Distributed Control System Design Standards

I. Background and Overview

A. The City’s Program Standards and Procedures (PSP) are intended to be used in conjunction with the data contained in related standards and procedures. They are not intended to be used as stand alone documents. It is the responsibility of the Designer to become familiar with all the PSP documents and comply with the criteria set forth as a whole.

B. The purpose of this document is to specify the control system standards that will be followed during the design, configuration, and commissioning phases of a Distributed Control System (DCS) project at the City of Salem, Willow Lake Water Pollution Control Facility (WLWPCF). Implementation of these standards will ensure uniformity and consistency throughout the DCS which will simplify the City’s operation and maintenance tasks. The Designer should be aware that the DCS at WLWPCF is an Invensys/Foxboro Intelligent Automation (I/A) series system. This Distributed Control System Design Standards includes the following sections:

II. General Requirements
III. Nameplates and Labels for DCS Enclosures
IV. Enclosures
V. System Grounding
VI. Cabling
VII. Uninterruptible Power Supplies
VIII. System Hardware Components
IX. Station and Fieldbus Module Naming
X. System Definition
XI. Control Algorithm Development
XII. Process Display Development
XIII. Historians
XIV. Alarming
XV. Process Trends

C. Throughout this document the Designer is directed to reference the WLWPCF Internal DCS Configuration Standard. It is required that the Designer follow the specific plant DCS standards that are detailed in the referenced document.

D. The Design Team shall apply this design standard in the preparation of the project documents.

E. Designer shall adhere to the design standards without exception unless permission is granted by the Project Manager to deviate from these standards. The Project Manager
shall be notified in writing of the need to deviate from any standard and approval issued by the Owner in writing before the design deviation is made. Approval will be authorized by the Project Manager in writing before the design deviation is made. Should a design be made that deviates from these standards without approval from the Project Manager, the Designer shall bear the cost of modifying the design to conform.

F. Intended Document Users.

This document is intended to be utilized by the Designer for the implementation of a DCS project at WLWPCF. This document has been developed with the assumption that the users are familiar with the Invensys/Foxboro DCS and the various configurators that must be utilized to implement a DCS project. This document provides the users with guidelines for developing the following deliverables associated with a WLWPCF DCS project:

1. Required DCS hardware.
2. Control logic configuration.
3. Graphic design.
4. Graphic configuration.
5. Historian configuration.
6. Alarm configuration.
7. Trend configuration.

G. System Overview:

1. The Invensys/Foxboro DCS at WLWPCF provides control and monitoring of plant processes and equipment from workstations that are located throughout the plant. It also provides process information to the City network for reporting. The DCS is a multi-node networked system connected by Carrierband LANs (Local Area Networks). It is comprised of Unix based workstations, Control Processors, Instrument Gateways, I/O Modules, and Communication Processors all located throughout WLWPCF. Refer to the WLWPCF Internal DCS Configuration Standard (Appendix C) for a network diagram of the WLWPCF DCS system.
2. At each workstation the operator interface (display manager) utilizes process graphics to provide the monitoring and control interface for operations and maintenance staff. Control algorithms are executed in the control processors and control is achieved via the Fieldbus Modules which connect to the physical equipment to be operated. Various software packages provide historical tracking of plant data, alarming capabilities, operator action tracking, and status of all stations on the DCS network.

II. General Requirements

General requirements shall be pursuant to Section II - Measurement and Control Design Standard.

III. Nameplates and Labels for DCS Enclosures

DCS enclosures shall be labeled pursuant to Section V - Process Identification, Finishes and Labeling Design Standards.

IV. Enclosures

A. Invensys/Foxboro offers a wide selection of enclosures. When an enclosure(s) are required, the available models will be evaluated and the determination will be made at that time which model will be utilized.

B. If Invensys/Foxboro DCS enclosures are utilized they shall be Owner provided.

C. All non-Invensys/Foxboro DCS enclosures shall be provided by the Contractor.

D. DCS enclosures shall be pursuant to Section IV - Measurement and Control Design Standards.

V. System Grounding

A. System power and enclosure grounding shall be pursuant to Master Guide Specification, Section 16060 - Grounding and Bonding.

B. System equipment grounding shall be Owner provided.

C. System equipment grounding shall include Nodebus, Fieldbus, Carrierband LANs, and Signal (DC logic).

D. System equipment grounding shall be pursuant to specification detailed in the Invensys/Foxboro Equipment Installation Guide.
VI. Cabling

A. All DCS hardware component and communication cable connections shall be Owner provided.

B. Fieldbus cables shall be pursuant to Master Guide Specification, Section 13430 - Boxes, Control Panels, and Control Centers.

C. Fiber optic cables shall be pursuant to Master Guide Specification, Section 13430 - Boxes, Control Panels, and Control Centers.
   1. Fiber optic cable utilized for Carrierband LANs shall be terminated with industry standard ST type connectors.
   2. Fiber optic cable utilized for Invensys/Foxboro A2 equipment (100 mbs nodebus) shall be terminated with industry Trend Configuration Standard MT type connectors.

D. Shielded Coaxial cables (RG11) utilized for Carrierband LANs shall be pursuant to Master Guide Specification, Section 13430 - Boxes, Control Panels, and Control Centers.

VII. Uninterruptible Power Supplies

Uninterruptible Power Supplies shall be pursuant to Measurement and Control Design Standard, Section VI - Uninterruptible Power Supply for Control Equipment.

VIII. System Hardware Components

A. All system hardware components shall be Owner provided.

B. All system hardware components shall be pursuant to Section II.B - WLWPCF Internal DCS Configuration Standard.
   1. Carrierband LANs:
      a. Copper Carrierband LANs are currently being utilized at WLWPCF. Any future LANs will be fiber optic.
      b. All Carrierband LANs shall be fault tolerant.
   2. Workstations:
      a. The Invensys/Foxboro company continually qualifies and offers new workstation models for the DCS. Available technology will be evaluated at the time a new workstation is required. The determination will be made at that time which model will be utilized.
b. All workstations will utilize the Unix operating system as a software platform.

3. Control stations:
   a. Control processors shall be utilized for control stations whenever possible.
   b. All control processors shall be fault tolerant.
   c. If there is a need to communicate to a proprietary system that cannot be achieved through a control processor, the Project Manager shall make the determination which Invensys/Foxboro control station will be utilized. This determination will be based on the communication protocol of the proprietary system.
   d. The Invensys/Foxboro company continually integrates new technologies into the DCS control stations. Available technology will be evaluated at the time a new control station is required. The determination will be made at that time which model of control station will be utilized.

4. Fieldbus Modules:

   Fieldbus Modules that are to be hosted by a control processor models 30, 40, or 40B shall be legacy series. All other Fieldbus Modules shall be 200 series.

5. System peripherals:

   Peripheral devices shall include printers, graphic controllers (GCIOs), annunciator keypads, and communication modules.

IX. Workstation, Control Station, and FBM Naming and Labeling

A. Workstation, control station, and Fieldbus Module naming shall be Owner provided.

B. All workstation, control station, and Fieldbus Module naming assignments shall be pursuant to, Section III.P - WLWPCF Internal DCS Configuration Standard.

X. System Definition

All system definition/configuration shall be Owner provided.
XI. Control Algorithm Development

A. All Control Algorithm development for the WLWPCF shall be Owner provided.

B. Control Algorithm design shall be pursuant to Section III.C - WLWPCF Internal DCS Configuration Standard.

XII. Process Display Development

A. All display configuration shall be Owner provided.

B. DCS process displays shall be developed pursuant to Section III.K - WLWPCF Internal DCS Configuration Standard.

XIII. Historians

A. The current standard for DCS historians at WLWPCF is the Invensys/Foxboro Aim Historian. When a new historian is required to be added to the DCS, available Invensys/Foxboro historians will be evaluated and the determination will be made at that time which historian shall be utilized.

B. All historians shall be Owner provided.

C. All historian configuration shall be Owner provided.

D. Historian configuration shall be pursuant to Section III.I - WLWPCF Internal DCS Configuration Standard.

XIV. Alarming

A. Alarming shall be pursuant to Section XVII - Alarms, Measurement and Control Design Standards.

B. Alarm configuration shall be pursuant to Section III.J - WLWPCF Internal DCS Configuration Standard.

XV. Process Trends

A. Process trends shall be Owner provided.

B. Process trend configuration shall be pursuant to Section III.L - WLWPCF Internal DCS Configuration Standard.

—End of Section—