

# Pipeline Control Room Management

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# Pipeline Control Room Management

## 1 Scope

### 1.1 Purpose

The purpose of this recommended practice is to provide pipeline operators, and pipeline Controllers with guidance on industry best practices on control room management to consider when developing or enhancing processes, procedures, and training. This document was written for operators with continuous and non-continuous operations, as applicable.

### 1.2 General

This document addresses pipeline safety elements in Pipeline Control Rooms for hazardous liquid and natural gas pipelines in both the transportation and distribution sectors:

- personnel roles, authorities, and responsibilities;
- guidelines for shift turnover;
- provide adequate information;
- fatigue mitigation;
- change management;
- training;
- operating experience; and
- workload of pipeline Controllers.

## 2 Normative References

This document contains no normative references. A list of documents associated with API RP 1168 is included in the bibliography.

## 3 Terms, Definitions, and Abbreviations

### 3.1 Definitions

For the purposes of this document, the following definitions apply.

#### 3.1.1

##### **abnormal operating condition AOC**

A condition identified by the operator that may indicate a malfunction of a component or deviation from normal operations that may:

- a) indicate a condition exceeding design limits; and/or
- b) result in a hazard(s) to persons, property, or the environment.

**3.1.2****abnormal operation****AO**

Non-emergency operation while exceeding normal operating design limits, typically caused by an AOC such as:

- a) unintended closure of valves or shutdowns;
- b) increase or decrease of pressure or flow rate outside of normal operating limits;
- c) loss of communications;
- d) operation of any safety device; and
- e) any other malfunction of a component, deviation from normal operation, or personnel error which may result in a hazard to persons or property.

NOTE The terms AO and AOC are defined differently; however, some operators may use the terms interchangeably.

**3.1.3****change management**

Process used by pipeline operators to manage changes to their facilities and processes, organizations, and documents to ensure that changes are adequately identified, planned, controlled, and communicated.

**3.1.4****displays**

The visual presentation of text and objects on a monitor.

**3.1.5****emergency**

A condition that presents an immediate hazard to persons, property, or the environment.

**3.1.6****event**

Any unplanned occurrence that may negatively impact pipeline operations in the judgment of the pipeline operator.

**3.1.7****fatigue management**

A data-driven means of continuously monitoring and managing fatigue-related safety risks, based upon scientific principles and knowledge as well as operational experience that aims to ensure relevant personnel are performing at adequate levels of alertness.

**3.1.8****fatigue mitigation room**

A room provided by the operator to help mitigation of fatigue risk and may include exercise equipment, television, bed, zero-gravity chair, etc.

NOTE 1 This room might also be referred to as a Circadian room.

NOTE 2 Use of the term room does not imply a separate space, but could make reference to a general area.

**3.1.9****pipeline control room**

An operations center staffed by personnel charged with responsibility for remotely monitoring and controlling entire or multiple sections of pipeline systems.

NOTE For the purpose of this document, "pipeline control room" and "control room" are synonymous.

**3.1.10****pipeline Controller**

A qualified individual whose function is to remotely monitor and control the operations of entire or multiple sections of pipeline systems via a SCADA system from a pipeline control room, and who has operational authority and accountability for the daily remote operational functions of pipeline systems.

NOTE 1 For purposes of this document, the term “qualified” means an individual has been evaluated and can at a minimum a) perform assigned covered tasks; and b) recognize and react to abnormal operating conditions.

NOTE 2 For purposes of this document, the terms “pipeline Controller” and “Controller” are synonymous.

**3.1.11****pipeline operator**

A person who owns or operates pipeline facilities.

NOTE 1 For the purpose of this document, the terms “pipeline operator” and “operator” are synonymous.

NOTE 2 A person means any individual, firm, joint venture, entity, partnership, corporation, association, state, municipality, cooperative association, or joint stock association, and includes any trustee, receiver, assignee, or person representative thereof.

**3.1.12****supervisory control and data acquisition****SCADA**

A system that is a combination of computer hardware and software used to send commands and acquire data for the purpose of monitoring and/or controlling.

**3.2 Abbreviations**

For the purposes of this document, the following abbreviations apply.

AOC	Abnormal Operating Conditions
ASME	American Society of Mechanical Engineers
CFR	Code of Federal Regulations
AO	Abnormal Operation
CRM	Control Room Management
PSAP	Public Safety Access Point (also known as Public Service Answering Point)
SCADA	Supervisory Control and Data Acquisition

**4 Personnel Roles, Authorities, and Responsibilities****4.1 General**

Pipeline operators should have a document to detail the roles, authorities and responsibilities of the pipeline control room personnel to ensure safe, efficient, and effective operations during normal, abnormal and emergency operating conditions. The document should include responsibilities for Controllers and any other personnel involved in control room operational decision-making.

**4.2 Pipeline Controller Authorities and Associated Responsibilities****4.2.1 General**

Pipeline controllers perform duties necessary for safe operations. To better ensure that these responsibilities are discharged and that pipeline controllers understand their scope of authority, individual pipeline operators should have

a document that defines pipeline Controller authorities, physical domain of responsibilities, and associated responsibilities during normal, abnormal and emergency operating conditions. The pipeline Controller should have full and independent authority and responsibility to divert flow, shut down, and/or isolate pipeline systems. Pipeline operators should have a procedure for the startup of a pipeline following an AOC/AO/emergency shutdown that includes identification of individuals to authorize restart for the Controller.

#### **4.2.2 Normal Operations**

Pipeline operators should establish guidelines and provide training that includes pipeline Controller responsibilities during normal operations. Under normal operations, a pipeline Controller's responsibilities may include specific duties, such as:

- ensuring safe system operations;
- responding to a changed condition by use of an appropriate action or procedure;
- notifying other personnel as appropriate of the status of operations;
- accurate and thorough documentation of operational information;
- accurate and thorough documentation of temporary changes;
- system, segment or equipment start-up or shut-down;
- monitoring systems, segments, or equipment for deviations from normal operations;
- managing distractions.

Pipeline operators should establish guidelines and provide training that includes pipeline Controller responsibilities during pipeline system start-up, monitoring/adjustments, and shutdown. System monitoring and/or control practices should address pipeline Controller requirements related to the following (if applicable):

- fieldwork on pipelines or associated equipment;
- monitoring system flow rate, pressure, or field/tank delivery;
- communicating to other personnel;
- adjustments to alarm priorities/thresholds;
- adjustments to equipment availability (e.g. tagout a unit).

#### **4.2.3 Abnormal Operating Conditions (AOC), Abnormal Operation (AO), and Emergencies**

Pipeline Controllers are trained to recognize and respond to AOCs, AOs, and emergencies. Pipeline operators should establish guidelines for the responsibilities of pipeline Controllers during these conditions. These responsibilities may include specific duties associated with:

- responding to emergency and abnormal alarms;
- notification of emergency services (e.g. dialing 9-1-1, Public Safety Access Point [PSAP], etc.);
- investigating an abnormal condition;

- 
- notifying other personnel as appropriate;
  - notifying other potentially impacted entities;
  - ensuring that the system returns to normal operating condition;
  - ensuring required follow-up activities are performed;
  - documenting activities and responses accurately and thoroughly;
  - continuing operations of the system based on the condition;
  - obtaining authority as necessary to restart pipeline systems, segments, or equipment;
  - managing distractions.

### **4.3 Interfacing with the Public**

Pipeline operators should establish guidelines and training that includes the pipeline Controller's responsibilities when contacted by the public. The pipeline Controller may be responsible for:

- determining the nature of a contact and taking appropriate action;
- providing information to the contacting party;
- notifying appropriate operator personnel;
- notifying appropriate external agencies; and/or
- documenting the details of the contact and the actions taken.

Operators may refer to the other industry-based documents for additional guidance on this topic (see Bibliography).

### **4.4 Non-Controller Operations Authorities and Associated Responsibilities**

Pipeline operators should have a document that defines authorities and associated responsibilities for non-Controller operations personnel for normal operations, AOCs, AOs, and emergencies that may impact control room operations. Associated responsibilities may include:

- providing control room operational decision-making;
- providing oversight and quality assurance for safe operations;
- ensuring necessary actions are taken based on circumstances;
- ensuring only qualified personnel have access to operate the system;
- ensuring all necessary personnel are notified of AOCs, AOs, and emergencies;
- ensuring notification of other potentially impacted external entities;
- adjusting alarm priorities/thresholds;
- adjusting equipment availability (e.g. tagout a unit);

- providing authorization to restart pipeline systems, segments, or equipment;
- managing distractions;
- considering additional controls or required orientations for personnel due to new operating conditions; and/or
- ensuring that first responder agencies/authorities are notified of emergencies;
- ensuring notifications are made prior to activities that could impact control room operations.

## **5 Guidelines for Shift Turnover**

### **5.1 General**

Establishing practices for shift turnover reduces the possibility of an unplanned event and improves pipeline operations. Pipeline operators should establish a shift turnover process to ensure that relevant operating information is transferred. This may include overlap time between outgoing and incoming pipeline Controllers as applicable. The operator should determine when a documented shift change process is necessary and the level of appropriate detail. Turnovers are not limited to scheduled activities, but also include unscheduled ones (e.g. illness, home emergencies).

### **5.2 Shift Turnover Process**

Pipeline operators should establish an overall shift turnover process that includes the level of information to be exchanged. A checklist may be used during shift turnover. When considering the level of information exchange, the process should take into consideration the following:

- when a shift change is needed and not needed;
- Controller's proximity to the console;
- length of time away from the console (breaks);
- type of technology and/or process used to monitor while away from the console (e.g. audible alarms vs. visual);
- proper coverage; and/or
- how information is to be exchanged and documented.

### **5.3 Shift Turnover Procedure**

To ensure effective shift turnover, pipeline operators should establish shift turnover procedures and train pipeline Controllers on the process. A shift turnover procedure should address aspects that impact operational safety and continuity. These items may include:

- ensuring system control accountability during turnover;
- ensuring uninterrupted monitoring;
- ensuring initiated operational commands are fully executed and/or will be properly followed through by incoming Controller;
- recording of the accountability transfer inclusive of date and time;
- a process for addressing fatigue and other related issues; and

- managing distractions that could adversely impact transfer of information.

## **5.4 Shift Turnover Information Exchange**

A turnover information exchange should be conducted to brief incoming pipeline Controllers on the status of current operations. The shift turnover process should be defined and followed on a consistent basis by all Controllers. Part of this turnover information exchange should be the clear understanding for outgoing pipeline Controllers that incoming pipeline Controllers have taken over the responsibility of the operations. This should include electronic or hard copy checklists or signed documents that are developed and maintained by the pipeline operator.

## **5.5 Information to Exchange**

### **5.5.1 General**

Pipeline operators should determine the extent and detail of information provided and documented for effective shift turnover. The following major categories of information are examples of items that may be addressed during shift turnover:

- AOCs/AOs/emergencies;
- daily operation information;
- status of scheduled/unscheduled maintenance activities;
- changes to physical assets, practices, and responsibilities;
- equipment malfunction or temporarily out of service;
- general communication issues;
- natural disaster and weather events that impact or may impact operations;
- alarm reviews; and
- third-party events with potential direct or indirect impact on operations.

### **5.5.2 Abnormal Operating Condition (AOC), Abnormal Operation (AO), and Emergencies**

Any unresolved AOC, AO, or emergency shall be communicated to the incoming Controller by means determined by the operator. Any actions taken or planned to remedy the condition shall also be conveyed to the incoming Controller.

### **5.5.3 Daily Operation Information**

Basic information about daily operations should be conveyed during shift turnover with emphasis on imminent activities. The following items of daily operation may be included during the shift turnover:

- status of shipment schedules;
- linepack/pressure issues;
- storage issues;
- pigging schedules;
- pipeline section restrictions;

- weather events that impact or may impact operations;
- batch changes/line fill;
- operating assets/equipment;
- right-of-way maintenance; and/or
- status of dispatched or remotely located personnel in the field.

#### **5.5.4 Status of Scheduled/Unscheduled Maintenance Activities**

Pipeline Controllers should be informed of scheduled/unscheduled maintenance activities that may impact operations. Information may include:

- reason for required maintenance;
- internal/external contact information;
- impacted equipment;
- current situation;
- temporary operations or operating procedures to accommodate the situation;
- anticipated return to normal operations and required follow-up actions.

#### **5.5.5 Changes to Physical Assets, Processes, Procedures, and/or Responsibilities**

Changes to physical assets, processes, procedures and/or responsibilities that have become operational during a shift should be conveyed during shift turnover. See Section 8 (Change Management) for a detailed list of topics for consideration.

#### **5.5.6 Equipment Malfunction or Temporarily Out-of-Service**

Basic information about equipment consequential to operations that has malfunctioned or is temporarily out of service should be conveyed during shift turnover with emphasis on imminent activities, such as:

- valve closures;
- inadvertent shutdown of equipment;
- pipeline segments;
- pumps/motors;
- compressors;
- leak detection systems;
- instrumentation.

### 5.5.7 General Communication Issues

Basic information about communication issues should be conveyed during shift turnover with emphasis on imminent activities, such as:

- loss of SCADA;
- power outages;
- non-SCADA computer or network issues;
- loss of communication (voice and data).

### 5.5.8 Natural Disasters and Weather Events that Impact or May Impact Operations

Basic information about natural disasters and weather events that may impact operations should be conveyed during shift turnover with emphasis on imminent activities, such as:

- earthquakes;
- hurricanes;
- tornadoes;
- thunderstorms;
- fires;
- floods;
- landslides.

### 5.5.9 Alarm Reviews

Current alarm status should be reviewed by incoming shifts. This information may be contained automatically in the SCADA system or otherwise documented. When discussing maintenance and out-of-service equipment, the degree of impact that the activity is having on the alarm rates should be conveyed. Any activity that may cause abnormal alarm levels or rates should be discussed. The following are examples of, but not limited to, the type of alarm information that should be reviewed by the oncoming shift:

- active alarms;
- inhibited alarms;
- nuisance alarms;
- maintenance overrides; and/or
- recurring/persistent alarms.

Automatic control functions (e.g. pump/compressor shutdowns or isolations, line segment valve controls, etc.) that have been overridden should be documented and conveyed to the incoming shift. Operators may refer to other industry-based documents for additional guidance on this topic (see Bibliography).

### 5.5.10 Third-party Event Potentially Impacting Operations

All relevant information concerning third-party operations (refineries, tank farms, connected pipelines, etc.) with potential direct or indirect impact to the operator's pipeline should be transferred in the shift turnover. The types of information exchanged may include:

- type of unplanned event/emergency at 3<sup>rd</sup> party facility;
- tank information (e.g. out-of-service, change of product type, levels);
- internal/external contact information;
- local or remote operation status;
- state of operational readiness of receipt or delivery facility;
- any safety condition existing at facility; and/or
- construction activity.

## 6 Provide Adequate information

### 6.1 General

Each operator shall provide its Controllers with the information, tools, processes and procedures necessary for the Controllers to carry out the roles and responsibilities for each of the following areas.

### 6.2 Supervisory Control and Data Acquisition (SCADA) System

Operators should define the types of changes to the SCADA system that constitute adding, expanding, or replacing a SCADA system used by Controllers to operate a pipeline system. When changes are required, appropriate *CFR* referenced sections of API RP 1165, *Recommended Practice for Pipeline SCADA Displays*, should be implemented, unless the operator can document that certain provisions of RP 1165 are not practical for the SCADA system used.

### 6.3 Point-to-Point Verification

Operators should develop a process for performing point-to-point verification on safety-related points. This process should include:

- definition of safety-related points;
- access to list of safety-related points;
- when point-to-point is required;
- responsibilities for point-to-point verification;
- documentation of point-to-point activities;
- timing criteria to complete point-to-point; and
- verification of physical location on SCADA screen.

Operators should perform point-to-point verification from the end device unless there is a safety-related risk to ongoing operations. In some cases, use of simulated signals may be justified.

Documentation of a point-to-point verification should include what was tested, the date of the test, identification of who performed the test on both ends (field and SCADA), and the results of the test.

The following documentation should be considered for SCADA verification to be accomplished:

- SCADA graphics completed with data points populated on the graphic;
- P&ID (piping and instrument diagram) or other representative drawing for point location verified; and
- data points configured and verified in SCADA.

#### **6.4 Internal Communication**

Operators should have a written plan of action in the event of a SCADA failure/outage. This may include:

- reduction in flow/rate;
- manual operation, if the intent is to operate manually;
- shutdown of a pipeline segment or facility;
- monitoring of facilities on a predetermined time basis to verify system integrity; and
- what information is required to be communicated, at what time intervals, and to whom.

In the event of a SCADA failure/outage and the need for manual operation, operators should have a process for managing data and information required to monitor and safely operate the system.

If manual operation is applicable, an operator's plan should account for the availability and timely deployment of personnel.

#### **6.5 Testing Backup SCADA Systems**

Operators should develop procedures for use of any identified back-up SCADA systems including testing of the system.

Backup SCADA system tests should include testing equipment at backup locations off-site, and testing redundant equipment that is co-located on the same site (e.g. hot/standby systems).

Operators should maintain documentation on this test showing:

- how the test was conducted;
- what equipment and personnel were included;
- test date; and
- results.

When testing the operator's backup SCADA system at a backup control room/facility, the procedures should include:

- designation of an individual authorized to determine when to use the backup control room/facility, and when to return to the primary facility; and
- logistics of staffing the back-up control room/facility.

## 7 Fatigue Management

### 7.1 General

Fatigue could affect performance on cognitive tasks. Therefore, pipeline operators should establish pipeline control room fatigue management practices and guidelines that include staffing considerations, as well as methods for maintaining alertness of Controllers while working. Following is a list of potential fatigue management practices and guidelines that a pipeline operator may choose to incorporate. At a minimum, Controllers should be trained and informed of fatigue management methods.

Even with effective fatigue management strategies, pipeline operators should recognize that there may be times when Controllers will experience fatigue. Fatigue management practices and guidelines should provide adequate flexibility to maintain continuity of operations during emergency/abnormal operations.

### 7.2 Work Schedule

Pipeline operators should take into account fatigue mitigation when developing a pipeline Controller work schedule to govern normal operations. Operators should include and document all company work hours when developing and implementing a work schedule including training, meetings, project work, non-Controller work hours, etc. No single schedule will be appropriate for all operators. Pipeline operators may account for the following factors when developing a shift schedule (as appropriate):

- circadian rhythms;
- staffing levels;
- collective bargaining rules;
- rotating shift implications;
- shift start time implications;
- sleep deprivation;
- demographics of the work force;
- shift turnover duration;
- absence coverage (e.g. vacation, training, illness);
- overtime (e.g. scheduled, unscheduled, short notice call outs);
- commute time; and
- continuity of staffing (e.g. 24-hours-per-day/7-days-per-week, non-continuous coverage).

When developing shift schedules, pipeline operators should provide pipeline Controllers the opportunity for eight hours of continuous sleep prior to working each shift. To accommodate this need, consideration should be given to the following when developing a shift schedule:

- consecutive hours worked by an employee;
- consecutive shifts worked by an employee; and/or
- downtime between rotating shift blocks to allow adequate recovery from sleep deprivation (i.e. going from a day shift to a night shift or a night shift to a day shift).

When a new shift schedule is under development or an existing shift schedule is under consideration for revision, a pilot program may be considered as part of the development process.

### **7.3 On-shift Breaks**

To manage fatigue, pipeline operators should consider establishing a policy, schedule, and accommodations that, if possible, allow for on-shift breaks that does not adversely impact operations.

**NOTE** The policy may include provisions for break times that are identified by the controller as permitted by on-going control room activities and may take place within the control room.

### **7.4 On-shift Stimulation**

Pipeline operators may consider providing on-shift stimulation for managing employee fatigue. If such methods are allowed, guidelines should be established to govern their use, so Controllers are not distracted from their responsibilities. Pipeline operators may decide which method of stimulation is appropriate and effective, according to their individual situations.

### **7.5 Education**

Education and awareness are important parts of any fatigue management program. Training and education in fatigue mitigation strategies, recognizing the effects of fatigue and how off duty activities contribute to fatigue is required for Controllers and supervisors. Additional education of family members may also be considered as part of an operator's training program.

### **7.6 Pipeline Control Room Environment**

Other industry-based documents provide design aspects that may be considered appropriate for developing or revamping a pipeline control room regarding lighting, temperature, humidity, ergonomics, and other environmental factors when developing a fatigue management strategy (see Bibliography).

### **7.7 Exercise Equipment**

Pipeline operators may consider providing access to exercise equipment for use by Controllers to help manage fatigue. If provided, Controllers should be instructed on safe and effective use of exercise equipment, as well as appropriate times for use.

### **7.8 Fatigue-mitigation Room**

Pipeline operators may consider the use of a fatigue mitigation room as a method for managing employee fatigue. If used, operators should establish practices and guidelines to govern the use of a fatigue-mitigation room, so that employees will know the appropriate times to use the rooms, durations of use, and other factors to consider during use.

### **7.9 Hotel/Sleep Facilities**

Pipeline operators may consider the use of hotel rooms or other nearby sleeping facilities as a method of managing employee fatigue. If used, operators should establish practices and guidelines to govern the use of facilities, so that employees will know the appropriate times to use the facilities, durations of use, and other factors to consider during use.

### **7.10 Transportation Service**

Pipeline operators may consider providing transportation services for employees. If provided, pipeline operators should establish practices and guidelines to govern the use of transportation services provided.

## **8 Change Management**

### **8.1 General**

Change is a regular part of pipeline control room operations that shall be managed and governed by effective processes and procedures. For change management to be effective, control room personnel shall be a part of the decision and implementation process if the change could affect control room operations.

### **8.2 Inclusion of Pipeline Control Room Representative**

If the control room could be impacted by the change, a pipeline control room representative shall be included in the planning process. Pipeline operators should require the control room representative to review and provide input on change management, and have the authority to request changes, as appropriate. System changes may impact control room operations and pipeline operators should solicit input on operational impact from the control room early in the project development.

### **8.3 Systems/Processes Undergoing Change**

Pipeline operators should consider defining which systems/processes will be governed by change management policies. Among the activities to consider are changes that may include:

- purchase or sale of physical assets;
- new equipment coming online;
- retired equipment going offline;
- operations and maintenance manuals;
- new or revised procedures;
- identification of operating responsibilities between pipeline Controllers and field personnel or third-party operations;
- field maintenance activity affecting pipeline control room operations;
- control system changes;
- SCADA system changes; and
- jurisdictional classification changes.

### **8.4 Notification and Training**

Adequate notification, time, and resources should be devoted to training Controllers on the impact of the change to operations.

Training may consist of formal classroom instruction, field visits, computerized training, or any other method that the pipeline operator finds appropriate.

### **8.5 Emergency Change Management**

An emergency change management procedure allows the change to be implemented and commissioned immediately in order to address an immediate safety, operational, health, or environmental situation. Because of the

immediacy of an emergency change management, some steps may be done verbally. Control room representatives should be involved with review, approval, and communication of the emergency change management at the time of implementation. The follow-up formal review and approval should be conducted as soon as practical after the change has been made. Examples of emergency change management situations include:

- pressure reductions;
- mainline leaks;
- natural disasters;
- unforeseen operational changes;
- safety-related conditions; and/or
- critical equipment failure.

## 9 Operating Experience

Each operator should ensure that lessons learned from its operating experience are incorporated, as appropriate, into its control room management procedures. Performing each of the following may be beneficial to incorporate in lessons learned:

- developing a method for reviewing and critiquing reportable events to identify lessons learned;
- developing a method of adequately sharing findings with appropriate control room personnel;
- determining if strategies to mitigate a repeat occurrence are needed; and
- determining if control room actions were contributing factors in an event, and correct deficiencies related to:
  - Controller fatigue;
  - field equipment changes or failures;
  - operation of any relief or safety-related device;
  - inadequate procedures;
  - inadequate training;
  - SCADA system configuration/performance; and
  - incomplete or inadequate change management process.

Other topics for lessons learned may include:

- near misses;
- third-party events;
- audit events;
- non-reportable events;

- review of historical alarm logs;
- other sources of operating experience; and
- industry identified events.

## **10 Training**

### **10.1 General**

An operator's training program shall provide Controller and control room personnel, training to carry out their roles and responsibilities as defined by the operator. The training program may include the following:

- requirements for new pipeline Controllers;
- training schedules;
- refresher and retraining schedules;
- dates of completion of training;
- types of training completed (e.g. manuals, table top drills, computer based training, simulators, etc.); and
- operator qualification.

### **10.2 Roles and Responsibilities**

Pipeline operators should ensure that training is provided to control room personnel on roles and responsibilities for normal, abnormal and emergency operating conditions and on operator specific documents, such as:

- Operations and Maintenance Procedures;
- Emergency Plan;
- Control Room Management Plan.

### **10.3 Shift Turnover**

Training associated with the shift turnover for Controllers should include:

- shift turnover process;
- shift turnover procedure;
- information to exchange.

### **10.4 Fatigue Mitigation**

Training associated with fatigue mitigation for both Controllers and control room supervisory personnel should include:

- fatigue mitigation strategies;
- how off-duty activities can contribute to fatigue;

- recognizing the effects of fatigue;
- reporting of fatigue.

### **10.5 Alarm Management**

Training associated with alarm management for control room personnel should include:

- Controller response to alarms;
- documentation and authority requirements associated with changing alarm limits or set points, inhibiting alarms, or taking points off scan; and
- alarm management philosophy.

### **10.6 Change Management**

Training associated with change management for control room personnel should include:

- change management processes and procedures;
- changes to roles and responsibilities prior to implementation due to:
  - physical changes to pipeline equipment;
  - configuration changes;
  - SCADA, display, or other processes that provide the Controller with adequate information; and
  - Temporary operations.

### **10.7 Operating Experience**

Training associated with operating experience for control room personnel should include operator identified “lessons learned.”

### **10.8 Team Training**

Training may be provided on team effectiveness to improve control room decision-making. Any personnel identified as team resources involved in control room operational decision-making, which may include Controllers, supervision, technical support, and/or others, should be included in the training. Topics may include:

- leadership and team building;
- team communication;
- situational awareness;
- information resources;
- decision-making.

## 10.9 Other Training

Other areas for Controller training should include:

- working knowledge of the pipeline system, especially during the development of an AOC, and may include operating limits of pipeline systems, product characteristics, hydraulics, and pressure/flow;
- infrequently used procedures;
- recognizing AOCs;
- responding to AOCs likely to occur simultaneously or in sequence; and
- responsibilities for communication under the operator's emergency response procedures.

## 11 Workload of Pipeline Controllers

An operator should monitor the content and volume of general activity being directed to, and required of each Controller to ensure Controllers have sufficient time to analyze and react to incoming alarms. This review may include the following categories of tasks:

- commands and controls;
- monitoring (observing/analyzing pipeline operations);
- communications (face-to-face, phone/radio, etc.);
- alarm acknowledgment and response; and,
- administrative tasks.

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<sup>1</sup> ASME International, 2 Park Avenue, New York, New York 10016-5990, [www.asme.org](http://www.asme.org).

<sup>2</sup> Department of Transportation. The *Code of Federal Regulations* is available from the U.S. Government Printing Office, Washington, D.C. 20402. [www.gpoaccess.gov](http://www.gpoaccess.gov).







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