1.0 PURPOSE AND SCOPE

This standard establishes the requirements for process displays (Human-Machine Interfaces) that are being designed or acquired for process monitoring and control systems of Washington River Protection Solutions LLC (WRPS) facilities and managed projects.

This standard is intended to be used by the design agent and system integrators to ensure that human factors are considered in the design process consistent with TFC-PLN-09, “Human Factors Program.”

In addition, this standard provides requirements relating to the hardware or physical design characteristics of control panels or any similar devices or components that are used in the Tank Farm facilities and/or projects.

2.0 IMPLEMENTATION

This standard is effective on the date shown in the header. Systems designated in Operation prior to the issue date may not comply with the current standard. For these systems, as updates are performed, the systems should be updated to comply with the new standard. If a requirement spelled out in this document cannot be satisfied, justification of an alternative design shall be submitted for approval to the Design Authority.

3.0 REQUIREMENTS

3.1 Process Display Requirements

3.1.1 Colors and Fonts

1. The background color for graphic displays shall be RGB Color Code 185, 173, 132 (dark tan). When a contrasting background color is needed, this shall be RGB Color Code 221, 216, 200 (light tan). (5.1.1)

2. All graphics shall use the “Tahoma” font. (5.1.1)

3. To maintain consistent color indication, all graphics shall follow the RGB colors set in Table 1. (5.1.1)

Table 1. Text and Color Status Indication.

<table>
<thead>
<tr>
<th>Text Indication</th>
<th>RGB Color</th>
<th>Color</th>
</tr>
</thead>
<tbody>
<tr>
<td>ON</td>
<td>(0,255,0)</td>
<td>Green</td>
</tr>
<tr>
<td>OFF</td>
<td>(255,255,255)</td>
<td>White</td>
</tr>
<tr>
<td>RUN</td>
<td>(0,255,0)</td>
<td>Green</td>
</tr>
<tr>
<td>STOP</td>
<td>(255,255,255)</td>
<td>White</td>
</tr>
<tr>
<td>ALARM</td>
<td>(255,0,0)</td>
<td>Red</td>
</tr>
<tr>
<td>NORMAL</td>
<td>(255,255,255)</td>
<td>White</td>
</tr>
<tr>
<td>OPEN</td>
<td>(0,255,0)</td>
<td>Green</td>
</tr>
</tbody>
</table>
4. Blinking or flashing shall be at a consistent rate throughout all screens. (5.1.1)

5. Blinking within a window should be synchronized.

6. For items not in Table 1, the Design Agent shall select color combinations that provide good contrast and obtain approval from the Design Authority. (5.1.2)

### 3.1.2 Time and Data Format

1. Time information shall be presented in 24-hour clock format (hh:mm:ss) and shall not include a.m. or p.m. indications. (5.1.1)

2. The format for the date shall be mm/dd/yyyy. (5.1.1)

3. Data that is arranged in rows and columns shall have titles that make the data entries clearly distinguishable. Data should be sortable and numeric data should be justified on the decimal point. (5.1.1)

### 3.1.3 Hierarchy

1. Overview screens shall be for navigation only and limit object access. (5.1.1)

2. The Overview screens shall allow navigation to Process graphics which mimic Piping & Instrumentation Diagrams (P&ID) and allow object control. (5.1.1)

3. Control shall be available by selecting display objects or values. (5.1.1)

4. The Operator should be provided with a simple means to go to the Overview screen, Log-in screen, or forward and back up a level of the hierarchy.

5. All Process graphics shall be arranged with a similar layout. (5.1.1)

6. Maintenance/Diagnostic Screens should be developed which display Discrete I/O status, Analog IN (AI) values, Analog OUT (AO) values, Controller or PLC Communication information-Diagnostics, and any ancillary connected equipment (i.e., VFD status, remote I/O from other connected systems).

### 3.1.4 Symbology

1. Instrument values shall have text on the graphics to describe the source of the reading. Text may be abbreviated, such as TI-1234. (5.1.1)

2. Objects shall have text on the graphics to describe the object. Text may be abbreviated, such as Tank-102. (5.1.1)
3. If the text to describe an instrument and/or object is abbreviated, the system shall have a method to link the text to the full equipment identification number (EIN), so the object can be linked to the full name in the maintenance database. One suggested method is the mouse-over of an object will display a tool-tip with the full EIN. (5.1.1)

4. Abbreviations and symbols that define the component functional identifiers shall conform to tank farm component identifiers listed on drawings H-14-020000 (sheets 1 through 4, for tank farm piping and instrumentation drawings) and H-14-030000 (sheets 1 and 2, for tank farm electrical systems). (5.1.1)

5. When no tank farm facility or project specific symbol exists, or when the existing symbol is not suitable for a screen, national standards and industry practices should be consulted for symbol development.

6. Symbols may be rotated in any orientation to represent the process clearly.

7. Crossing of process lines should be avoided. Where this is unavoidable, precedence should be given to the primary process, vertical line; that is, the horizontal line should break either side of the cross-over.

8. All process flows shall be labeled at entry or exit of the screen and shall be indicated by arrows shown when a line joins or leaves the screen. (5.1.1)

9. Use of three-dimensional graphics, animation, etc., should only be used when it provides the Operator with additional information that enables effective decision-making.

### 3.1.5 Equipment Indication

1. It shall be indicated on the graphic when equipment is in an interlock condition. (5.1.1)

2. It shall be indicated on the graphic when equipment or signals are in a forced condition. (5.1.1)

### 3.1.6 Operator Interaction

1. A control movement upwards, to the right, or clockwise shall result in an increasing value. (5.1.2)

2. Conversely, a control movement downward, to the left, or counterclockwise shall result in a decreasing value. (5.1.2)

3. Actions to control equipment shall require at least two keystrokes with the option to cancel after the first. (5.1.2)

4. To reduce the risk of accidental activation, ‘double-clicking’ on a single target area shall not be used as a confirmation step. (5.1.2)

5. When options are selected, the on-screen button shall appear ‘depressed.’ The button shall remain depressed until the action has been completed. If, for any reason, the data input is not acceptable, an error message shall appear identifying/recommending the corrective action to the Operator. (5.1.2)
6. Process operations shall be provided with positive feedback mechanisms to clearly identify the state change of operating equipment. (5.1.2)

7. Operators shall be provided with information concerning the progress of lengthy operations (such as a slow cycling of a valve). (5.1.2)

8. The system shall prompt the Operator when data entry is required. Any erroneous entry should be displayed until corrective action has been taken. It is recommended that error messages should be informative and indicate possible remedial actions, for example, “Value entered exceeds allowed setpoint, enter a value of 150 gpm or less” rather than “Invalid input.” (5.1.2)

9. Functions not available to a specific user shall either not be visible or if visible, be in an unavailable status (e.g., “grayed”). (5.1.1)

10. Function keys may be used for applications, provided that each key is assigned a single function and that the same function exists for the same key in any related applications.

11. Pushbuttons used for accepting or canceling or other similar functions shall be consistent in appearance and size, clearly distinguishable from other types of pushbuttons (for example, process control). (5.1.1)

12. Tank farm facility items and/or equipment that are not controlled by a computerized system (passive devices) may be displayed on screens as static items to provide the Operator with contextual information.

13. The Operator shall have a simple means to follow process information from screen to screen. This may be accomplished by showing target areas on the ends of the process or the use of menus. (5.1.1)

14. An on-line help system shall be provided. This system shall be consistent with any paper-based manuals that are provided. (5.1.1)

### 3.1.7 Indicating Components

1. Engineering units shall be clearly labeled. (5.1.1)

2. Engineering units shall be consistent with those in the Tank Farm Maintenance Database. (5.1.1)

3. Totalizers, timers, and counters shall be resettable, either by a user or automatically. (5.1.1)

4. Totalizers, timers, and counters shall have the ability to totalize for a minimum of one year. (5.1.1)

### 3.1.8 Trends

Trends are screens that are used to display data in graphical format.

1. The number of channels should be configurable, but generally should not exceed six.
2. When multiple trends exist, color-coding shall be used to clearly differentiate between variables. (5.1.1)
3. Trend lines and labels should be the same color, if color is used.

3.1.9 Alarms

The HMI alarm system interface is designed to alert Operators of off-normal conditions requiring action, guide Operators to appropriate responses, assist in determining tank farm facility or project status, and minimize distracting, nuisance alarms. For additional alarm requirements, see TFC-ENG-STD-40.

3.1.10 Alarm History

The Alarm History List shall catalog alarms over a minimum of one month. (5.1.1)

3.1.11 Event History

Events and Operator Actions shall be captured for a minimum of one month. (5.1.1)

3.1.12 Auditory Alarms

NOTE: The following auditory requirements are only for control areas and may not be applicable for field installations.

1. Systems shall be capable of auditory alarms in order to direct the Operator to take appropriate action. (5.1.1)

2. An auditory test feature shall be available from each workstation. (5.1.1)

3. A separate “Silence” feature should be included to silence without acknowledging. However, any newly initiated alarm reactivates the audible alarm.

3.2 Workstation Access Control

1. Workstations require a log-on process that is expected to be completed before any system function can be accessed by the user. At a minimum, the log-on process shall require the user’s name and password to be correctly entered for system access. (5.1.3)

2. Operators shall be restricted in application access based on the user’s login. Workstation configurations are generally limited for Operators, in that, typical Windows functions (such as ALT-TAB, or the Task Bar) are disabled. (5.1.3)

3.3 Control Panel/Cabinet Color Coding

Each control panel/cabinet (hardware) shall use the color coding for lights and switches identified in Table 2. (5.1.2)

Table 2. Color-Coding for Control Panel/Cabinet Indicators.
### Component and Color

<table>
<thead>
<tr>
<th>Component</th>
<th>Color</th>
</tr>
</thead>
<tbody>
<tr>
<td>Caution Alarm or Annunciator (Unacknowledged)</td>
<td>Flash Yellow (Amber)</td>
</tr>
<tr>
<td>Caution Alarm or Annunciator (Acknowledged)</td>
<td>Solid Yellow (Amber)</td>
</tr>
<tr>
<td>Danger Alarm or Annunciator (Unacknowledged)</td>
<td>Flash Red (Red)</td>
</tr>
<tr>
<td>Danger Alarm or Annunciator (Acknowledged)</td>
<td>Solid Red</td>
</tr>
<tr>
<td>Alarm or Annunciator - Normal Condition</td>
<td>Lamp Off or Dim White</td>
</tr>
<tr>
<td>Control Circuit Indicating Lamp - Circuit Energized and Equipment Not Operating (e.g., Pump, Fan, Air Compressor)</td>
<td>Green</td>
</tr>
<tr>
<td>Control Circuit Indicating Lamp - Circuit Energized and Equipment Operating (e.g., Pump, Fan, Air Compressor)</td>
<td>Red</td>
</tr>
<tr>
<td>Control Circuit Indicating Lamp - Circuit Not Energized (e.g., Pump, Fan, Air Compressor)</td>
<td>No Color (Neither Green Or Red)</td>
</tr>
<tr>
<td>Circuit Breaker Open Indicating Lamp</td>
<td>Green</td>
</tr>
<tr>
<td>Circuit Breaker Closed Indicating Lamp</td>
<td>Red</td>
</tr>
<tr>
<td>Valve - Full Open Position Indicating Lamp</td>
<td>Green</td>
</tr>
<tr>
<td>Valve - Closed Position Indicating Lamp</td>
<td>Red</td>
</tr>
<tr>
<td>Valve - Between Full Open and Closed Positions - Indicating Lamp</td>
<td>No Color (Neither Green Or Red)</td>
</tr>
<tr>
<td>Process Permissive Indicating Lamp - Condition Met</td>
<td>Green</td>
</tr>
<tr>
<td>Process Permissive Indicating Lamp - Condition Not Met</td>
<td>Red or Yellow (Amber)</td>
</tr>
<tr>
<td></td>
<td>Depending on Caution or Danger Condition</td>
</tr>
</tbody>
</table>

### 4.0 DEFINITIONS

**Alarm.** A visual and audible notification of an automatic process or safety system trip or failure of the control system. Operator action is typically required.

**Annunciator.** An indicator of the status of a parameter, component, system, or function that does not necessarily require the attention of operations personnel. When such attention is required, an alarm condition exists.

**Component.** An individual piece of equipment such as a pump, valve, or vessel; usually part of a sub-system or system.

**Event.** A changing point or alarm state usually followed by a defined course of action.

**Facility.** The facilities of the tank farms. Includes the various programs, projects and associated systems and components of the tank farms.

**Human-machine interface.** Human-machine interface between user and terminal or system that consists of a physical section and a logical section dealing with functional operation states. A system that consists of a combination of hardware and software.

**Interlock.** Occurs when an object is prevented from operation by a process condition.

**Mouse-over.** Occurs when the cursor is hovered over an object.
**Parameter.** Parameters are typically measures of the performance of systems and processes of the facility.

**Pop-up menu.** Appears temporarily when you click the mouse button on a selection. Once you make a selection from a pop-up menu, the menu disappears.

**Pull-down menu.** A menu that appears when a menu bar option is selected.

**Setpoint.** The value of a monitored parameter that defines the boundary between the parameter’s normal range and an alarm condition. An alarm condition exists when the parameter exceed the normal range that is defined by the upper and or lower limit setpoints. Graded alarms may have multiple setpoints outside of the normal range that produce alarms that indicate increasing levels of severity of the abnormal conditions.

**System.** An integrated collection of components and control elements that operate together and possibly in conjunction with other systems to perform a function.

### 5.0 SOURCES

#### 5.1 Requirements

1. TFC-PLN-09, “Human Factors Program.”


#### 5.2 References

1. TFC-BSM-AD-C-01, “Administrative Document Development and Maintenance.”

2. TFC-ENG-DESIGN-D-29, “Guidance for Inclusion of Human Factors in Design.”


5. H-14-020000, Tank Farm System P&ID Drawing Legend.