

**VOLUME 1-11**

**CONDUCT OF  
POWER OPERATIONS**



**FACILITIES INSTRUCTIONS,  
STANDARDS, AND TECHNIQUES**

**UNITED STATES DEPARTMENT OF THE INTERIOR  
BUREAU OF RECLAMATION  
DENVER, COLORADO**



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**FACILITIES INSTRUCTIONS,  
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**CONDUCT OF  
POWER OPERATIONS**

**December 2002**

**OFFICE OF POLICY  
POWER RESOURCES OFFICE**

**UNITED STATES DEPARTMENT OF THE INTERIOR  
BUREAU OF RECLAMATION  
DENVER, COLORADO**

## **PREFACE**

This document presents guidelines for operations of powerplants owned and operated by the Bureau of Reclamation. These guidelines are not intended to replace operators' judgment. Instead, they are intended to provide criteria and procedures that should be considered for incorporation into all levels of operations.

These guidelines were developed by power maintenance, operations, and management personnel from Reclamation's Denver, Regional, and Area Offices.

For more information on these guidelines and the Power Review of Operations and Maintenance Program, please contact Mitchell Samuelian at the Power Resources Office, D-5400, 303-445-3712.

## **DISCLAIMER**

This written matter consists of general information for internal Bureau of Reclamation operations and maintenance staff use. The information contained in this document regarding commercial products or firms may not be used for advertising or promotional purposes and is not to be construed as an endorsement of any product or firm by the Bureau of Reclamation.

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## **1. GENERAL DESCRIPTION OF RECLAMATION'S POWERPLANT OPERATIONS**

Reclamation is responsible for generating hydroelectric power and releasing water for authorized project purposes at its dams and powerplants. Powerplant Operators ensure the safe and sound operation of all structures and equipment associated with the fulfillment of this responsibility. At some facilities, powerplant Operators are responsible for a limited amount of transmission, but, for the most part, the power marketing administrations (PMAs) are responsible for transmission and marketing of the generation.

Reclamation power facilities maintain system voltage by providing reactive support. They respond to system emergencies by controlling powerplant loading and system frequency and voltage as required by the system dispatcher.

Reclamation powerplant Operators follow operating procedures and criteria that have been developed for each dam and powerplant. These procedures and criteria are contained in the Standing Operating Procedures (SOP) and the Designers Operating Criteria (DOC). Powerplant Operators also follow Facilities Instructions, Standards, and Techniques (FIST) volumes that have been developed by Reclamation. In addition, powerplant Operators follow guidelines on system operations from the Western Electricity Coordinating Council (WECC) and the North American Electric Reliability Council (NERC).

Power operation functions include the operation of all machinery and equipment used in the generation of hydroelectric power. These functions include the overall operation of the power and water system. The Operator is responsible for control of powerplant and water release equipment.

## **2. SCOPE**

The organization and administration of operations is intended to achieve a high level of safety and performance accomplished through effective implementation and control of operational activities. Operational policies and procedures recognize that protecting the environment and ensuring safe and efficient operations are compatible goals. Such policies and procedures reflect the standards of excellence used in operating Reclamation facilities. These policies set up the lines of responsibility for normal and emergency operations and provide a method to monitor and assess performance. This FIST manual, "FIST 1-11, Conduct of Power Operations," discusses the policies, resources, and assessment needed in operations.

## **3. MANAGEMENT ROLE IN OPERATIONS**

Reclamation facilities achieve a high level of excellence because the operations management establishes high performance standards. This excellence is achieved by management communicating these standards to the staff. Management is responsible to ensure personnel are well trained by committing time and resources to training. Management is also responsible for monitoring employee performance.

The Operations Head establishes standards, defines goals, and determines the responsibilities of the operational staff. The operations staff provides input and feedback to standards and training. Management uses reports and goals to measure performance. Personnel are held accountable for their performance through supervisory counseling, performance appraisals, and, when necessary, administrative action. Remedial training is provided, if appropriate.

#### **4. DEFINITIONS**

##### **4.1 Controls Area**

The control area is the area from which the Operator monitors and operates plant and system equipment. It is normally the area where clearances are issued and released.

##### **4.2 Logsheets**

Logsheets are procedures or forms used to record equipment operation and data that provide information necessary for evaluating and trending plant conditions

##### **4.3 Logbooks**

Logbooks are narrative records maintained and used by the operations personnel that describe and record operating information and events that aid in evaluating present and past plant status.

##### **4.4 Operations Head**

Operations head is the term used in the FIST manual to identify the operations person responsible for setting operational policies at the facility. Depending on the local facility practices, this could be the Operations Manager, Operations Supervisor, Operations and Maintenance (O&M) Supervisor, Shift Supervisor, Control Center, or person designated as Plant Operator.

##### **4.5 Operator Reading Files**

Operator reading files are reading materials that operations staff should be knowledgeable of as determined by the Operations Head and Facility Manager.

##### **4.6 Operator Rounds**

Operator rounds include monitoring the operations of plant equipment through local observations and recording appropriate equipment parameters.

#### **4.7 Recorder Charts**

A recorder chart provides a record of plant process instrumentation plotting versus time. The record is automatically charted by the associated instrument.

#### **4.8 Shift Turnover**

Shift turnover is the process of information and responsibility transfer to the oncoming Operator from the offgoing Operator.

#### **4.9 Three-Part Communications**

Three-part communications include the sender giving the information, the receiver repeating the information back, and the sender acknowledging the correctness of the repeated information. This form of communication is used to limit the possibility of human error during switching operations and during critical or emergency operations.

### **5. INDUSTRY STANDARDS AND GUIDANCE**

#### **5.1 Western Electricity Coordinating Council**

##### **5.1.1 History**

The Western Electricity Coordinating Council was created on April 18, 2002, by merger of the Western Systems Coordinating Council (WSCC), the Western Regional Transmission Association (WRTA), and the Southwest Regional Transmission Association (SWRTA). Reclamation is a member of WECC and agrees to comply with WECC policies.

##### **5.1.2 Location of Web Site**

The *WECC Operations Handbook* can be found on the Internet at <[http://www.wecc.biz/committees/oc/documents/oc\\_handbook.html](http://www.wecc.biz/committees/oc/documents/oc_handbook.html)>. WECC follows the NERC *Policies, Standards Principles, and Guides*.

#### **5.2 North American Electric Reliability Council**

##### **5.2.1 History**

NERC was created in 1968 as a voluntary organization to promote bulk electric system reliability and security.

NERC's membership is unique. As a not-for-profit corporation, NERC's members are 10 Regional Councils. The members of these Regional Councils come from all segments of the electric industry: investor-owned; Federal power agencies; rural electric cooperatives; State, municipal, and provincial utilities; independent power producers; power marketers; and end-use

customers. These entities account for virtually all the electricity supplied in the United States; Canada; and a portion of Baja California Norte, Mexico.

NERC promotes electric system reliability and security by:

- a) Establishing operating policies and planning standards to ensure electric system reliability.
- b) Reviewing the reliability of existing and planned generation and transmission systems.
- c) Critiquing past electric system disturbances for lessons learned and monitoring the present for compliance and conformance to its policies.
- d) Educating others about how bulk electric systems operate.
- e) Maintaining liaisons with the Federal, State, and provincial governments in the United States and Canada and electricity supply industry organizations in both countries.
- f) Serving as the electric industry's primary point of contact with the Federal Government on issues relating to national security and terrorism.

### **5.2.2 Location of Web Site**

The NERC *Policies, Standards Principles, and Guides* are available on the Internet at <<http://www.nerc.com/noc/opermanl.htm>>.

## **5.3 Summary of Procedures Pertaining to Generators**

The following are summaries of standards from the "Minimum Operating Reliability Criteria" that generating agencies should comply with. These standards are based on WECC, NERC, and Reclamation standards.

### **5.3.1 Automatic Voltage Regulator (AVR)**

- a) The AVR Shall be kept in service to the maximum extent possible. The AVR Shall maintain voltages specified by the Host Control Area Operator.
- b) AVR equipment Shall be tested and calibrated in conjunction with the balance of the excitation system as often as necessary to maintain calibration/performance, but at least once every 5 years or following any repairs to the excitation system. Calibration Shall include verification that all limiters and protective features in the excitation system are functional and coordinated with the balance of plant protection.
- c) AVR operation Shall be reported monthly in accordance with the WECC Reliability Management System (RMS) reporting procedures.

### **5.3.2 Automatic Generation Control (AGC)**

The AGC, where applicable, Shall remain in service as long as its action continues to be beneficial. If the AGC is out of service, manual control Shall be used to adjust generation. AGC Shall be returned to service as soon as practicable.

### **5.3.3 Blackstart**

Each control area Shall develop and maintain a blackstart capability plan that includes:

- a) A list of all blackstart generators with MW capacity, type of unit, date of latest test, starting method, and transmission switching requirements of each unit.
- b) A demonstration of blackstart capability through simulation or testing that Shall be performed at least every 5 years.
- c) Each blackstart unit Shall be tested annually to show that it can be started and operated without being connected to the system. The test Shall be documented.

### **5.3.4 Forced Outages**

The Operations Head of any key facility Shall notify the host control area of a forced outage. The host control area Shall make the required WECC notification.

### **5.3.5 Governor Droop**

Governor droop should be set at 5 percent on all hydrogenerators.

### **5.3.6 Power System Stabilizers (PSS)**

- a) Keep PSS on on-line generators operational.
- b) Install PSS on all new generators. Install PSS on 30-MVA and larger generators when a new excitation system is installed.
- c) Test and calibrate PSS equipment in conjunction with AVR testing and calibration. Test and calibrate as often as necessary to maintain reliable PSS performance in accordance with "WECC PSS Tuning Criteria" (available on WECC website <[www.wecc.biz](http://www.wecc.biz)>). PSS recalibration must be performed if AVR response parameters are modified.
- d) Report PSS operation monthly in accordance with the WECC RMS reporting procedures.

## **6. OPERATING PROCEDURES AND CRITERIA**

The following are guides to be followed by operating personnel in performing their duties.

### **6.1 Operating Procedures**

Develop Standing Operating Procedures for activities that could adversely impact safety, the environment, or operations. Provide training for critical or especially complex procedures. Facility management should ensure that qualified personnel conduct on-the-job training (OJT) or formal classroom training (or both) covering SOPs.

### **6.2 Abnormal or Unusual Operating Procedures**

Develop procedures to handle conditions that require a response to failed equipment or situations that require an immediate response by plant personnel. Examples are the loss of station service power, failure of facility sumps, activation of the evacuation plan, and the loss of generation. Include these procedures as a section in the SOP.

### **6.3 Monitoring of Operating Performance**

Operations are monitored and reviewed by the Operations Head. Record all operating problems or conditions in the Operator's logbook. Document equipment failures in the facilities maintenance tracking system, which usually is Maximo.

### **6.4 Standing Operating Procedures**

The SOP is a comprehensive, single-source manual that establishes procedures to be used in the operation of Reclamation facilities. The purpose of the SOP is to ensure adherence to approved operating procedures over long periods of time and during changes in operating personnel. A current and accurate SOP Shall be available at the dam or operating facility according to the requirements in *FAC 02-01 Operating Practices and Procedures for High- and Significant-Hazard Dams*

Operations personnel Shall review the facility SOP annually, at a minimum. All required changes will be noted and submitted to the Operations Head. The Operations Head is responsible to ensure the SOP is updated and reflects accurate information. The annual SOP review Shall be documented in the control room logbook.

### **6.5 Emergency Action Plan (EAP)**

The EAP outlines emergency action procedures for each facility. It includes detection of an event, decisionmaking, notification, response levels, expected

actions, and emergency termination. It covers events such as earthquakes, floods, and dam failures. It is included as a section in the SOP.

Operations personnel Shall review the facility EAP annually, at a minimum. All required changes will be noted and submitted to the Operations Head. The Operations Head is responsible to ensure the EAP is updated and reflects accurate information. The annual EAP review Shall be documented in the control room logbook.

## **6.6 Designers' Operating Criteria (DOC)**

The DOC are intended to provide the field personnel engaged in operation and maintenance with the designers' views on the proper use of the project features. The DOC are to be regarded as definite instructions for the safe, proper, and effective use of the facilities.

## **6.7 Facilities Instructions, Standards, and Techniques Volumes**

FIST manuals provide guidelines for the operation and maintenance of power facilities. Current copies of FIST manuals may be found on the Bureau of Reclamation Intranet at <[http://www.usbr.gov/power/data/fist\\_pub.htm](http://www.usbr.gov/power/data/fist_pub.htm)>. The Operations Head Shall ensure current copies of the FIST manuals are available.

# **7. SHIFT ROUTINES AND OPERATING PRACTICES**

## **7.1 Scope**

This section describes some important aspects of routine operations practices.

## **7.2 Purpose**

Effective monitoring of equipment is necessary to detect abnormal conditions or adverse trends. Monitoring allows actions to be taken before the equipment malfunctions. Notifying the Operations Head of unusual or unexpected situations will help ensure that attention is given to any problems. The Facility Manager is responsible for operations and formally transfers authority to operate to the Operations Head, who decides on the response to abnormal conditions.

## **7.3 Guidelines**

### **7.3.1 Operator Rounds**

Operator rounds Shall be of sufficient detail to ensure that the status of equipment is known. Operators Shall conduct a thorough tour of all areas within their responsibilities. Inspect equipment a minimum of once per shift. Normally, rounds should be made at the beginning of a shift.



The following checks Shall be done in conjunction with Operator rounds:

- a) Determine the status of plant equipment (i.e., operating, out of service, under clearance, or under maintenance).
- b) Inspect electrical panels, alarm panels, and breakers for abnormal or unusual conditions. Report unexpected conditions, such as equipment vibration, noise, unusual smells, or excessive temperatures, to the controls area.
- c) Check equipment alarm panels weekly to ensure the visual and audible alarms are working properly.
- d) Ensure that Operators check all facility areas and note any deficiencies. These deficiencies may include oil or water leaks; clogged floor drains; housekeeping or cleanliness problems; fire and safety hazards; and building deficiencies such as inoperative lighting, roof leaks, or doors that do not close properly.
- e) Note deficiencies in the facilities maintenance tracking system.

### **7.3.2 Round Sheets**

Round sheets are an excellent diagnostic tool and Operator Aid.

- a) Round sheets are an effective method for providing Operators with guidance on the extent to which equipment and areas should be inspected during routine rounds.
- b) Round sheets should be detailed enough to ensure personnel visit all key areas of the facility. However, the Round sheets should not be so detailed and time consuming that they inhibit the Operator from performing other assigned duties.
- c) Recording key equipment parameters provides a record of equipment performance that can be used to reconstruct events leading up to an equipment malfunction.
- d) Round sheets provide for short-term trending of equipment parameters and assist in Operator turnover and on-the-job training.
- e) Round sheets should include maximum and minimum values for readings taken to assist the Operator in identifying abnormal readings.
- f) Parameters outside the specific maximum and minimum values should be circled or otherwise highlighted on the round sheets and promptly reported to the controls area.
- g) The round sheets should contain a narrative section to allow the Operator to document major evolutions and abnormal conditions.

- h) The Operations Head should periodically review Operator round sheets and the performance of Operator rounds to ensure that comprehensive tours continue to be conducted, including as necessary, periodic inspections of equipment and areas not listed on the round sheets.

### 7.3.3 Essential Equipment

Essential equipment is defined as equipment that requires extra scrutiny by operations staff because of the consequences of failure. The failure of essential equipment can compromise the safety, environment, and operations of the facility.

The operations staff Shall ensure that this equipment is monitored by one of the following: procedures, Operator rounds, round sheets, or preventative maintenance checks.

- a) **Cooling Water System** – This cooling water system consists of cooling water pumps, regulators and piping systems. These systems ensure proper operation of transformers and generators. A loss of cooling water flow can cause equipment damage. If the system is at penstock pressure, a failure of the system could cause plant flooding. Check cooling water systems each shift or monitor with an alarm system and write a work order if a failure occurs.
- b) **Critical Valves** – Critical valves are valves that must be operated to isolate systems in the facility that are at reservoir static pressure or that contain fluids that could damage equipment or cause an uncontrolled release of undesirable materials to the environment. These valves are often in remote locations in the plant and are infrequently operated. These valves include, but are not limited to, penstock fill and drain valves, cooling water valves, sump discharge and fill valves, lube oil transfer and filling valves, and service air isolation valves. The annual operation of these valves will ensure Operator familiarity of the valve locations and determine whether the valves can be operated in an emergency.
- c) **Emergency Lighting** – Emergency lighting is essential to ensure safe egress in the event that normal lighting is lost. Reclamation has strict testing requirements (in accordance with National Fire Protection Act (NFPA) standards) to ensure this lighting is reliable. (See FIST 4-1B.) Depending on facility practice, Operators may conduct or assist in conducting this testing. Operators should observe all emergency lighting panels and alarms and report any problems to the proper contact. Emergency lighting should be tested monthly and load tested annually.
- d) **Facility Sump Pumps and Controls** – Facility sumps serve as barriers to the discharge of materials from the facilities to the environment, prevent flooding in the plant, and indicate problems with facility equipment. Checking the sumps for proper operation shift will limit the

possibility of a release into the environment or flooding in the facility because of leakage of plant equipment going unnoticed for a long period of time.

- e) **Fire Protection and Detection and Generator CO<sub>2</sub> Systems** – Plant fire protection and detection systems are important to alerting staff that fire is in the plant. Reclamation has strict testing requirements (in accordance with NFPA standards) to ensure these systems are reliable. Depending on facility practice, Operators may conduct or assist in conducting this testing. Operators should observe all fire protection and detection panels and alarms and report any problems to the proper contact. Generator CO<sub>2</sub> systems detect and suppress fires inside generator air housings that result from faults in the stator windings. Periodic testing and inspection of these systems are required on a regular basis. (See FIST 4-1B.)
- f) **Generator Exciter and Voltage Regulator System** – The exciter and voltage regulator are essential to generator operation. Failure means that the unit will not be able to control voltage or reactive power. This system has several alarm, indication, and shutdown functions that must be monitored regularly; some of these are on the exciter cubicle. Operators should periodically inspect the cubicle, observe all indicating devices, observe any visual and audible anomalies, and report as needed to the appropriate contact.
- g) **Instrument AC and DC Systems** – Instrumentation is essential to plant operations. Operators often rely (especially in the controls area) on remote indications of plant equipment. On/off status, voltage, current, temperature, pressure, flow, power, and many other parameters allow the Operator to monitor the performance of plant equipment and determine if the equipment is operating properly.
- h) **Lubrication Systems** – Lubrication systems ensure the proper operation of plant equipment. A loss of lubrication can cause a failure of equipment bearings or an environmental release. Check lubrication flows, levels, and temperatures every shift or monitor with an alarm system. Write a work order if the equipment has a low lubrication level.
- i) **Protective Relays and Protection Circuits** – Protective relays monitor critical unit quantities and act to shut down the unit when abnormal conditions exist. Relays are essential to the protection of plant equipment, the stability of the power system, and the safety of personnel.

Likewise, protection circuits that enable relays to actually trip plant protective equipment (e.g., breakers) must be fully functional at all times. Operators should periodically observe the following: relay targets to see that they are not dropped inappropriately, relay power supply lights to ensure proper operation, and lockout relay red lights to ensure the

integrity of trip coils.<sup>1</sup> Any anomaly in relay and protective relay circuit operation should be reported to the appropriate contact. Additional relay actuation sheets should be used, as appropriate, to document relay actuations. Operators may assist maintenance staff that periodically test the function of lockout circuits.

- j) **Station Service AC System** – Station service AC systems provide all necessary auxiliary power to operate critical loads such as sump pumps and battery chargers. Failure of the AC system leaves these critical loads unsupplied, risking the plant or generating units. Station service AC systems should be checked regularly to ensure proper operation, including voltage levels, current levels, transformer temperatures and levels, and any unusual noises or visual cues. Any anomaly should be referred to the proper maintenance or management contact.
- k) **Switchyards** – Switchyards contain components that are often the lifeblood (station service power) of the facility. Switchyards need to be monitored for abnormal conditions or intrusion.
- l) **Transformers** – Transformers are a critical component of the power train for several reasons. A transformer failure can be catastrophic, and, because many transformers are located on the tailrace of a facility, their failure can cause an oil spill on the ground or into a body of water. Additionally, the replacement of a transformer can take several months and leave the associated unit unavailable. Transformer temperatures should be checked often to ensure the transformer is performing properly. Moisture intrusion can lead to a failure; therefore, nitrogen pressure also should be monitored. For selected transformers, oil analysis should be performed on a regular basis, and the results and trends should be monitored.

#### **7.3.4 Response to Indicators**

Operators must log any abnormal operating conditions and report these conditions to appropriate personnel for corrective actions.

#### **7.3.5 Resetting Protective Devices**

Protective devices are installed to protect personnel and equipment from operating beyond their design limits. Protective devices may be reset only after establishing the reason the device limit was exceeded. Corrective action by the Operator or technical staff is taken and reported as needed.

Use relay sheets to document any relay actuations.

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<sup>1</sup> Most lockout relay (and circuit breaker trip coil) circuits are designed so that the red indicating light monitors the trip coil to ensure it is intact. If the red light is not lit, the coil may be burned out, jeopardizing the protection.

## **8. CONTROLS AREA ACTIVITIES**

### **8.1 Scope**

This section discusses the controls area activities that help to achieve safe and efficient operations.

### **8.2 Purpose**

The controls area is the coordination point for all operations of equipment under the jurisdiction of the Operator. Operators should not be overburdened with administrative responsibilities. Access to the controls area should be limited so that Operators are not distracted from properly monitoring and adjusting facility equipment.

### **8.3 Guidelines**

#### **8.3.1 Access to the Controls Area**

- a) Facility controls area Shall have access limited to authorized personnel in accordance with the directive and standard covering security of Reclamation facilities. Facility management and the Operations Head should establish a security plan to control access to the controls area.
- b) The Operator on duty has the authority to restrict access to the controls area.
- c) Personnel not specifically trained and authorized are restricted from operating any device that controls the operation of equipment.
- d) Students, visitors, and Apprentices must be made aware of safe working habits before entering the controls area.
- e) Authorized personnel should accompany visitors in the controls area.

#### **8.3.2 Professional Behavior**

The Operations Head is responsible for enforcing professional behavior in the controls area. Personnel disrupting operations will be asked to leave the controls area.

#### **8.3.3 Monitoring the Main Control Panels**

Operators monitor, prepare printouts, and save files of the main operating parameters and also major changes in operational requirements. Operators log and respond to malfunctions and alarms according to established procedures.

### **8.3.4 Monthly Reports**

Monthly operational reports generated by the operations staff are listed in FIST 1-3, *Reports and Records*.

### **8.3.5 Controls Area Ancillary Duties**

The Operations Head is responsible for reviewing Operator tasks to ensure that Operators are not performing duties that could interfere with the proper monitoring of operations. Operators perform administrative tasks only when operating conditions permit.

### **8.3.6 Operation of Controls Area Equipment**

Only Operators trained and authorized by the Operations Head may operate the controls. New operating personnel should receive operations training through an on-the-job training program. Experienced Operators supervise new operating personnel until the Operations Head formally approves their ability to operate the controls.

### **8.3.7 Continuity of Operations**

A Continuity of Operations Plan Shall be established to ensure operations can continue in the event the controls area has to be evacuated. This plan should list locations to operate equipment from and how communications will be established.

### **8.3.8 Self-Checking**

Self-checking is a work practice in which an individual consciously and deliberately reviews intended actions and expected responses before performing a task.

Self-checking includes distinct thoughts and actions designed to enhance an individual's attention to detail at a specific moment before performing a task.

The self-checking technique consists using the STAR acronym as follows:

- a) **Stop** – This is the most important step of any self-checking technique. Pause before performing a task to enhance attention to detail. The simple act of stopping increases the likelihood of performing each task correctly. Attempt to eliminate distractions.
- b) **Think** – Understand specifically what is to be done before manipulating any equipment. Identify the correct component, train, unit, etc., before taking any action. Use all senses that apply such as sight, hearing, and touch. Question the situation by trying to identify information, available or unavailable, pertinent to the task. Determine if the task is appropriate

for the given conditions. Consider expected responses and indications associated with intended actions (such as flow noise, breaker noise, meters, recorders, radiation levels, and vibration). Decide what actions to take should expected responses not occur.

- c) **Act** – Without losing eye contact, physically touch the component without actuating it. While touching it, confirm correct component, train, unit, etc. Compare component or device label to checklist, procedure, drawing, or memory (if necessary). Depending on the situation, there is some benefit to saying the component's name out loud to enhance one's attention to detail. Without losing the hand contact established earlier, perform the intended action.
- d) **Review** – Compare the actual response to the expected response.

### **8.3.9 Potentially Distractive Materials and Devices**

The Operations Head should approve the use of computerized, written, audio, or visual material not having to do with operations before any of these is used.

## **9. COMMUNICATIONS**

### **9.1 Scope**

Communications should be reliable and accurate when transmitting information.

### **9.2 Purpose**

Oral and computer communications are the primary means of sending operations information. Since accurate communication is essential for safe and efficient operation, guidance in its use is necessary. Operators use the facilities audio and visual warning devices to alert personnel to abnormal or emergency conditions. These communications are controlled to insure that they do not detract from normal operations and are available in an emergency. Specific information on communication procedures must be given to outside users.

### **9.3 Guidelines**

#### **9.3.1 Emergency Communications Systems**

Each facility Shall establish who is the Local Emergency Manager or Coordinator.

The automatic fire alarm system sounds warning bells in all areas in the event of an emergency requiring an emergency evacuation.

### **9.3.2 Communication System Failure**

The facility Shall establish a plan to deal with disruptions in the facility's communication system. At a minimum, this plan Shall include alternate methods to communicate with plant staff and outside organizations that are necessary for the continuing operation of the facility.

### **9.3.3 Contacting Operators**

The staff normally contacts Operators by the facility telephone. The Operators use portable radios, pagers, cell phones, satellite phones, microwave, and portable phones to maintain contact with the controls area and each other, when necessary.

### **9.3.4 Communication with Dispatchers**

Because these communications are often critical, a method of documenting verbal communications with dispatchers Shall be established. This could be in the form of a voice recorder or a written log.

### **9.3.5 Radios**

Portable radios may be used by the facility operations staff to maintain contact with the controls area and each other.

### **9.3.6 Testing of Radios**

Test radio, telephone, satellite, and cellular systems monthly.

### **9.3.7 Abbreviations and Acronyms**

Operators should use only commonly known abbreviations and acronyms in communications.

### **9.3.8 Oral Instructions and Information Communication**

Oral instructions should be clear and concise, and the sender and intended receiver should be readily identifiable. When necessary to insure that the instructions are understood, the receiver, should repeat instructions involving the operation of equipment.

During switching, emergency, or critical operations, three-part communications must be used to prevent human error.



### **9.3.9 Communication of Testing Activities**

When performing tests on plant equipment, notify the Control Room Operator before starting the test to prevent confusion associated with alarms coming into the control room.

## **10. CONTROL OF ON-SHIFT TRAINING**

### **10.1 Scope**

The primary mode of training for operating the facility is through on-the-job training. Training must be carefully supervised and controlled to avoid mistakes in operations. This chapter discusses the facilities training requirements.

### **10.2 Purpose**

On-the-job training is that part of training where the new Operator or Apprentice receives hands-on experience with the facility controls and equipment. Experienced operations personnel supervise this instruction. The Operations Head is responsible for determining the training methods, materials, and documentation.

### **10.3 Guidelines**

#### **10.3.1 Adherence to Training Program**

The Operations Head or Apprenticeship Committee determines the training requirements, duration of training, and when an Operator is qualified to operate the facility without direct supervision. In addition, a checklist should be used to ensure completion of training requirements.

New Operators and Apprentices are required to familiarize themselves with the facility reference documents, facility systems, policies, and procedures. The Operations Head selects which facility-specific or other training programs personnel must attend to be qualified to operate or use the facility. The Operations Head or Apprenticeship Committee may authorize training exemptions based on an assessment of personnel experience.

#### **10.3.2 On-Shift Instructor Qualifications**

The Operations Head or Apprenticeship Committee determines who is qualified to instruct the Apprentices.

#### **10.3.3 Qualified Operator Supervision and Control of Apprentices**

Qualified Operators supervise training whenever Apprentices operate equipment, ensuring that errors are not made that could degrade facility

safety or operation. Qualified Operators should review log readings and other information recorded by Apprentices.

#### **10.3.4 Suspension of Training**

Training Shall be immediately suspended in the event of an abnormal occurrence or emergency condition.

#### **10.3.5 Maximum Number of Apprentices**

The Operations Head should limit the number of Apprentices on any given shift to ensure quality training occurs.

#### **10.3.6 Use of Apprentices to Support Operations**

The facility Shall set standards to determine when an Operator Apprentice is permitted to perform certain procedures independently. Because of personnel safety concerns, Apprentices Shall not independently perform clearances.

### **11. INVESTIGATION, EVALUATION, AND DOCUMENTATION OF INCIDENTS**

#### **11.1 Scope**

The Directive and Standard for Power Operations and Maintenance Incident Evaluation and Reporting Program (FAC 04-02) establishes the minimum requirements for incident evaluation and reporting practices at Reclamation power facilities. The requirements include the following:

- Events (emergency, abnormal, and near-miss situations) are thoroughly investigated to assess their impacts on operations.
- Occurrences meeting certain criteria are promptly reported to facility management.
- Root causes are identified.
- Corrective actions are identified and taken to prevent recurrence.
- The event is properly documented.

#### **11.2 Purpose**

Each facility Shall have formal training to ensure that events (emergency, abnormal, and near-miss situations) are recognized, reported, investigated, and corrected.

Abnormal events are occurrences that could:

- Affect the health and safety of the public, employees, or guests.
- Have an adverse effect on the environment.
- Affect the operations and intended purpose of the facility.
- Result in loss or damage to property.
- A violation of an established rule, standard practice, or standing operating procedure.
- Result in dangerous operating conditions.
- Result in an unintentional equipment or system outage.

## **12. NOTIFICATION PROCEDURES**

### **12.1 Scope**

To aid the operations staff, establish a process to systematically notify plant personnel or outside personnel or both should be established.

### **12.2 Purpose**

It is essential to notify proper personnel in a timely manner regarding incidents. Because notifications are not often provided, establish policies to ensure notification of appropriate personnel.

### **12.3 Guidelines**

#### **12.3.1 Management Notification**

Promptly notify management of abnormal occurrences to ensure that the facility is responsive to public health and safety concerns. This section provides guidance to ensure the uniformity, efficiency, and completeness of these notifications.

Post a Notification Call List for occurrences, which includes the Facility Manager and alternates, together with their telephone numbers, in the facility controls area.

#### **12.3.2 Types of Notifications**

- a) Emergency Plan activations require verbal notification within 15 minutes.
- b) Other event notifications will be based on local facility policies and procedures.

- c) All reportable events require a written report to management within 24 hours of categorization.
- d) NERC requires notification when a threat or act of sabotage occurs at a power facility.
- e) Keep the Emergency Plan in the SOP manual and describe notification procedures in the event of an emergency.
- f) The facility should establish local callout procedures for maintenance issues that occur after normal working hours.

### **12.3.3 Notification Responsibility**

- a) The facility Operations Head ensures that those individuals listed on the appropriate call-in list have indeed been notified and that any requirements for notification have been satisfied.
- b) List the names and phone numbers of facility personnel to be notified in the event of an emergency in the Emergency Action Plan.
- c) Keep the equipment responsibility call-in lists in the facility controls area. The call-in lists should be broken down by equipment responsibilities and include the names of primary and alternative personnel, their phone numbers, and their pager numbers.
- d) The on-duty Operator will log all abnormal conditions and any call-in of facility personnel.
- e) All call-outs and abnormal conditions shall be logged in the facility logbook.

## **13. CONFIGURATION MANAGEMENT**

### **13.1 Scope**

Good operating practices will maintain the facility's configuration within its design limits and provide the Operators with knowledge of the status of the equipment and systems.

### **13.2 Description**

Facility Operators must be aware of how the equipment and systems function. Operators also must be aware of operational limits. Communicate changes in equipment and system configuration to the affected operating personnel by noting these changes in the operations logbook(s) or by other methods that allow Operators to review the changes.

The status of the equipment and systems is controlled according to SOPs. Identification and documentation of equipment deficiencies is important to ensure safe and reliable operation.

## **13.3 Guidelines**

### **13.3.1 Status Change Authorization and Reporting**

Changes to major equipment and systems should be reviewed by qualified personnel. Maintenance personnel must notify the on-duty Operator of any equipment changes that may affect the operations or safety of the facility. Operators ensure that changes in the facility configuration and status are communicated to all operations personnel and must document those changes in the facility operations log.

### **13.3.2 Equipment and Systems Check**

Perform equipment operational checks after shutdowns for maintenance or repairs to ensure the equipment is properly restored. Use checklists as needed or appropriate.

### **13.3.3 Equipment Locking and Tagging**

Train all operations personnel on Lockout/Tagout in accordance with FIST 1-1, *Control of Hazardous Energy*.

Record the use of locks and tags in a logbook that is maintained in the controls area. Audit this log on a regular basis.

### **13.3.4 Disabling Alarms or Protective Devices**

Alarms and protective devices are an essential part of plant operations. Alarms notify facility Operators when parameters are exceeded. Protective devices are often the Operators' first line of defense against system failures, but the malfunction of systems or the testing of equipment may require the disabling of alarms or protective devices.

When alarms are disabled, it is crucial that they be disabled in a controlled manner:

- a) Retain a logbook in the controls area documenting the disabling of facility alarms.
- b) The use of the controls area log to document the disabling of this equipment is not recommended if the device will remain disabled past the current shift.
- c) Any procedures requiring the disabling of an alarm or protective device Shall contain a step to restore that alarm.
- d) The review of disabled alarms or protective devices Shall be a part of the shift turnover.

### **13.3.5 Equipment Deficiency Identification and Documentation**

Equipment deficiencies are noted in MAXIMO and are reported to the responsible group for repair by the appropriate craftsman.

### **13.3.6 Changes in Relay Settings**

Changes in relay settings Shall be peer reviewed and documented.

### **13.3.7 Alarm Status**

Operators are trained to respond to all facility equipment and system alarms. After establishing and/or correcting the cause, the Operator may reset equipment alarms.

### **13.3.8 Temporary Modification Control**

The Operations Head or the Facility Manager or both must approve temporary modifications. Temporary modifications Shall be logged in the operations logbook(s) by the on-duty Operator, and a special condition tag may be issued, if appropriate, in accordance with FIST 1-1.

## **14. HAZARDOUS ENERGY CONTROL PROGRAM, FIST 1-1**

### **14.1 Scope**

This section provides a method to control equipment through locking or tagging or both. These actions protect personnel from injury and protect equipment from damage. Accidental operation of equipment during normal operation, servicing, or maintenance has the potential to cause personal injury or equipment damage. The Hazardous Energy Control Program allows workers to be sure that equipment has been removed from service and later restored to operation.

### **14.2 Purpose**

All clearances and lockouts on the facility will be done in accordance with FIST 1-1. Clearances and lockouts will be in accordance with the FIST 1-1 local implementing policy.

## **15. LOG KEEPING**

### **15.1 Scope**

Operations records contain a narrative log of the facility status and all events required to reconstruct a history of operations. In this context, logs are defined as a narrative sequence of events or functions performed by the operations staff.

## **15.2 Purpose**

Operation logs are established to record the data necessary to provide a history of facility operations. FIST 1-3, *Reports and Records*, contains additional information about Operation logs.

The scope, type, and amount of data required by management is entered into the logs, including documentation of actions taken, activities completed, and data necessary to reconstruct events. Logs are reviewed to ensure that they are adequately maintained and that operations personnel are aware of the information in the logs.

## **15.3 Guidelines**

### **15.3.1 Establishment of Operating Logs**

Maintain the facility operations logs in the facility controls area. Only authorized personnel may make entries in the controls area log.

### **15.3.2 Timeliness of Recordings**

Information is entered, promptly or as soon as reasonably possible, to prevent inaccuracies. Log keeping does not take precedence over controlling and monitoring the facility.

### **15.3.3 Controls Area Log Requirements**

Record all information pertaining to the safe and efficient operation of the facility in the operations logbooks. To aid in reconstructing events, log as much information as possible during emergencies and abnormal or unexpected events.

- a) The controls area logbook is a legal record of facts about project operations. It is not a forum for opinions or philosophies.
- b) Each logbook entry shall be preceded by the time associated with the event recorded.
- c) All references to time shall be made utilizing the 24-hour clock.
- d) Activities of only 1 day shall appear on an individual logbook page. At remote facilities, this is not required because of the limited number of entries. At remote plants, log the date and time for each entry.
- e) If a logbook entry contains an out of chronological order sequence, note the logbook entry by the phrase "Late Entry" or "LE."
- f) Commonly used acronyms are acceptable for logbook entries.
- g) Individual pages shall not be removed from the controls area logbook.

#### **15.3.4 Information To Be Recorded:**

- a) A chronological history of all communications involving plant operations
- b) Switching operations
- c) Hot line orders
- d) General switching
- e) Changes in reservoir elevation operating criteria or water releases
- f) Relay operations, including the relay identification
- g) Clearances (issued or released), including the clearance number and equipment cleared
- h) Special condition tags (issued or released), including the equipment they are placed on.
- i) Unit start and stop times
- j) Any pertinent alarms
- k) Any equipment failures or malfunctions
- l) Line outages
- m) Breaker opening and closing
- n) Call-outs
- o) Any change in unit status:
  - Generator number
  - Condensing
  - Standby
  - Unavailable/available
- p) The status of all major equipment at 0000 hours

#### **15.3.5 Legibility**

All log entries must be legible, understandable, and made in ink of a color that can be photocopied.

#### **15.3.6 Corrections**

Score incorrect entries with a single line and initial.



### **15.3.7 Log Review**

The Operations Head should review the operations logbook daily.

### **15.3.8 Care and Keeping of Logs**

The Operator's Supervisor is responsible for filing and storing the logs for the expected life of the facility. Previous logs Shall be available for review by Operators or staff returning after an absence.

## **16. SHIFT TURNOVER**

### **16.1 Scope**

Shift turnover provides oncoming Operators with an accurate picture of the overall status of the facility. This section describes the important aspects of good operations turnover.

### **16.2 Purpose**

Operations turnover is a critical part of the facility's operation. Inaccurate or improper (incomplete) shift turnover can contribute to or cause incidents, so it is essential that operations personnel perform shift turnovers in a manner so that an effective transfer of information takes place. Personnel Shall not assume operational duties unless they are physically and mentally fit to do so and not until they and the offgoing personnel have a high degree of confidence that an appropriate information transfer has taken place.

Oncoming personnel Shall review logs, the turnover check sheet, visual displays, computer pages, and alarm pages; and they Shall receive a verbal briefing before assuming the responsibility of operating the facility.

### **16.3 Guidelines**

#### **16.3.1 Information Exchanged at Turnover**

At a minimum, the following information should be exchanged during a shift turnover:

- a) Equipment on clearance
- b) Major equipment status
- c) Alarm status
- d) Work in progress
- e) Any abnormal plant conditions
- f) Work scheduled

### **16.3.2 Turnover Checklists**

A turnover checklist is an invaluable tool to alert the oncoming Operator to the status of the facility. If used, the oncoming Operator should review the turnover checklist.

### **16.3.3 Plant Status Review**

Before being relieved, the outgoing Operator should perform a plant status review to provide the latest details to the oncoming Operator. Oncoming Operators use the first part of the shift to scan various SCADA displays, alarm displays, disabled alarms, protective devices, and computer pages. They also read the operations log to familiarize themselves with the current operating conditions. The plant status review should include a walk down of control panels to determine equipment-operating parameters.

### **16.3.4 Control Panel Walk Down**

As part of Operator takeover, the oncoming Operator reviews the equipment status and previous operational history.

### **16.3.5 Purpose and Exchange of Responsibility**

Before taking responsibility for operating the facility, the on-coming operation staff will discuss operating conditions with the out-going operation staff. The operation staff will then sign in the controls area log.

### **16.3.6 Relief Occurring During the Shift**

The Operations Head or a qualified Operator, cognizant of the operating conditions of the facility, may relieve the on-duty Operator.

When a relief occurs during the shift, the out-going Operator gives the oncoming Operator a verbal briefing containing at least the minimum information for turnover discussed in this section.

## **17. OPERATOR READING FILES**

### **17.1 Scope**

A reading file for operations personnel should ensure that appropriate individuals are aware of the important information related to job assignments and plant operating conditions. This section describes such a reading program.

## **17.2 Purpose**

Facility operations personnel receive important information from the Operations Head. The Operations Head is responsible for distributing information to the Operators.

## **17.3 Guidelines**

### **17.3.1 File Index**

A list of documents maintained in the Operator reading files should include:

- Operational logs
- Incident reports
- Material containing powerplant operations emergency operating procedures
- Spill Prevention, Control, and Countermeasures Plan (SPCC)
- Operational bulletins (containing changes in operational procedures and equipment)
- Operational schedules and maintenance schedules
- The facility Standing Operating Procedure

These documents should be a part of the initial Operator training.

Facility management may require seasoned operations staff members to review only revisions or the entire document on a periodic basis.

### **17.3.2 Reading Assignments**

The Operations Head gives reading assignments to the operations staff. Certain assignments require signatures by the operations staff to indicate that they have read and understand the document.

### **17.3.3 Required Dates for Completion of Reading**

The operation logs must be read by the oncoming shift before relief of the out-going personnel.

Operational bulletins and information pertaining to operational schedules or changes to plant procedures must be read by the oncoming operations staff. The oncoming operations staff must be fully cognizant of the status of the facility before taking over the shift.

The Operations Head will determine all other required reading completion dates of material placed in the required reading file.

#### **17.3.4 Documentation**

The Operations Head should establish a method to track the Operator reading files.

#### **17.3.5 Review**

Periodic reviews of the Operator reading files will be made by the Operations Head to ensure that relevant and up-to-date information is available.

### **18. DEVELOPMENT AND USE OF OPERATING PROCEDURES**

#### **18.1 Scope**

Operating procedures provide specific direction for operating systems and equipment during normal, abnormal, and emergency conditions. This section describes the important aspects of the development and use of operating procedures.

#### **18.2 Purpose**

Procedures are a key factor affecting the operations staff performance. Operating procedures should be sufficiently detailed so that the required actions can be undertaken without direct supervision. The format may range from detailed step-by-step instructions to general operating guidelines or outlines based on complexity and risk. In all cases, procedures should be written so that they can be easily used without making mistakes. To ensure that procedures are effective and that the best possible instruction is provided, procedures should receive periodic review and feedback.

#### **18.3 Guidelines**

##### **18.3.1 Procedure Development**

Procedures exist for all normal operations, postulated abnormal, and emergency situations. The detail used in the procedures is based on the complexity of the task, the experience and training of the operations staff, the frequency of performance, and the significance of the consequences of errors. Therefore, procedures can range from step-by-step instruction to general operating guidance.

At a minimum, procedures should exist for complex tasks, infrequent operations (more than one month interval), abnormal operations, and operations where personal, public, or equipment safety is a concern.

##### **18.3.2 Procedure Content**

To provide uniformity in operations procedures, facility procedures conform to the following guidelines:

- a) The scope and purpose are clearly defined.
- b) All procedures should be included in the SOP book.
- c) Procedures should include references.
- d) Warnings, notes, and cautions are easily identifiable (printed in bold) and appear on the same page as the step of the procedure that the warning, note, or caution applies.

### **18.3.3 Procedure Changes and Revisions**

Procedures should be written and checked by a second qualified person.

Make changes and revisions to procedures to reflect current operating practices and requirements. Facilities should set policies to control minor changes to procedures. Place all procedure changes in the required reading file for operations personnel.

### **18.3.4 Procedure Approval**

The Operations Head or the Facility Manager or both will review the procedures before issuance to ensure their accuracy.

The Operations Head is responsible for approving all operating procedures. The Operations Head will sign and date new or revised operation procedures with red ink. The signature in red ink indicates the original copy.

Revisions to the operating procedures require the same level of approval as the initial versions.

### **18.3.5 Procedure Review**

Emergency procedures are reviewed to insure that all aspects of safety and environmental impact have been fully covered before issuance.

Operational procedures are periodically reviewed by the Operator's Supervisor to ensure that they are accurate and current.

Applicable procedures are reviewed after any abnormal event to ensure their adequacy.

Drills covering the fire plan, facility evacuation, emergency action plan, action plan, and other similar procedures should be performed on an annual basis.

### **18.3.6 Procedure Availability**

Up-to-date emergency and operational procedures are maintained at the facility.

## **19. OPERATOR AIDS**

### **19.1 Scope**

Operator Aids should provide information to Operators in performing their duties. The Operations Head Shall ensure that posted Operator aids are current, correct, and useful.

### **19.2 Purpose**

Operator aids have an important function in the safe operation of the facility and may come in many forms: complete or partial copies of procedures, system drawings, memos, and placards. They can be placed throughout the facility to assist the operations staff. These postings must reflect the most current information and must not supersede or conflict with any procedure.

### **19.3 Guidelines**

#### **19.3.1 Operator Aid Development**

Any facility staff member may develop an Operator Aid. However, Operator Aids must be approved by the Operations Head before they can be posted in the controls area or in the facility.

#### **19.3.2 Approval**

Each facility should establish a local practice to ensure Operator Aids have an approval and control process.

#### **19.3.3 Postings**

Operator Aids are posted so they do not obscure instruments or controls. Aids are located near the area of their expected use.

#### **19.3.4 Use of Aids**

Operator Aids are used as a convenience and for supplementing approved procedures. They are not used to circumvent approved procedures.

#### **19.3.5 Recommended Operator Aids**

This is the list of recommended Operator Aids:

- Unit outage schedules
- Plant single-line diagram
- Plant switching diagram

- Generator capability curves
- Procedures for difficult or complicated tasks

### **19.3.6 Control of Operator Aids**

A log should be established and maintained listing all current Operator Aids and their revision number.

### **19.3.7 Review**

Operator Aids should be reviewed at least annually or after power plant procedure changes to insure that they are accurate, current and necessary.

## **20. EQUIPMENT LABELING**

### **20.1 Scope**

A well-established and maintained program for labeling equipment will help to ensure that the facility and support personnel can identify instrumentation, controls, and equipment. In addition, equipment labeling is required by Operational Safety and Health Administration (OSHA) regulations and various national consensus standards.

### **20.2 Purpose**

A good labeling program that is understood and maintained by operations and maintenance personnel enhances the effectiveness of training. Such a program also helps to reduce errors in operations and errors made by maintenance personnel. Errors can result from incorrect identification of equipment and controls.

The labeling program should allow personnel to identify instrumentation, controls, and equipment needing labels. In addition to equipment, doors to rooms should be labeled to help facility and support personnel to identify rooms and, if applicable, the equipment inside.

### **20.3 Guidelines**

#### **20.3.1 Components Requiring Labeling**

At a minimum, the following items should be labeled:

- a) Emergency exits, fire alarms, fire protection, fire extinguishers
- b) Rescue and first aid equipment

- c) Circuit breakers and power panels
- d) Valves, piping systems, and major plant equipment

### **20.3.2 Label Information**

Label information must be consistent with the information found in facility procedures, drawings, and other documentation.

- a) Labels must be permanently attached and have easy-to-read information. The label should use common names of facility systems and equipment, along with a number designator.
- b) Valves should be labeled with a number and name describing the purpose consistent with system drawings.
- c) Piping systems should be labeled with flow direction and contents.
- d) Major plant equipment should also be labeled by equipment number and function.
- e) Circuit breakers and panels are labeled so as to designate which circuit they are fed from and what devices they feed.
- f) Emergency exits, fire alarms, fireextinguishers, and fire protection equipment are labeled in a standard industrial format.

### **20.3.3 Label Placement**

Labels are placed on, or as near as practical to, the controls or equipment being labeled. Labels are oriented so that they are easy to read.

### **20.3.4 Replacing Labels**

The Operations Head (or other designated person) is responsible for ensuring that missing or damaged labels, once identified, are promptly replaced and that newly installed equipment or new modifications to existing equipment are properly labeled.



## Acronyms and Abbreviations

<b>AC</b>	alternating current
<b>AGC</b>	automatic generation control
<b>AVR</b>	automatic voltage regulator
<b>CO<sub>2</sub></b>	carbon dioxide
<b>DC</b>	direct current
<b>DOC</b>	Designers Operating Criteria
<b>EAP</b>	emergency action plan
<b>FIST</b>	Facilities Instructions, Standards, and Techniques
<b>kV</b>	kilovolt
<b>LE</b>	late entry
<b>MVA</b>	megavoltampere
<b>MW</b>	megawatt
<b>NERC</b>	North American Electric Reliability Council
<b>NFPA</b>	National Fire Protection Association
<b>O&amp;M</b>	operations and maintenance
<b>OJT</b>	on-the-job training
<b>OSHA</b>	Occupational Safety and Health Administration
<b>PMAs</b>	power marketing administrations
<b>PSS</b>	power system stabilizer
<b>SCADA</b>	Supervisory Control and Data Acquisition
<b>SOP</b>	Standing Operating Procedures
<b>SPCC</b>	Spill Prevention, Control, and Countermeasures Plan
<b>STAR</b>	stop, think, act, review
<b>SWRTA</b>	Southwest Regional Transmission Association
<b>WECC</b>	Western Electricity Coordinating Council
<b>WSCC</b>	Western System Coordinating Council
<b>WRTA</b>	Western Regional Transmission Association