The documentation requirements for a given project include all materials used in design, planning, construction, operation, and maintenance. Each year industry faces increased pressures from regulatory agencies to maintain a safe and secure workplace. In the United States, these agencies include the Occupational Safety & Health Administration (OSHA), the U.S. Environmental Protection Agency (EPA), State Departments of Environmental Quality (DEQ), the U.S. Department of Transportation (DOT), and the U.S. Department of Homeland Security (DHS). Industry has developed various procedures in order to comply with these requirements, as well as those imposed by state and local governments. As a result, project documentation now extends far beyond traditional prints and drawings.

2.0 SITE PROCEDURES

Each site presents a complex set of safety, security, operations, and environmental issues. These vary greatly from industry to industry and are often unique to a specific location. To address them, most companies maintain site procedures for each location (see example in Figure 2-1).

FIGURE 2-1
Typical Site Procedure

<table>
<thead>
<tr>
<th>Instructions &amp; Methods</th>
</tr>
</thead>
<tbody>
<tr>
<td>Revision Date</td>
</tr>
<tr>
<td>Prior Revision Date</td>
</tr>
</tbody>
</table>

Site & Safety Standards Guidelines

This Instruction and Method applies to all Company members, contract personnel, governmental agency personnel, and visitors who enter or perform any services on property or sites owned or operated by the Company.
Site procedures establish the operating authority for the facility. Typically, the site operation authority is responsible for maintaining and administering the site procedures.

Site procedures also define the work that can only be performed by the operating authority. Examples include the issuing of clearances and work permits. While all industries face certain requirements, major differences do exist. It is important to note that even plants of similar design can present unique challenges. The site procedures are an important tool for the PMT since all employees (company and contract) are responsible for acquiring a thorough understanding of the site procedures for the specific facility.

### 2.1 SAFETY PROCEDURES

All personnel are responsible for understanding the hazards that may be present and the type of Personal Protective Equipment (PPE) that is required. Companies are required to develop written procedures for personnel, whether employees or contractors, to safely carry out job duties.

Certain hazards exist at all sites. These include, but are not limited to:

- High pressures and temperatures (steam, water, oil)
- Combustible gases
- Chemicals
- High voltage electrical equipment
- Rotating equipment
- Confined spaces entry hazards
- Breathing hazards
- Noise
- Trip and fall hazards

Safety is an important aspect of project management. PMTs may be comprised of people who do not regularly work together. Often, some or all of the team members are not familiar with the facility.
While most accidents are preventable, they do happen. In an effort to maintain a safe workplace and minimize the effects of accidents (injuries, equipment damage, and lost production), most companies develop an Emergency Response Plan (ERP). Typically, the corporate Environmental Health & Safety Department develops the plan with input from the site operating authority. The ERP (Figure 2-2) covers emergencies, disasters, and accidents at a specific site.

**FIGURE 2-2**
*Typical Site ERP Manual*

Regardless of their level of experience, CSTs must be familiar with applicable safety procedures and take the necessary steps to protect themselves. Knowing the hazards of the location, the required PPE, and the methods for responding to an emergency are the best way to stay safe.

Safety is important on and off the job. More information on this topic is available in the second chapter of the ISA book titled “Start-Up: A Technician’s Guide” (Harris, 2000).
2.1.1 CONTROL OF HAZARDOUS ENERGY

Conditions exist in all facilities that could expose personnel to the unexpected start-up of equipment or the release of stored energy. To limit risk to personnel, the U.S. Occupational Safety & Health Administration (OSHA) developed standard 1910.147 titled, “The control of hazardous energy (lock out/tag out).” A lock out/tag out, or clearance procedure provides the means to safely isolate plant systems and individual components.

2.1.2 WORK AUTHORIZATION PERMIT

Requirements vary by industry, but in general, personnel must obtain authorization from the facility operating authority prior to starting the work. It is important to review the facility requirements of the particular facility prior to starting a project.

During a project, a CST will work under and may even hold a work authorization permit (WAP). Depending on the CST’s role on the PMT, the CST may also coordinate the work of contractors. This includes ensuring that contractor personnel have obtained a WAP from the facility operating authority.

2.1.3 MATERIAL SAFETY DATA SHEETS

The OSHA Hazard Communication Standard 29 CFR 1910.1200 establishes uniform requirements for chemical manufacturers to evaluate all chemicals in order to determine hazards associated with use or exposure. The manufacturers must make this information available to the public. In the United States, the information is conveyed to users by means of container labels and material safety data sheets (MSDS). The MSDS sheet is organized into the following eight (8) sections:

- Section I - Manufacturer’s Information
- Section II - Hazardous Ingredients/Identity Information
- Section III - Physical/Chemical Characteristics
- Section IV - Fire and Explosion Hazard Data
- Section V - Reactivity Data
• Section VI - Health Hazard Data
• Section VII - Precautions for Safe Handling and Use
• Section VIII - Control Measures

The international version of the MSDS is compliant with ANSI Standard Z400.1-2003. Containing sixteen sections (shown below), the international version is more comprehensive and is becoming the international norm.

• Chemical Product and Company Identification
• Composition/information on ingredients
• Hazard(s) identification
• First-aid measures
• Fire-fighting measures
• Accidental release measures
• Handling and storage
• Exposure controls/personal protection
• Physical and chemical properties
• Stability and reactivity
• Toxicological information
• Ecological information
• Disposal considerations
• Transport information
• Regulatory information
• Other information

Employers are required to educate their employees and contractors on the hazards associated with the hazardous materials they work with and ensure that information is readily available. CSTs working outside the United States should become familiar with the chemical safety programs and standards of that country.
Typically, companies develop a Hazard Communication Program to meet these requirements. The program provides specific training and communication on the following:

- Information about the hazards of chemical products used at the facility
- Location of and access to material safety data sheets (MSDS)
- Proper labeling of containers
- The appropriate use and disposal of hazardous materials

Using this information, personnel can take measures to protect themselves from these chemical hazards. In some industries, a CST routinely works with hazardous chemicals while in others a CST might have limited contact. Regardless of the industry, a CST is expected to understand and follow the site Hazard Communication Program.

2.2 PHYSICAL SECURITY PROCEDURES

Site security requirements are another major factor the PMT must consider. Security requirements vary by industry and in some cases are driven by government regulations. As an example, some industries maintain tight security requirements due to the threat of industrial espionage. In the U.S. various agencies provide oversight and maintain standards for security which is often specific to the industry. For example, the NERC Critical Infrastructure Protection (CIP) standards set physical, cyber, and sabotage security requirements for the power industry. Like the other members of the PMT, a CST should be familiar with the security requirements of the particular industry(s) they serve.

The United States Department of Homeland Security maintains a homeland security advisory system to alert industry to the threat of terrorist activities. In many cases, this will limit or restrict access of personnel to certain areas of the facilities or to cyber assets. More information is available online at www.dhs.gov/index.shtm.
In addition to background checks, many companies now issue photo identification (ID) badges to anyone entering their facilities. To obtain a badge may require a worker to present two forms of government identification. With few exceptions, workers are required to wear their display where it is easily visible at all times. The PMT must take into consideration the time it takes for contractors to acquire security badges. Additional time may be required when the threat level increases.

Figure 2-3 shows a typical employee and contractor ID badge. Typically this information is coded into a visitor management system and the badge is issued. In this example, both ID badges are coded to allow the holder access to particular areas of the facilities. As shown, the ID cards would give the company member and the contract employee access to the entire facility. In many cases a contractor or visitor access is restricted access or the individual may require an escort. Additional information on the contractor’s badge includes their host, which could be a member of the PMT.

**FIGURE 2-3**
*Typical Employee & Contractor Security Badges*

In facilities where everyone is required to badge in and badge out, the visitor management system may be programmed to provide a report on who is in the facility. This is extremely useful in emergency situations. It also provides the PMT a secondary way to verify that all workers have left the site at the end of the day.
2.3 PROJECT ENGINEERING DOCUMENTATION

Project engineering documentation includes field drawing, electronically generated prints, lists, vendor information, and other materials. Manually creating and maintaining accurate documentation is very difficult. The use of a computer-based document management system greatly improves this process.

Drawings are organized in a logical fashion in the drawing index where each item is classified according to the area of engineering (electrical/electronic, mechanical, civil, architectural, automation, etc.). As illustrated in Figure 2-4, a relationship often exists between the other engineering areas. One of the advantages of computer-aided design and drafting systems is the ability to layer drawings by engineering discipline and automatically generating a drawing index.

FIGURE 2-4
Classification of Prints & Drawings

A new CST is expected to become familiar with materials relevant to the industry(s) they serve and with some level of guidance utilized materials. Likewise, an experienced CST possesses a thorough understanding of the materials you can apply the information contained within these documents.

One often-made mistake is to assume that the prints and other documents in the corporate or facility reference library are current.
A CST should check the drawing index and confirm with the facility whether or not changes have been made, but not submitted for review. This may mean contacting the facility staff in that discipline to verify the drawing index number of the print in question.

For automation projects, these documents are further defined to include:

- **Process Flow Diagrams (PFDs)**, which illustrate the generalized flow of plant processes with simplified depictions of equipment and automation systems. The emphasis is on process temperatures, pressures and flows, often including heat and material balances.

- **Piping and Instrumentation Drawings (P&IDs)**, which show a much more detailed depiction of equipment arrangements and automation systems. The emphasis is on the piping, mechanical, instrumentation and automation aspects of the plant.

- **Instrument Index (List)**, spreadsheets which provide detailed information on each instrument device or function. Data includes, but is not limited to, tag numbers and instrument types, relevant P&IDs, specifications, location drawings, installation details, wiring diagrams and/or loop drawings, I/O designations and other drawings and documentation related to each instrument.

- **Specification Forms**, which list detailed information about each instrument and provide the basis for the bidding and procurement process.

- **Logic Diagrams**, which define the cause and effect relationships between instruments and the process for normal control as well as alarm and safety shut down actions.

- **Location Plans**, which show the approximate physical location of instruments as an overlay to an area plan drawing.

- **Installation Details**, which show how instruments are to be physically mounted or connected to piping systems.
and equipment. Also shown is the way in which electrical or pneumatic utilities are supplied to instruments, and how signal cabling or tubing is taken from the instruments.

- **Wiring diagrams and pneumatic connection diagrams**, either on a large format or on an individual loop basis (Loop Diagrams) which show point-to-point connections from the field to a local control panel or to a centralized control building or room.

- **Junction box drawings**, which show how individual signal wire pairs or pneumatic tubing lines are gathered and connected to multi-pair wiring cables or tubing bundles for transmission to control panels remote from the field.

These documents are most often developed in sequential order as a project moves from design through construction.

### 2.4 DOCUMENTATION LOCATION AND MEDIA TYPES

Until the advent of affordable computer technology, all project documents were printed or hand-written. Typically, companies maintained master copies in one location and working copies in another. Some companies also maintained an additional master copy at an offsite location. A CST may be required to obtain copies of these materials and determine what, if any, differences exist between working copy and master copy.

Today the majority of project documentation is developed and maintained in electronic form. Computer technology has enhanced the ease with which a PMT generates and distributes documentation. Common software systems include:

- **Business Software Suites**: Software for word processing, spreadsheet, presentation, database, email, and scheduling (project activities), packaged as a unified product.

- **Enterprise Software Suites**: Typically business-oriented tools for HR management, accounting, security, content management, customer relationship management (CRM),
enterprise resource planning (ERP), business intelligence, manufacturing, maintenance, and project management.

- **Computer-Aided Design (CAD):** CAD systems are used to generate diagrams and drawings in the various engineering disciplines. For a typical automation project, a CAD system is used to produce materials for the design and construction phases and to document changes on “as-built” drawings.

It is also common for a CST to receive job assignments via an email or task list. The email or task list may direct the CST to an order generated by an enterprise software system. The order may instruct the CST to print a copy of a drawing from a CAD system. A CST needs a working knowledge of each type of document and each system being used in order to fulfill their duties on a PMT.

Managing and controlling documents is a big challenge. Many companies now use a document management system (DMS). A DMS consists of a computer system or a set of computer programs that track and store electronic and/or paper documents. As a member of the PMT, a CST may be required to obtain information from a DMS or to store information in a DMS and so must know how this is to be done.

**SUMMARY**

Long gone are the days of the typewriter and blueprints. While hard-copy written and print data does still exist, the majority of project management data is moving to an electronic form. Understanding the wide variety of formats and systems used to produce project management data is a challenge for a CST. This, combined with government regulations and associated compliance requirements, has also increased the complexity of an automation project. To deal with these issues, industry has developed site-specific plans that address safety, security, operations, and environmental concerns specific to the project location and that can directly affect a project. As a member of the PMT, a CST uses information in the site procedure to determine hazards associated with the site and where possible, to suggest ways to eliminate the hazard.
Obtaining accurate information is essential to running a successful project. A CST must be familiar with the various types of information used on an automation project and the systems used to develop the information and must know how to obtain this information. Throughout the project, a CST will verify the accuracy of information through field inspections and will use the appropriate system to record their findings.

REFERENCES


REVIEW QUESTIONS

1. How can a CST obtain a copy of the Site Procedure for a location?

2. Explain the purpose of, and information provided by, Material Safety Data Sheets (MSDS).

3. What is the purpose and importance of lock-out/tag-out procedures?

4. What types of materials make up project engineering documentation?

5. What is the purpose of an “as-built” drawing?

6. A maintenance department typically maintains a _________ of prints for routine use.
7. Logic Diagram depict _______________ relationships between instruments and the process.

8. Installation details display the power and signal connections between devices, but these do not correspond to the _______________ of the devices.

9. How can physical security issues affect a project?

10. A __________ _________ system that tracks and stores electronic and/or paper documents.

11. Today many _______________ _______________ __________ include project management software?