showed that historical data is typically retained for a minimum of 3 - 5 years. As such, the minimum retention periods selected for most types of historical data does not exceed 5 years. A notable exception is historical data pertaining to overall plant performance, such as effluent sample analysis and effluent flows. As this data is critical to assessing and tracking overall plant performance and environmental impact, extended retention of this data is recommended.

The retention times noted only apply to data stored on the plant historian, and the City may choose to keep data for longer periods as part of their internal record keeping.

The following tables contain generalized guidelines for different types and classes of equipment. It is anticipated that there will be exceptions and additions to these guidelines. Exceptions are to be reviewed and approved on a case-by-case basis.

3.2.1 Overall Performance Data

Overall performance data shows the performance of the wastewater plant as a whole, as well as its environmental impact. Retention of this data over an extended period of time is recommended.

Table 3-1 : Data Retention – Overall Performance Data

Data Type	Recording Interval *	Minimum Retention	Notes
Plant Influent Flow	Minute	2 yrs	
Plant Influent Flow Hourly Total	Hour	20 yrs	
Plant Influent Flow Daily Total	Day	20 yrs	Calculated from hourly flow totals
Influent Analytical Data	Minute	1 yr	Currently an offline measurement **
Influent Analytical Data Daily Avg/Max	Day	20 yrs	
Intermediate Analytical Data	Minute	1 yr	Currently an offline measurement **
Intermediate Analytical Data Daily Avg/Max	Day	20 yrs	
Effluent Analytical Data	Minute	1 yr	Currently an offline measurement **
Effluent Analytical Data Daily Avg/Max	Day	20 yrs	
Plant Effluent Flow	Minute	2 yrs	
Plant Effluent Flow Hourly Total	Hour	20 yrs	5 years retention required for the Fisheries act
Plant Effluent Flow Daily Total	Day	20 yrs	Calculated from hourly flow totals

* *Recording Intervals are an order-of-magnitude estimation of the average interval between consecutive samples for each type of data, not a pre-defined recording interval or sampling rate*

** *Recording interval and retention period shown as a guideline for possible future inclusion in control system automated measurement and recording*

3.2.2 Major Equipment Data

Historical data associated with major equipment is likely to be useful in evaluating overall process performance, and helping to determine the cause of failures. Major equipment has the most direct impact on the process, so it is recommended that its historical data be kept for a longer period of time, as compared to historical data for other types of equipment.

Within historical data collected from major equipment, analog data that directly measures process flows and levels should be retained for longer periods of time. Similarly, discrete points that record failure and alarm states have the most potential to provide information relevant to determining the cause of process failures and inefficiencies, and should be retained longer. Analog data that may prove useful for equipment maintenance, but does not directly measure process performance shall be discarded after a shorter period of time.

Some examples of major equipment include:

- Sewage Pumps
- Grit Screens
- Grit Tanks and Pumps
- Clarifiers
- Sludge Pumps
- Reactors
- Aeration Blowers
- Digesters
- Dewatering Centrifuges
- Nitrogen and Phosphorus Removal Equipment
- Chemical Feed Systems

Table 3-2 : Data Retention – Major Equipment Data

Data Type	Recording Interval *	Minimum Retention	Notes
Analog Data			
Motor Speed	Minute	5 yrs	
Valve Position	Minute**	5 yrs	
Tank Level Hourly Min / Max / Average	Hour	5 yrs	
Flow Total Indication	Hour	5 yrs	
Miscellaneous analytical data Hourly Min / Max / Average	Hour	5 yrs	e.g. Turbidity, Dissolved Oxygen
Discrete Data			
Equipment Start/Stop	Event	5 yrs	
Valve Open / Close	Event	5 yrs	
Trouble / Warning Alarms	Event	10 yrs	
Failure Alarms	Event	10 yrs	
Analog Maintenance Data			
Motor / Pump Vibration	Minute	2 yrs	
Motor / Pump Vibration Daily Max	Day	5 yrs	
Motor / Pump Bearing Temperature	Minute	2 yrs	
Motor / Pump Bearing Temp Daily Max	Day	5 yrs	
Motor Winding Temperature	Minute	2 yrs	
Motor Winding Temperature Daily Max	Day	5 yrs	
Motor Amps Average	15 Minute Average	5 yrs	
Oil Temperature Average	15 Minute Average	5 yrs	

* *Recording Intervals are an order-of-magnitude estimation of the average interval between consecutive samples for each type of data, not a pre-defined recording interval or sampling rate*

** *To limit the amount of storage required for Valve Position data, the resolution of the recorded valve position may be set sufficiently coarse to limit the number of samples stored.*

3.2.3 Minor Equipment Data

Minor equipment may or may not be directly related to the process, but the value of the equipment is typically much lower than the major equipment and may have a lower impact on the overall process performance.

Historical data associated with minor equipment will be useful in maintenance planning and diagnostic activities, but may be less useful in determining the cause of overall process issues. Minor equipment has less direct impact on the process, so it is recommended that its historical data be retained for a shorter interval.

Some examples of minor equipment include:

- Valves – Electric Actuated
- Valves – Solenoid
- Sluice/Slide Gates

Table 3-3 : Data Retention – Minor Equipment Data

Data Type	Recording Interval *	Minimum Retention	Notes
Analog Data			
Motor Speed	Minute	3 yrs	
Valve Position - Modulating	Minute**	3 yrs	
Tank Level Hourly Min / Max / Average	Hour	3 yrs	
Flow Total Indication	Hour	3 yrs	
Miscellaneous analytical data Hourly Min / Max / Average	Hour	3 yrs	e.g. Turbidity, Dissolved Oxygen
Discrete Data			
Equipment Start/Stop	Event	5 yrs	
Valve Open / Close	Event	5 yrs	
Trouble / Warning Alarms	Event	5 yrs	
Failure Alarms	Event	5 yrs	
Analog Maintenance Data			
Motor / Pump Vibration	Minute	2 yrs	
Motor / Pump Vibration Daily Max	Day	10 yrs	
Motor Amps	15 Minute Average	5 yrs	

* *Recording Intervals are an order-of-magnitude estimation of the average interval between consecutive samples for each type of data, not a pre-defined recording interval or sampling rate*

** *To limit the amount of storage required for Valve Position data, the resolution of the recorded valve position may be set sufficiently coarse to limit the number of samples stored.*

3.2.4 Auxiliary Equipment Data

Historical data associated with auxiliary equipment may be useful in the troubleshooting and maintenance of that particular equipment, but is unlikely to prove to be important in the direct analysis of process performance. As such, this data will typically be retained for a shorter duration.

Auxiliary equipment is generally not directly part of the process, but will provide miscellaneous services to allow for overall operation of the facility. Some examples of auxiliary equipment include:

- HVAC
- Hot Water Pumps
- Cooling Water Pumps
- Glycol Pumps
- Heat Exchangers
- Potable water system
- Sump pumps

Table 3-4 : Data Retention – Auxiliary Equipment Data

Data Type	Recording Interval *	Minimum Retention	Notes
Analog Data			
Motor Speed	Minute	2 yrs	
Valve Position	Minute	2 yrs	**
Tank Level Hourly Min / Max / Average	Hour	2 yrs	
Flow Total Indication	Hour	2 yrs	
Discrete Data			
Equipment Start/Stop	Event	3 yrs	
Valve Open / Close	Event	3 yrs	
Trouble / Warning Alarms	Event	5 yrs	
Failure Alarms	Event	5 yrs	
Analog Maintenance Data			
Motor / Pump Vibration	Minute	2 yrs	
Motor / Pump Vibration Daily Max	Day	5 yrs	
Motor Amps	15 Minute Average	2 yrs	

* *Recording Intervals are an order-of-magnitude estimation of the average interval between consecutive samples for each type of data, not a pre-defined recording interval or sampling rate*

** *To limit the amount of storage required for Valve Position data, the resolution of the recorded valve position may be set sufficiently coarse to limit the number of samples stored.*

3.2.5 Fire, Gas Detection, and Security

Although fire, gas detection, and security equipment does not typically directly affect the process, it is important from a health and safety perspective.

Table 3-5 : Data Retention – Security and External Access Data

Data Type	Recording Interval *	Minimum Retention	Notes
Analog Data			
Hazardous gas level	Minute	3 yrs	
Hazardous gas daily maximum	Day	20 yrs	
Discrete Data			
Security Alarm / Trouble	Event	5 yrs	
Door open/close	Event	3 yrs	
Motion Sensor	Event	3 yrs	
Fire Alarm / Trouble	Event	5 yrs	
Hazardous Gas Alarm	Event	5 yrs	

* *Recording Intervals are an order-of-magnitude estimation of the average interval between consecutive samples for each type of data, not a pre-defined recording interval or sampling rate*

3.2.6 Electrical Distribution Equipment

Interruptions to the electrical distribution may be very disruptive to the process. Logging major events in the primary and backup power supplies will aid in analysis of process disturbances resulting from power supply disturbances.

Table 3-6 : Data Retention – Electrical Distribution Equipment

Data Type	Recording Interval *	Minimum Retention	Notes
Analog Data			
Main Switchgear Voltage, Current, Power, Power Factor	Minute	5 yrs	
Main Switchgear Harmonics	Hour	5 yrs	
Individual MCC Voltage, Current, Power, Power Factor	Minute	3 yrs	
Individual MCC Harmonics	Hour	3 yrs	
Main Switchgear and MCC Daily Maximum, Minimum, and Average Voltages	Day	5 yrs	
Generator Voltage, Current, and Power	Minute	2 yrs	While generator is running
Generator Vibration, Exhaust Manifold Temperature, Oil Temperature, Oil Pressure, and Fuel Consumption	Minute	2 yrs	While generator is running
Generator Vibration, Exhaust Manifold Temperature, Oil Temperature, and Oil Pressure Daily Max	Day	5 yrs	While generator is running
Discrete Data			
Main / Tie Breaker Status	Event	5 yrs	
Generator Start / Stop	Event	5 yrs	
Generator Fault	Event	5 yrs	
UPS Alarms	Event	5 yrs	
Transfer Switch Operation	Event	5 yrs	

* *Recording Intervals are an order-of-magnitude estimation of the average interval between consecutive samples for each type of data, not a pre-defined recording interval or sampling rate*

3.2.7 Control System Equipment

Failures in the control system hardware and associated communications network are likely to disrupt control and monitoring of the process. Logging control system status information will aid in analysis of process disturbances resulting from these events.

Table 3-7 : Data Retention – Control System Equipment

Data Type	Recording Interval *	Minimum Retention	Notes
Analog Data			
Network Traffic Hourly Avg / Max	Hour	3 yrs	
Discrete Data			
Network Switch Alarms	Event	3 yrs	
Control Network Communications Alarms	Event	3 yrs	
Control System Power Supply Alarms	Event	3 yrs	
Profibus Network Communications Alarms	Event	3 yrs	
PLC Module Fault	Event	3 yrs	
Cyber-Security Related Event Logs	Event	3 yrs	

* *Recording Intervals are an order-of-magnitude estimation of the average interval between consecutive samples for each type of data, not a pre-defined recording interval or sampling rate*

3.2.8 Operator Action Data

Operator Action Data refers to the record data of all operator commands issued from the HMI, field device panels, and local equipment controls (if they are monitored by the control system). Operator commands, and particularly setpoints, are crucial in understanding the operation of the wastewater facility. This data is usually required to reconstruct a sequence of events after a significant abnormal operating event. The importance of this historical data, combined with relatively low frequency of operator commands, merits longer minimum retention times for this data.

Table 3-8 : Data Retention – Operator Action Data

Data Type	Recording Interval *	Minimum Retention	Notes
Discrete Events			
Login / Logout	Event	5 yrs	
Equipment Operation	Event	5 yrs	
Alarm Acknowledgement	Event	5 yrs	
Analog Setpoints			
Setpoint Changes	Event	5 yrs	

* *Recording Intervals are an order-of-magnitude estimation of the average interval between consecutive samples for each type of data, not a pre-defined recording interval or sampling rate*

3.3 Archival Requirements

Control system historical data will primarily be archived on the local hard drive of the historian server. Consequently, this historian hardware must incorporate some form of local data redundancy. This may include a redundant set of hard drives or storage devices in RAID (Redundant Array of Independent Disks) configuration, or a hot-standby Historian server.

In some rare cases, the size of the historical data archive may exceed the storage capacity of the historian server hardware, resulting in the historian server being only able to maintain a rolling window of the most recently collected data. If this situation cannot be avoided by limiting data archival, historical data will need to be periodically copied to a means of external storage in order to maintain a complete archive of historical data.

3.4 Backup and Disaster Recovery Requirements

In addition to the local redundancy provided by RAID storage and server hardware redundancy, measures must be taken to maintain an off-site copy of historical data to safeguard it against physical harm at the local facility. Nightly incremental backups to an off-site server would protect the historical data archive in the event of a catastrophic event at the wastewater facility.