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1.0 Revision History

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| 0        | 02/21/2017    | HDR        | All            | DRAFT
  • Modification as part of APM Program.
  • Restructured to 5 volumes and updated to current industry best practices.
  • New volume containing reports, PCN and other related PCS standards |
| 1        | 05/05/2017    | HDR        | All            | FINAL - Revised to incorporate District Draft review comments.               |
| 1.1      | 12/30/2019    | NEORSD/PJM | All            | Added Revision and Date to the footer.                                       |

2.0 Introduction

This manual is a compilation of The Northeast Ohio Regional Sewer District’s (NEORSD) standards for Process Control System (PCS) programming, configuration and design. It is intended to be applied by the District’s contractors, consultants, and in-house personnel when developing or modifying any portion of the District's PCS. The PCS is a utility-wide system of hardware and software that spans the wastewater collection system and all three wastewater treatment facilities. This document must be treated as both requirements and guidance for PCS work.

This manual is divided into five main volumes:

**Volume 1** contains an introduction to the Process Control System Standards and Conventions Manual. It also comprises District policies and procedures that apply to the use and management of the PCS, including approvals and practices for applying and documenting changes to hardware and software, code changes, alarm management requirements, contractor’s responsibilities related to work performed on the PCS and other related topics. This volume also contains the standards deviation request form.

**Volume 2** addresses practices for development and programming of control processors, primarily programmable logic controllers (PLCs) of various types, including requirements for programming software, databases, alarm processing, networking, control loops, control logic structure, I/O layout and signal processing, tagging and naming conventions.

**Volume 3** includes operator interfaces and the PCS subsystem that provides Human-Machine Interface (HMI) functionality. Volume 3 includes the requirements for programming and configuration of the Area Control Stations (ACSs), historians, servers and the related network infrastructure. Standards for programming and display development for Operator Interface Terminals (OITS), industrial operator interfaces typically located in the field PLC panels, are included in this volume.
Volume 4 includes databases and other PCS interconnected software.

Volume 5 includes design standards for PCS including panel design, Process and Instrumentation Diagrams (P&ID), network architecture and security.

Compliance with the standards and conventions outlined in the manual are required for all projects that add to or modify the PCS. If a contractor or District staff member identifies a need for an addition or modification to the standards for a specific project, or if in the course of the work it is found that some part of the standards cannot be adhered to, a Standards Deviation Request may be submitted in accordance with the requirements of that section.

Refer to section 6.0 for a complete list of all NEORSD standards and forms, and industry standards and best practices referenced in this manual.

3.0 Abbreviations

The following is a list of applicable acronyms and definitions which may be utilized throughout the Automation Standards and Conventions Manuals.

- **A2ALMDB** Wonderware Alarm and Event Database
- **ACS** Area Control Stations
- **AOI** Add-On Instruction (RSLogix PLC)
- **AOS** Application Object Server (Wonderware)
- **APM** Automation Program Management
- **BTL** Base Template Library (Wonderware Scripting)
- **CAD** Computer-Aided Drafting
- **CAT** Category - relates to communication cable types such as CAT5, CAT6, etc.
- **CIP** Capital Improvement Project
- **CLX** Allen-Bradley ControlLogix PLC
- **CPU** Central Processing Unit
- **DAS** Data Acquisition Server (Wonderware)
- **DASABCIP** Data Acquisition Server – Allen Bradley IP Driver
- **DASABTCP** Data Acquisition Server – Allen Bradley TCP driver
- **DASMBTCP** Data Acquisition Server – Allen Bradley Modbus TCP driver
- **E&C** Engineering and Construction
- **EMSC** Environmental and Maintenance Services Center
- **FBD** Function Block Diagram
- **HMI** Human Machine Interface
- **ID** Identification
- **IO or I/O** Input/Output - refers to process signals or signal processing equipment
- **IP** Internet Protocol
- **ISA** International Society of Automation
- **IT** Information Technology
- **JSR** Jump Subroutine
- **LAN** Local Area Network
- **MOC** Management of Change
4.0 Overview

The following sections detail the required standards and provide development guidance for Databases, Reports and Other Integrated Software which interact with the NEORSD Process Control System (PCS). In general, this section addresses interactions with PCS from software packages which are not critical to monitoring and control and are not PCS OEM provided packages.
5.0 Process Reports

5.1 Background
This NEORSD standard addresses project requirements related to:

- Identification, specification and implementation of process data-related reports that may need to be created or modified as the result of the work included in projects involving the PCS.
- Functionality requirements for report software applications.
- Guidelines for report definition and implementation.
- Report data retention policy.

The objectives of this standard are:

1. To ensure that process reporting impacts are addressed under each contracted project such that when each project is completed, no work is needed by the District to create new reports, or delete or modify existing reports.

2. That the District’s process data reporting hardware and software infrastructure and functionality meets all users’ needs at all times.

Special Note: For some capital projects NEORSD includes process control system integration, configuration and programming services in the Contractor’s scope of work, while on a growing number of projects the responsibility is placed upon the District’s Design Consultant or a third-party service provider.

In all cases, the responsibility to investigate, identify and specify process report requirements lies with the design Consultant.

Implementation-related services that are described throughout this Section must be written by the Design Consultant and either included in the Contract Specifications if the Contractor’s System Integrator will provide the programming services, or submitted as a Process Report Specification Document for review by the District if the Consultant or third-party will act as the Owner’s Application Programmer. In the following subsections of Section 5.0, references to “Programmer” shall mean the Contractor’s System Integrator for projects under which the Contractor will perform the programming, and as Owner’s Application Programmer for other projects. References to “Specifications” shall be interpreted as either the Contract Specifications or Process Report Specification Document as applicable.
5.2 General

The District relies on accurate, readily-accessible and reliable reports for:

- Decision-making for operation of wastewater and stormwater processes
- Governmental regulatory compliance reporting
- Tracking and evaluating process and control system condition and performance
- Analyzing the impact of, and response to, storm events, equipment failures, power failures and other disruptions
- Planning its capital and strategic programs
- Providing internal and public information.

Projects undertaken by the District often affect the content of existing reports and/or require development of new reports. Examples of projects and other initiatives that may affect reports are:

- Process Modifications: Design of new, expanded or modified wastewater collection and treatment process units, facilities, infrastructure, controls, equipment and instrumentation
- Control System Modifications: Expansion, modification or reconfiguration of any part of the District's process control and automation systems that may affect report content, real-time or historical database content or access, report production, and report distribution
- Operational Needs: New or modified operational strategies, automation initiatives, operator decision support requirements, changing or expanding use of energy and chemicals, alarms, events, operator accountability, and global process management strategies
- Maintenance Needs: New points to compute and store elapsed running time data for equipment, motor condition monitoring, mechanical and electrical data and alarms, calibration data, signal quality indicators, asset data, etc.
- Regulatory Requirements: Changes to the District's compliance monitoring and reporting requirements stemming from new or modified regulatory statutes or other mandatory reporting requirements
- Other mission-related reporting needs including, but not limited to, network performance and availability reporting, laboratory data, monitored water and air quality data, system and network security, process management, administrative reports, engineering and planning assessments, process studies, and project development support data.

To accomplish the objectives of this Standard, Consultants shall provide comprehensive investigation of the District’s reporting needs as they pertain to each project. Each consultant shall develop the process control report requirements carefully and work closely with the Operation and Maintenance Department and other District stakeholders to understand and satisfy the District’s report elements. Consultants shall conduct workshops with District staff and stakeholders to verify and validate the reporting needs during design, and to identify factors affecting report configuration such as user access restrictions, report activation, and report distribution.
5.3 Investigation and Specification of Reporting Requirements

Consultants performing work for the District shall provide the following report-related services during the planning and design stages of projects that affect the District’s process facilities, process parameters and/or Process Control System (PCS) in any way:

- Investigate whether each project they undertake will have an impact on the District’s existing process data reports, require development of new reports, or affect the data archiving, report development, or report production system.
- Develop new or modified reports and/or design reporting system infrastructure and functionality as needed to accommodate the District’s reporting needs for projects under which reports or report generating capabilities are affected.
- Define the report structure, content, scheduling, and deployment plan based on users’ needs for new or modified reports.
- Implement specified new and modified reports and/or reporting capabilities.

In order to assess the impact of a new project on the existing Process Control System, the consultant shall become familiar with the District-wide PCS and existing process data reports and reporting tools.

To properly integrate new work and mitigate adverse impact on the District’s operations, the consultant shall work closely with District staff, conducting report development workshops and report design and specification reviews.

Planning of implementation, testing and phase-over of process reports shall be part of the overall project planning and shall be a collaborative workshop process with District personnel. Special emphasis shall be placed on regulatory and operational needs. District workshop attendees shall be determined on a project-specific basis. The Consultant shall coordinate with the District project manager to identify areas of impact and affected stakeholders whose input should be solicited to help define the report-related work. All workshops shall include representation from Operations & Maintenance; additional participation may be required from personnel representing Information Technology (IT), Process Control and Automation (PC&A), District management, or the District’s commissioning manager.

Each consultant shall study and take into account federal, state and local rules and regulations that require compliance reporting. Consultants shall identify any governmental agencies, District departments, and other entities that require Process Control System generated reports, specify the process data retention requirements, identify the types of reports to be included in the project specifications, and create the Specifications that define the report development.

Each consultant shall review and become familiar with the District’s current and pending water and air quality permits and any other government or judicially issued reporting regulations and mandates in order to determine:
• Whether process interruptions or instrumentation and Process Control System work within the project scope will cause data for any regulated parameters to be unavailable for reporting
• Whether Process Control System work will have any effect on the District’s ability to produce compliance reports in the normal manner
• Whether compliance reports must be expanded or modified to accommodate new parameters, data aggregations or other reporting details resulting from the project work.

Consultants shall determine, through investigation and collaboration with the District, whether any existing, non-regulatory, reports will be affected, and whether new reports are needed.

Note: Ad hoc reports are not a subject of this Standard. Only standing reports that are run on a regular basis or are run on demand or under specific circumstances are included in this requirement.

Consultant shall appropriately specify each modified or newly-created, preconfigured report to be:

• Accessible for viewing and/or downloading on demand via portable devices, whether through web-based access or direct wireless connection to the District’s Process Control System or business networks.
• All reports shall be configured to be initiated based on one or more of the following trigger types:
  o Initiated on demand via HMI workstations or other Process Control System access points (initiated by users when needed)
  o Event-triggered (initiated under specific process or Process Control System conditions)
  o Scheduled (automatically initiated based on fixed or adjustable schedule.)

Examples of types of standing reports that the District utilizes are:

• Monthly Discharge Monitoring Reports
• Annual Discharge/Water Quality Reports
• Annual Production Reports
• Monthly/Daily/Weekly Production Reports
• Monthly/Daily/Weekly Raw Materials Usage Reports
• Alarm Summary Reports
• Shift Reports by Facility/Process Area/District
• Process Control System Network/Communications Status Reports
• Statistical Analysis Reports
• Event Reports/Logs
• Energy/Chemical Consumption
• Graphical Reports or Report Components – e.g. Trends, Tables, Pie Charts, Bar Charts, Scatter Plots, etc.
Templates for any applicable existing reports shall be requested from the District for inclusion in the Specifications for use by the firm responsible for report development.

5.4 Report Definition

After the Consultant becomes familiar with the regulatory and user reporting requirements, assesses the impact of the project on report data and report generation, and identifies needed report modifications and/or report development resulting from the project work, the Consultant shall develop detailed report definitions for inclusion in the Specifications. The report definitions shall include all information necessary for a qualified Programmer to configure and implement the needed changes on the existing Process Control System. For each new or modified report, the report definition shall include:

- Report title and description
- Page layouts for printed reports that conform to District standards and, where applicable, regulatory requirements
- Screen layouts for HMI, OIT, web-based or mobile device display reports
- Database tags associated with each report column, field, graphic, etc.
- Data computations, aggregations, averages, totals, quality codes, minimums, maximums, etc. as determined during report development workshops
- Report generation requirement; hardcopy, on-screen, electronic file in XML or other formats that are useful to the District, etc.
- On-line report format requirements (where applicable) – screen readable, printer ready, downloadable, plain text, Excel, pdf, portable device formats, etc.
- User-specific or job title-specific rights for report modification, report scheduling, and on-demand report initiation
- Facility, workstation and remote access specific domain definition (Specific computers that are allowed to view, initiate or modify individual reports)
- Other information needed by the Programmer to facilitate successful development, deployment and implementation of each report.

5.5 Report Configuration Requirements

This section is intended to provide general report configuration requirements to be included in the Specification and utilized by the Programmer during report implementation:

- Reports lay-out shall not allow context areas to split across pages. Define page breaks such that all data for a particular context area falls within a single page.
- Reporting software shall be utilized to perform all calculations, scaling and other data manipulation at time of data query. (i.e. calculations shall not be performed within Excel cells)
- Saved report output file shall not require data link to source data for viewing. File and data integrity shall be retained when files are viewed from PC outside of the District network.
• Saved reports shall conform to the following naming example or other format defined elsewhere in the NEORSD PCS Standards and Conventions Manual:
  o REPORTNAME_YYYYMMDD
• Font size less than 10-point is not allowed unless required by regulatory report authority.

5.6 Report Implementation

After reports have been defined and formats accepted by the District, the Programmer shall develop and deploy the required reports as defined in the Specifications and provide all testing, training and close-out services related to the Report Implementation.

The following activities must be carried out by qualified personnel:

• Implementation
  o Develop and submit report formats for review and approval prior to implementation of logic, calculations or other advanced features
  o Reports shall follow the configuration requirements stated in Section 5.5
• Testing
  o Develop and submit Test Plan
  o The Test Plan, at a minimum, shall address validation of all data points including ranges, report triggers, report distribution destinations, file storage, security and accessibility.
  o Comply with District Applications Management of Change Policy (reference Volume 1 Section 8.0 of this Manual).
• Training
  o Develop and submit a Training Plan to meet District Training Guidelines and any project-specific requirements
  o Training Plan shall address needs of each stakeholder for the new or modified reports under this project
• Close-out
  o Final copies of all reports
  o As-Built report design documentation and backup copies of native files.

5.7 Record Retention

Reports are subject to NEORSD record retention policies. Reports shall be stored for the following periods:

• Electronic reports available from reporting package or saved report – 5 years on-site.
• Electronic reports available from saved report or data restoration – 10 years off-site data and report image repository.
• Electronic records will be deleted after 15 years.
• All printed reports are subject to NEORSD record retention policies and procedures.
6.0 Reference Documents

Table 6-1 contains a complete listing including live links to all referenced District standards and forms, and industry standards and best practices.

Table 6-1 Reference Documents

<table>
<thead>
<tr>
<th>Document Title</th>
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<tbody>
<tr>
<td>Control of Hazardous Energy (lockout/tagout) – 29 C.F.R. § 1910.147</td>
</tr>
<tr>
<td>ISA88, Batch Control Standard</td>
</tr>
<tr>
<td>ISA101, Human-Machine Interfaces Standard</td>
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<tr>
<td>NEORSD Asset Tag Abbreviations File</td>
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<tr>
<td>NEORSD Process Control Description Design Standard</td>
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<tr>
<td>NEORSD Standard Object Library Programming Guideline</td>
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<tr>
<td>One Point Lesson (OPL)</td>
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