Central Valley Gas Storage

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June 15, 2017

Mr. Kenneth Bruno, Program Manager
Gas Safety and Reliability Branch
Safety and Enforcement Division (SED)
California Public Utilities Commission
505 Van Ness Avenue
San Francisco, CA 94102

Subject: **2017 General Order 112 Gas Inspection of Central Valley Gas Storage**

Dear Mr. Bruno,

Central Valley Gas Storage, LLC (CVGS) continues to place the safety of the public and its workforce as its top priority and endeavors to operate and maintain its gas pipeline facilities at standards that meet or exceed the requirements of California Public Utilities Commission General Order (GO) 112. Our management team at CVGS values the SED inspection process as an opportunity to improve our practices and records with the benefit of your findings and recommendations, and we appreciated being able to interact with your SED auditors during the February 2017 inspection of CVGS' Control Room Management Procedures, Patrolling and Leak Survey, Public Awareness Program and Operator Qualification records.

We have carefully reviewed the Summary of Inspection Findings and respond to each of the individual items as follows:

I. 1. Title 49 Code of Federal Regulations (CFR) §192.631(b)(1)

Title 49 CFR §192.631(b)(1) states in part: "Roles and responsibilities. Each operator must define the roles and responsibilities of a controller during normal, abnormal and emergency operating conditions...A controller's authority and responsibility to make decisions and take actions during normal operations."

During SED's review of the Control Room Management Plan, Section 300 – Roles and Responsibilities – CVGS does not explicitly define the responsibilities for each controller when both controllers are present at the station. According to CVGS's schedule this scenario occurs primarily on Wednesdays.

CVGS has added the following instruction to Section 300:

> *When two or more controllers are scheduled for the same shift only one controller can be logged in at a time. The controller that has been on duty previously will be the primary controller. The controller that is coming on shift will assist the primary controller.*

2. Title 49 CFR §192.631(b)(3)

Title 49 CFR §192.631(b)(3) states in part: "Roles and responsibilities. Each operator must define the roles and responsibilities of a controller during normal, abnormal and emergency operating conditions…A controller's role during an emergency, even if the controller is not the first to detect the emergency, including the controller's responsibility to take specific actions and to communicate with others:"

During SED's discussion with facility personnel it was mentioned that the controller has the authority to call 911 or other local emergency personnel. However, the current version of the written plan does not incorporate that language under Section 300 Roles and Responsibilities, or into a procedure contained within the Control Room Management Plan. CVGS needs to clearly state in its written plan the controller's authority to call 911 or other local emergency personnel.

CVGS has added authority to call 911 or local emergency personnel to the Roles and Responsibilities in Section 300.

3. Title 49 CFR §192.631(b)(4)

Title 49 CFR §192.631(b)(4) states in part: "Roles and responsibilities. Each operator must define the roles and responsibilities of a controller during normal, abnormal and emergency operating conditions…A method of recording controller shift-changes and any hand-over of responsibility between controllers."

The Control Room Management Plan Section 406 describes the use of the shift hand-off process for normal shift changes and unforeseen circumstances. However, the CRM does not explicitly describe the process used for alternate shift hand-overs and the controller's responsibilities during unplanned circumstances, such as short breaks, taking fatigue mitigation measures, or when the controller perform routine duties around the facility.

CVGS has added the following instruction to Section 406 page 30

> *When plant operators are required to leave the control room to attend to a function within the plant, take a short break, or take a fatigue mitigation measure, monitoring is performed as back up by plant operator(s) at other plants on the same DCS network. The on duty operator (on site) will call the remote operator to monitor the facility during the short absence. If an alarm is generated while the on site operator is away from the control console the remote operator will call the on site operator on the on site operator's cell phone to respond to the alarm. Also the alarm system generates an audible alarm that is broadcast over the plant intercom system when process variables are exceeded enabling the on site controller / plant operator to*

know there is an out of range event while out of the control room. The on site controller / plant operator has the capabilities to monitor and make adjustments to the system via operator control stations located in the compressor buildings.

When the on site operator is back at the control console the operator will call the remote operator(s) to inform them that the remote monitoring event is finished. The remote monitoring operations will be noted in the operator's daily log at both locations.

4. Title 49 CFR §192.631(c)(2)

Title 49 CFR §192.631(c)(2) states in part: "Provide adequate information. Each operator must provide its controllers with the information, tools, processes and procedures necessary for the controllers to carry out the roles and responsibilities the operator has defined by performing each of the following:…Conduct a point-to-point verification between SCADA displays and related field equipment when field equipment is added or moved and when other changes that affect pipeline safety are made to field equipment or SCADA displays;"

The Control Room Management Plan does not define safety related points as they pertain to Central Valley Gas Storage's SCADA system. Additionally the "Point-to-Point Verification Procedure" document refers to the Alarm Management Plan for the definition of a safety related point, but the Alarm Management Plan does not contain the definition.

Southern Company Gas has developed a new Alarm Management Plan ("AMP") for CVGS, which is attached. (See Attachment 1.) The new AMP includes the following Safety Related Alarm definition:

Safety-Related Alarm	A safety related alarm is defined as an alarm that has a Human or Environmental impact severity of III, IV, or V (see Table for definitions of the impact severities). An alarm that specifically indicates that equipment or processes are outside the pipeline operator's defined safety-related parameters. Federal regulations 49 CFR 192 specify certain requirements around safety related alarms. It is therefore desirable for each pipeline operator to identify and document any safety related alarms along with the criteria for that identification. Regulations 49 CFR 192 require that safety related alarms are accurate, be reviewed, and support safe pipeline operations.

5. Title 49 CFR §192.631(c)(3)

Title 49 CFR §192.631(c)(3) states in part: "Provide adequate information. Each operator must provide its controllers with the information, tools, processes and procedures necessary for the controllers to carry out the roles and responsibilities the operator has defined by performing each of the following:… Test and verify an internal communication plan to provide adequate means for manual operation of the pipeline safety, at least once each calendar year, but at intervals not to exceed 15 months."

a. The internal communication plan does not address scenarios under which the control room must be evacuated.
b. The internal communication plan does not provide information describing the failure state of SCADA controlled facilities if there is event such as a power loss, etc. Additionally, there is no test procedure that verifies the state or mode of remote facilities during a SCADA failure.

CVGS has added/modified the Internal Communication Plan to include items on page 26 in the Control Room Management Plan as follows:

- *In the event the control room must be evacuated during an emergency the controller / plant operator will trip the ESD system and report to the assigned safe muster area. The controller / plant operator will notify the operations supervisor and implement the Emergency Response Plan. Examples for a Control Room evacuation may include but are not limited to:*
  - *Control Center Fire*
  - *Facility Emergency*
  - *Earthquake*
  - *Civil Unrest*
  - *Weather Emergency*

Additionally, CVGS has added/modified items to the Internal Communication Plan on page 24 and page 26 in the Control Room Management Plan as follows:

- Page 24 - *Upon loss of communications between any one site, multiple sites or controller a system alarm is generated and stored as an event along with the date and time.*
- Page 26 -*The test may be conducted on a section of the system or the entire system by safely disabling communications between sites to generate an alarm. The test shall ensure the equipment is working properly as designed, alarms are received at the proper location, and that employees are familiar with how communications shall be conducted.*

6. Title 49 CFR §192.631(d)(4)

Title 49 CFR §192.631(d)(4) states in part: "Fatigue mitigation. Each operator must implement the following methods to reduce the risk associated with the controller fatigue that could inhibit a controller's ability to carry out the roles and responsibilities the operator has defined…Establish a maximum limit on controller HOS, which may provide for an emergency deviation from the maximum limit if necessary for the safe operation of a pipeline facility."

CVGS's Control Room Management Plan Section 501 lists a minimum time off of 34 hours, if the maximum hours of service (HOS) limit is reached. This needs to be corrected to reflect a minimum time off of at least 35 hours, unless AGL can provide technical justification for reducing the 35-hour minimum time off as prescribed in PHMSA FAQ D07.

CVGS has modified its Control Room Management Plan in section 501 to correct the 34 hours to 35 hours:

> *All shift rotations shall provide off duty time sufficient for 8 hours of continuous sleep by the controller/plant operator between shifts. Hours of service should be limited to 65 hours in any normal consecutive shift work schedule. If this recommended limit is reached, a minimum period of 35 hours of no work should be provided. For shift schedules on 12-hour shifts, the number of consecutive hours under normal circumstances should not exceed 14. For shift schedules on 8-hour shifts, the number of consecutive hours under normal circumstances…*

7. Title 49 CFR §192.631(e)(3)

Title 49 CFR §192.631(e) states in part: "Alarm management. Each operator using a SCADA system must have a written alarm management plan to provide for effective controller response to alarms.

Central Valley Gas Storage uses the Honeywell system as one of the tools used to track alarm content and volume. With the Honeywell system non-operative, it limits Central Valley Gas Storage's ability to perform analysis on the content and volume of the alarms controllers are receiving over the course of the year. Since the Honeywell system is an integral part of managing Central Valley Gas Storage's SCADA system under its Alarm Management Plan, its loss affects the quantity of data that Central Valley Gas Storage can examine, limiting their ability to analyze the effectiveness of its plan to provide for effective controller response to alarms.

As a continuation of recent upgrades to its systems, CVGS plans to migrate the Alarm Management system to Honeywell's latest Alarms Management system, called Dynamo.

To ensure CVGS will not have any connectivity issues associated with the Alarms Management system CVGS will be installing a server locally at the facility running the Dynamo application. CVGS is currently waiting for Honeywell to respond with a quote and a project timeline, but expects to have the new system in place by the end of the year or early 2018.

To further strengthen CVGS' process, for any day the Honeywell system is inoperative, the CVGS operator will conduct a manual alarm count, documenting alarms that occurred. The daily alarm documentation will be reviewed at least weekly by the CVGS Operations Manager.

8. Title 49 CFR §192.631(e)(3)

Title 49 CFR §192.631(e)(3) states in part: "Alarm management. Each operator using a SCADA system must have a written alarm management plan to provide for effective controller response to alarms. An operator's plan must include provisions to:…(3) Verify the correct safety-related alarm set-point values and alarm descriptions at least once each calendar year, but at intervals not to exceed 15 months."

a. During SED's interview of the field technician, it was stated that point-to-point verification is done simultaneously with JISH; however this is not documented in the written plan. Central Valley Gas Storage's Control Room Management Plan did not have a procedure or process that explicitly describes how a point to point verification is performed.
b. SED's review records found that only the hi-hi settings are recorded during point to point verification. All alarm settings used to inform the controller for effective response must be documented during a point to point verification.

CVGS has added Appendix E to its Alarm Management Plan, which specifies the following procedure:

Point To Point Verification Procedure

1. APPLICABILITY

1.1. When specific changes are made to the field-based equipment, a point-to-point verification of all of the impacted safety-related points must be completed prior to relying on those points for facilities operation. The specific field changes that are in scope include:

- *Adding a new RTU, PLC*

- *Migrating existing equipment to a different make/model of RTU, PLC*
- *Adding or changing safety-critical pressure monitoring equipment*
- *Adding or changing safety-critical remote control equipment*
- *Adding or changing gas and fire detection equipment*
- *Adding or changing hazardous atmosphere detection equipment*
- *Adding or changing emergency shutdown (ESD) equipment*
- *Adding or changing a SCADA display*

1.2. The definition of "Safety-Related Points" can be found in the Alarm Management Plan.

2. TESTING REQUIREMENTS

2.1. The following shall be verified during the point-to-point verification:

- *Physical location of device*
- *Data value or status*
- *Alarm settings (Hi & Hi-Hi or Lo & Lo-Lo)*
- *Confirmation of test signals to the local and remote control rooms*

2.2. The point-to-point verification process is accomplished by working with a Technician at the remote site.

2.2.1. Signals being verified are generated at the site and tracked to the correct graphic component on the appropriate SCADA screen(s).

2.2.2. In the case of verification of controls, the command is issued from the appropriate SCADA screen(s) and the command is confirmed to reach the appropriate equipment at the remote site.

2.2.3. The Technician may have to intercept the command in the case of an operating facility.

2.2.4. Alarms that are related to the testing may be temporarily disabled for the duration of the test provided the Operations manager give their approval.

3. DOCUMENTATION

3.1. Maintain records demonstrating the following minimum information:

- *Date of testing*
- *Personnel performing testing*

- *Reason for testing*
- *Points verified*
- *Record all alarm set points related to the alarm (Hi & HiHi or Lo & LoLo)*
- *Record that the alarm is being received at local and remote control rooms*
- *Adjustments / follow-up, as necessary*

3.2. Maintain records for a minimum of 5 years.

9. Title 49 CFR §192.631(e)(5)

Title 49 CFR §192.631(e)(5) states in part: "Alarm management. Each operator using a SCADA system must have a written alarm management plan to provide for effective controller response to alarms. An operator's plan must include provisions to:…Address deficiencies identified through the implementation of paragraphs (e)(1) through (e)(5)."

During SED's review of the Alarm Management Plan, there is no procedure in place that clearly describes how Central Valley Gas Storage addresses and prioritizes any deficiencies identified in their alarm management.

CVGS has added Section 6.2 to its Alarm Management Plan:

6.2 ALARM SYSTEM REVIEW

The alarm system should be reviewed once per calendar year not to exceed 15 months to evaluate consequences of changes in areas such as regulatory requirements, alarm technology, or this management plan. The Director of Storage and Peaking Operations will determine the timing of such reviews. The local manager shall be responsible for investigating and resolving any deficiencies. Any deficiencies found will trigger a re-rationalization of the affected alarm classes and/or modification to the alarm management plan, as appropriate.

II. 1. Annual review timing specification

CVGS's Control Room Management Plan does not explicitly require for the procedures to be reviewed and updated at intervals not exceeding 15 months, but at least once each calendar year. This language is not incorporated into the Control Room Management Plan, although SED's review of records showed that reviews are being done annually.

CVGS added the following language to Section 101 of the Control Room Management Plan:

> *CRM procedures will be reviewed once per calendar year, but not to exceed 15 months.*

2. Emergency responder attendance

In examining the Paradyne emergency responder events for 2015 and 2016, SED observed that there were no attendees from the counties within Central Valley Gas' geographical boundaries. Central Valley Gas appeared to have better attendance when events are conducted in closer proximity to their facilities. SED recommends that Central Valley Gas Storage review the effectiveness of Paradyne's emergency responder events.

CVGS conducted a meeting in May, 2017 at its facilities for local emergency responders. Attached is a sign in sheet for the meeting. (See Attachment 2.)

CVGS has been working with Paradyne to conduct a meeting in Colusa County in 2018.

CVGS will continue with the local meeting held in May at the CVGS facility.

3. Fatigue education timing specification

Under Section 502 of AGL's Control Room Management Procedure it states, "Each controller/plant operator shall complete at least one training session per calendar year…" SED recommends that the refresher for fatigue education should require at least one training session per calendar year, but not to exceed 15 months.

CVGS agrees with the recommendation and has modified Section 502 to address it as follows:

> As part of this CRM, the Company has developed programs to educate control room staff and their supervisors in fatigue mitigation strategies and how off-duty activities contribute to fatigue as well as training controllers / plant operators and supervisors to recognize the effects of fatigue. Each controller/plant operator shall complete at least one training session per calendar year, but not to exceed 15 months, covering topics…

In summary, CVGS continues to apply what it learns from its performance to improve its processes and documentation. CVGS appreciates the thorough review of its facilities and documentation by the SED audit team and looks forward to continuing our constructive relationship with SED in accomplishing the top priority of maintaining safe and reliable

operations. We believe that the actions we have taken to address these audit findings demonstrate that CVGS continues to be responsive to safety concerns. I trust that the actions documented in this response are suitable to resolve the areas of probable violations and observations that were noted.

Please contact me at 404-584-3725 if you have any questions about this response or require additional information. You also should receive a hard copy of this response and referenced attachments shortly via U.S. Mail.

Sincerely,

/s/

Stephen L. Wassell, PE
Vice President
Storage and Peaking Operations

cc: John Boehme
Robert Cornell
Mark Stephens
Nathan Sarina – CPUC (via e-mail)

Attachment 1 – Alarm Management Plan

Midstream Storage Alarm Management Plan

Revision No.	Revision Date
PRE1	**3/27/2017**

The purpose of this alarm management plan is to provide a design basis for the alarm systems in the Midstream Storage group of SCG. It is based upon ANSI/ISA-18.2-2009 and API 1167 and is intended to meet the requirements of 49 CFR 192.

Revision History

Revision No.	Revision Date	Description
PRE1	2017-3-27	Initial Plan for use by Central Valley Gas Storage

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1. General

1.1. Purpose of alarm philosophy document

The purpose of this alarm management plan is to provide a framework for designing, operating, and managing the alarm systems in the Southern Company (SCG) Midstream Storage. It is based upon ANSI/ISA-18.2-2009 and API 1167 and is intended to meet the requirements of 49 CFR 192.631. This design basis will incorporate:

- Key definitions
- Relationship between the alarm management program and other site or corporate procedures
- Roles and responsibilities
- Candidate or potential alarm identification methodologies
- Definition of the rationalization process
  - Alarm selection
  - Prioritization
  - Alarm limit determination
  - Documentation requirements
- Alarm design principles intended to provide guidance and consistency for Operators across all systems and control rooms
- Testing and training requirements for the implementation, operation, and maintenance of alarms
- Definition of Key Performance Indicators (KPI) and routine alarm system monitoring and reporting requirements
- Alarm system management of change (MOC) requirements
- Alarm system auditing requirements

A documented alarm management plan is required by federal regulation 49 CFR 192.631 for pipeline control rooms and helps ensure:

- Agreement with good engineering practices
- Consistency across pipeline and station operations
- Consistency of alarm selection, design (prioritization and configuration), and presentation
- Consistency of alarm terminology
- Consistency of alarms with the SCG's risk management goals/objectives
- Effective Operator response to alarms
- Safe, and environmentally responsible operations
- Uniformity in the design and management of alarms

After approval by management, this alarm management plan will be communicated throughout Storage Operations. The Operator and Real-time System Specialists will receive detailed training about this alarm philosophy.

Purpose of alarm system

The alarm system is the hardware and software that determines when, how, and to which Operators a specific alarm is annunciated. It controls the presentation of alarms to help the Operator:

- Identify and respond to abnormal operating conditions that could adversely affect the business and its core values
- Identify deviations from desired operating conditions
- Navigate to the appropriate display to begin to resolve an undesirable situation.
- Recognize and avoid hazardous situations
- Stay within the safe operating parameters
- Understand complex situations

The primary users of the alarm system are the Operators who are using a SCADA system to operate their facilities. Other uses of the alarm system are acceptable only if they do not interfere with or compromise the use of the alarm system by the Operators.

1.2.Responsibilities and roles

The following responsibilities and roles are defined for the alarm management program in Table 3 below:

Table 3 Roles and Responsibilities

Responsibility	Role								
	Engineering & Operations	Director Storage Operations	Local Facility Management	Operators	Designated Support Personnel	Real-time System Specialist	Regulatory Compliance	Safety Department	
A. Recognize the life cycle requirements of the Alarm Management plan	S	A	R				S		
B. Ensure that the requirements of the Alarm Management plan are carried out		A	R						
C. Owner of the Alarm System		A							
D. Owner of the Alarm Management plan and related documents	A								
E. Enforce the ongoing use of the Alarm Management plan									
• In the management of change & hazard review processes	S	A	R	S	S	S	S	S	
• For all day-to-day system modifications / repairs	S	A	R	S	S	S	S	S	
• For all capital project work (operating procedures)	S	A	R	S	S	S	S	S	
F. Ensure that the alarm system achieves and maintains the performance levels defined by the key performance indicators.		A	S	S	S	R			

Responsibility	Role								
	Engineering & Operations	Director Storage Operations	Local Facility Management	Operators	Designated Support Personnel	Real-time System Specialist	Regulatory Compliance	Safety Department	
G. Initiate work requests to repair malfunctioning field devices responsible for nuisance alarms	S	R	A	R	S	S			
H. Provide subject matter experts to participate on the core team to rationalize alarms	S	A	R	R	R	S		S	
I. Provide subject matter experts to participate on the core team to develop advanced alarm applications (e.g. seasonal or operational changes)	S	A	R	R	R	S		S	
J. Maintain the alarm management software and the Master Alarm Database (MAdB)			R	S	S	A			
K. Maintain the tactical reports for nuisance, standing alarms, and when available shelved alarms		A	R	S	S	S			
L. Maintain a monthly analysis of the alarm history searching for violations of the alarm management plan that may have been created (e.g. duplicate or improperly prioritized alarms)		A	R	S	S	S			

Responsibility	Role								
	Engineering & Operations	Director Storage Operations	Local Facility Management	Operators	Designated Support Personnel	Real-time System Specialist	Regulatory Compliance	Safety Department	
M. Incorporate a review of all alarms as part of the regular, periodic hazard review process, including new unit hazard reviews. All alarm parameter changes will be updated in the Master Alarm Database.		A	R	S	S	S			
N. If a new alarm is added, the alarm rationalization process must be followed to establish the appropriate parameter settings and documentation.		A	R	S	S	S			
O. Manage and maintain the alarm system		R	R	S	S	A			
P. Provide technical support to resolve problems with the alarm system		R	R	S	S	A			
Q. Review and approve alarm rationalization results		A	R	S	S	S			
R. Conduct periodic alarm system audits	R	A	S	S	S	S	R		
S. Evaluating, reviewing, and approving control system changes	S	A	R	S	S	R			

Responsibility	Role								
	Engineering & Operations	Director Storage Operations	Local Facility Management	Operators	Designated Support Personnel	Real-time System Specialist	Regulatory Compliance	Safety Department	
T. Verify the correct safety-related alarm set-point values and alarm descriptions at least once each calendar year, but at intervals not to exceed 15 months			A	R	S	S			
U. Establish timeline for achieving interim and final alarm system metrics		A	R	S	S				
V. Review and evaluate alarm system metrics		A	R	S	S	S			
W. Investigate the causes and propose an action plans if alarm system performance metrics are not met		A	R	S	S	S			
X. Determine timing of periodic alarm system reviews		A	R	S	S	S			
Y. Conduct periodic audit of the Alarm Management program	R	A	R	S	S	S	R		
Z. Approve alarm limit changes as a result of D&R	S	A	R	S	S				
AA. Approve use of alarm attributes such as dead band, on/off delay, or PV filtering	S	A	R	S	S				

Responsibility	Role								
	Engineering & Operations	Director Storage Operations	Local Facility Management	Operators	Designated Support Personnel	Real-time System Specialist	Regulatory Compliance	Safety Department	
BB. Approve use of alarm state to trigger other logic	S	A	R	S	S				
CC. Establish procedures defining who may make changes to alarms and the alarm system and the specific changes they are allowed to make	S	A	R						

RASCI is an abbreviation for:

- **R** Responsible – owns the problem or project
- **A** Accountable – who must sign off (Approve) on work before it is effective, to whom "R" is Accountable
- **S** Supportive – can provide resources or can play a supporting role in implementation
- **C** Consulted – has information and/or capability necessary to complete the work
- **I** Informed – must be notified of results, but need not be consulted

1.3.PHMSA 192 requirements

Table 4 below lists the alarm management requirements of PHMSA regulation 49 CFR Parts 192.631, explains the tasks required fulfilling each requirement, and where they are described in this document.

Table 4 – PHMSA 192 and 195 Requirements

PHMSA Requirement 49 CFR Parts 192.631 and [195.446]	Tasks
(e) Alarm management. Each operator using a SCADA system must have a written alarm management plan to provide for effective Operator response to alarms. An operator's plan must include provisions to:	Define core values, assign roles and responsibilities, gather and organize relevant information, and write the alarm management plan. (Section 1 General)
(1) Review SCADA safety-related alarm operations using a process that ensures alarms are accurate and support safe pipeline operations;	Develop and implement a review process (rationalization) to ensure that undesirable events are correctly identified and properly alarmed (i.e., alarms must be prioritized and presented to the Operator in a clear and timely fashion). • Identify candidate or potential alarms (Section 2 Identification) • Accept or reject candidate or potential alarms (Section 3.2 Alarm selection) • Document cause, consequence/severity, corrective action, and verification of accepted alarms (Section 3.5 Alarm documentation) • Document time to respond (Section 3.3.1 Prioritization procedure) • Prioritize alarms (Section 3.3.1 Prioritization procedure) • Determine alarm limit or activation point (Section 0 3.4.1 Alarm limit review) • Classify alarms (Section **Error! Reference source not found. Error! Reference source not found.**)
(2) Identify at least once each calendar month points affecting safety that have been taken off scan in the SCADA host, have had alarms inhibited, generated false alarms, or that have had forced or manual values for periods of time exceeding that required for associated maintenance or operating activities;	Develop a monitoring program to identify alarms that are generating false alarms and alarms that have been set to not annunciate (e.g., disabled, inhibited, suppressed, shelved, out-of-service, off scan, forced, manual). (Section 6 Monitoring & Reporting)
(3) Verify the correct safety-related alarm set-point values and alarm descriptions **[***when associated field instruments are calibrated or changed and***]** at least once each calendar year, but at intervals not to exceed 15 months;	Develop a master list or database of all relevant alarms and their key parameters, and compare that master list to the set of installed alarms to identify and resolve any unauthorized changes. (Section 5.4 Alarm system maintenance and 7 Management of Change)

Table 4 – PHMSA 192 and 195 Requirements

PHMSA Requirement 49 CFR Parts 192.631 and [195.446]	Tasks
(4) Review the alarm management plan required by this paragraph at least once each calendar year, but at intervals not exceeding 15 months, to determine the effectiveness of the plan;	Conduct an annual audit of the alarm management program. (Section 8 Audit) • Conduct interviews • Compare managerial and work practices to procedures • Compare procedures to policy • Compare policy to regulations and industry guidelines
(5) Monitor the content and volume of general activity being directed to and required of each Controller at least once each calendar year, but at intervals not exceeding 15 months, that will assure Controllers have sufficient time to analyze and react to incoming alarms; and	Measure the alarm system performance and compare it to established targets. (Section 6 Monitoring & Reporting)
(6) Address deficiencies identified through the implementation of paragraphs (e) (1) through (e) (5) of this section.	Develop and implement any action plans or recommendations identified because of the programs developed in steps 1-5. • Basic Alarm Design (Section 4 Detailed Design) • Implementation (Section 5.1 Implementation guidance) • Maintenance (Section 5.4 Alarm system maintenance) • Management of Change (Section 7 Management of Change) • Audit (Section 8 Audit)

Note, text enclosed in [] in requirement (3) is specific to 195.446

2. Identification

Identification is a general term that refers to the methods for identifying candidate or potential alarms in a system. Typical methods include but are not limited to:

- Contracts
- Environmental permits
- Equipment warranties
- Field operational requirements
- Hazard reviews
- Process Hazards Analysis (PHA)
- Incident investigations
- Manufacturer recommendations
- Management of Change (MOC)
- Operation, maintenance, and safety procedure reviews
- P&ID reviews
- Pre-Startup safety reviews
- Projects
- Recommended practices and policies
- Regulatory requirements
- Site security

Typical methods for identifying externally (third-party) *Required* alarms include but are not limited to:

- Contracts
- Environmental permits
- Equipment warranties
- Regulatory requirements

When identifying candidate or potential alarms consider:

- Individual unit operations and the interconnections among them
- Various operating modes or states of the process and the transition between modes or states
- Time varying effects (non-steady-state, seasonal fluctuations, fast versus slow processes)

Whatever its source, every candidate or potential alarm must be justified, properly engineered, and consistent with this alarm management plan and SCG's corporate risk management policy. The identification of candidate or potential alarms shall be defined as tasks in the capital project management process and in the corrective actions resulting from incident & hazard reviews, manual and procedure reviews, and P&ID life cycle reviews. The MOC procedure will coordinate the identification of candidate or potential alarms with this alarm management plan and ensure that the requirements of this alarm management plan are followed. The identification of externally (third-party) required alarms will also be part of the MOC process for all new alarms.

3. Rationalization

Rationalization, sometimes referred to as Documentation and Rationalization (D&R), is a multi-step process. It begins with selection, the process of accepting or rejecting candidate or potential alarms or alarm changes by evaluating them against the criteria established in the alarm management plan. For accepted alarms, the next step is a preliminary design stage, in which the priority and alarm limit of each alarm are determined. Finally, accepted alarms are documented as specified in the alarm management plan. (See ANSI/ISA-18.2-2009 clause 9 or API-11677 section 6 for further discussion of the rationalization process.)

3.1. Rationalization Team

The core Rationalization Team should consist of:

- An experienced Operator who is responsible for the operation of the facilities and stations from a control room
- Designated Support personnel with control system experience as it relates to the rationalized facility.
- A representative from midstream Storage Management Team with industrial and alarm management experience
- An independent facilitator with significant industrial and alarm management experience who is responsible for managing the rationalization process, maintaining its integrity, and ensuring compliance with the alarm management plan

Personnel from the following areas should support the core team on an as needed basis:

- Health, Safety (Risk Management), & Environmental personnel who are responsible for establishment of safe practices and environmental guidelines
- Control Systems Design Engineers and/or Technicians who are responsible for design and maintenance of the control system (DCS, PLC, or SCADA) and HMI graphics.
- Operations representatives who are responsible for the operation of specialized equipment such as large rotating equipment, high voltage switchgear, etc.
- Personnel who are responsible for maintenance of the facilities and stations
- Management Personnel who are responsible for establishing and enforcing safe practices and environmental guidelines consistent with SCG's goals
- Consultants as needed

3.2.Alarm selection

Alarm selection is the process of selecting candidate or potential alarms for inclusion into the alarm system or rejecting them based on the criteria for an alarm (See definition of Alarm in Table 1). At this point, there are three key criteria for accepting an alarm. It must be:

1. Relevant — The consequence of failing to manage the alarm must be significant enough to justify interrupting the Operator's routine duties
2. Actionable — There must be an action that the Operator can take to manage the situation
3. Unique — The candidate or potential alarm does not duplicate other alarms, and if there are multiple candidate or potential alarms that could indicate the same event, the best one is selected

Once a candidate or potential alarm has been accepted, rationalization of that alarm continues with prioritization, alarm limit determination, and documentation.

The Rationalization Team will use Operator experience, facilitator guidance, and alarm class to identify common and repeated elements to improve the efficiency of the rationalization process.

3.3.Prioritization

Four (4) business critical impact categories (Table 5) and Severity categories (Table 6) will be used for the prioritization of alarms. Note that the impacts are designed to be independent of each other and to include all of the consequences associated with that category. For example, a *Human* impact with a severity of a Medical Treatment includes all of the consequences of that injury including financial consequences such as medical expenses, workers' compensation, etc. Alarms will be grouped into three (3) levels of priority as defined in table 8.

Table 5 - Description of Impact Categories

Impact Name	Impact Description
Safety	Impact on the health and wellbeing (i.e. illness or injury) of people, both employees and the public
Operability	Impact on the facilities ability to operate as designed
Environmental	Impact on the air, land, water, wildlife, and vegetation
Cost	Impact on cash flow; reduced profits; increased costs; product/equipment loss/damage; inability to achieve financial, operational, or strategic financial objectives; failure to deliver to customer (loss of revenue, breach of contract), damage to public/private property, fines that are **not** associated with *Safety, Operability, or Environmental* impacts

Table 6 - Severity Categories

Severity	Description
Incidental	No or negligible impact
Minor	Least severe impact
Serious	↓
Major	Most severe impact

3.3.1. Prioritization procedure

For each accepted alarm, the Rationalization Team will perform the following steps:

1. Determine the reasonable consequences of failing to manage the alarm.
   a. Assume that all other layers of protection are in place and functioning properly.
   b. In general, do not evaluate multiple or cascading failures unless they are known to be reasonable and likely to occur.
   c. Do not use the probability of the alarm occurring as a factor in this evaluation.
2. Use Table 6 to determine the severity of the impact in each of the four categories and document them in the MAdB.
3. Determine the maximum time to respond or urgency; select the appropriate priority (Table 8) and document the priority in the MAdB.

   Note that the maximum time to respond or urgency is not the time needed by the Operator to diagnose the alarm and take corrective action, which is commonly called the Operator action time. Urgency is the time that the Operator has from the time the alarm is annunciated until diagnosis and correction must begin or the undesirable consequence will occur. In its simplest form, it is estimated by calculating the time required for all corrective actions (Operator response time plus process stabilization time) and subtracting it from time to failure (the amount of time available from the annunciation of the alarm until the undesirable consequence is expected to occur). (See Figure 1)

   If the urgency is too long or unacceptably short, the candidate alarm should be redesigned or the condition should be handled outside of the alarm system.

4. Accept or override to ensure compliance with the configured alarm priority distribution goals, the Rationalization Team will conduct an internal prioritization review as specified in Section 3.3.1.

Figure 1 - Determination of Alarm Limit

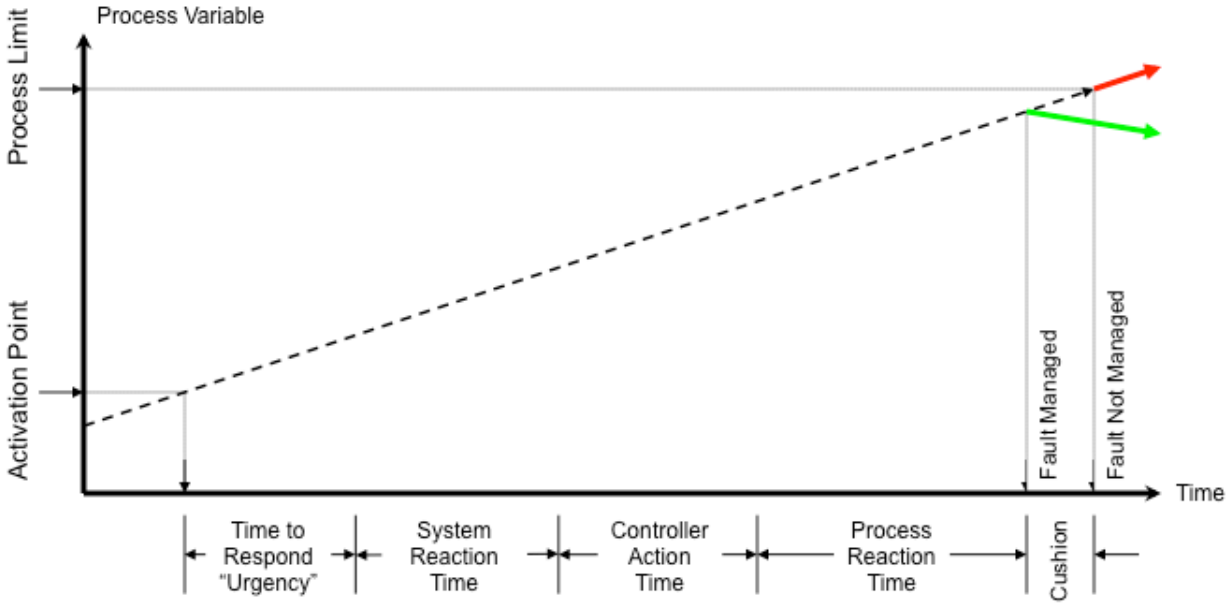


Table 7 – Description of Severity of the Four Impact Categories

Impact		Severity			
		Incidental	**Minor**	**Serious**	**Major**
	Safety	Minor or no injury	Single injury, not severe, possible lost time	Severe injury	Fatality of permanent disabling injury
	Operability	Minimal equipment damage with negligible plant downtime	Some equipment damage and possible downtime	Major damage to process areas with up to 30 days plant downtime	Major or total destruction to process areas with up to 30 days plant downtime
	Environmental Impact	No impact offsite, Environmental recordable event with no agency notification	Odor or noise complaint from the public, Release that results in some Agency notification or violation	One or more injuries or possible evacuation: significant release with serious environmental impact	One or more severe injuries; significant release with serious long-term offsite impact
	Cost	Event costing < $5,000	Event costing $5,000 - $25,000	Event costing $25,000 - $100,000	Event costing >$100,000

3.3.2. Prioritization calculations

Table 8 – Priority Table – time to Respond

	Severity			
Maximum Time to Respond	**Incidental**	**Minor**	**Serious**	**Major**
<10 minutes	Low	Low	Low	High
<5 minutes	Low	Low	High	Urgent
Immediate	High	High	Urgent	Urgent

3.4 Alarm limit determination

Alarm limits will be reviewed and/or determined during alarm rationalization by the Rationalization Team. If a facility or station has significant operating history, the Rationalization Team will be able to accept many of the current alarm limits through a review process, since an experienced Operator can verify that an alarm limit gives him enough time to respond. However, if it is known that an alarm limit does not provide adequate time to respond, or there is little or no operating history, the alarm limit must be determined.

3.4.1 Alarm limit review

Final responsibility for approving alarm limits will reside with the Director of Peaking Operations or Midstream Storage.

3.5 Alarm documentation

For accepted alarms, the next step is to determine and document the information necessary for the design stage of the lifecycle. At a minimum, this includes:

- Point/Tag Name
- Alarm Description
- Alarm type (Process or System)
- Priority (Low, High, Urgent)
- Sub-priority / Time to Respond - (e.g., 00, 05,10)
- Alarm limit value or logical condition (e.g., off-normal)
- Cause of alarm or abnormal situation
- Corrective action
- Consequence of inaction or incorrect action
- Dead band, on/off delay, PV filter by exception

As alarms are being evaluated during the rationalization process, the Rationalization Team will document any identified needs for advanced alarming.

3.5.1 Highly managed alarms

The Highly Managed Alarm class, as defined by ANSI/ISA-18.2, will not be used.

3.6 Rationalization wrap-up and final approval

The Director of Storage and Peaking Operations will conduct the final review and approval of the alarm rationalization (see above Table 3, Item Q above). This review will include both the candidate alarms that were accepted and those that were rejected. The MOC process will be used to facilitate any changes recommended during the review process.

Candidate or potential alarms that were rejected in the initial selection step or the prioritization step of the rationalization process may still require an alert or notification to the Operator. However, they are not alarms and are not included in the scope of this alarm management plan. These alerts may be presented in screens similar to, but distinct from, alarm summary screens and will not have an audible annunciation associated with them nor require Operator acknowledgement. For alerts that are not intended for the Operator, other delivery means such as paging or e-mail may be used. Candidate or potential alarms that are rejected and removed from service must be documented via the MOC process.

4. Detailed Design

Detailed design is the final design phase in which the essential requirements for the accepted alarms within the target control system are determined.

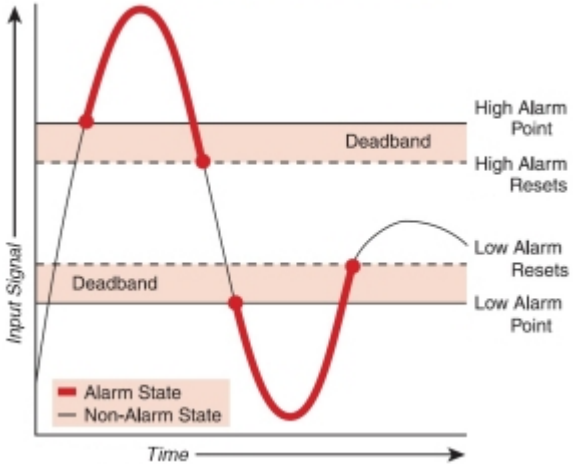
4.1 Alarm attributes

Shelving of alarms is an available option supported in the facility control systems. Alarm Shelving will be documented on the Shift Handoff Form.

Use of alarm attributes such as dead band, on/off delay, or PV filtering will be done on a case-by-case basis and with the approval of local management.

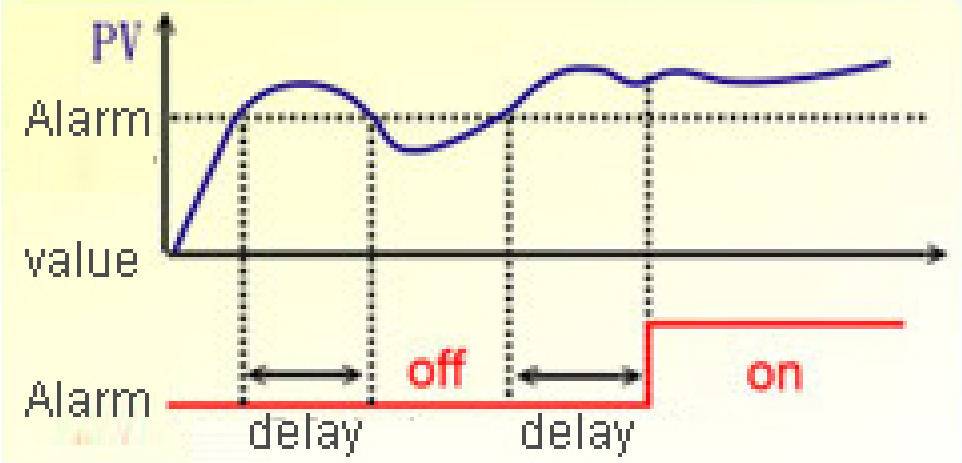
Alarm dead band is an alarm attribute within the control system that requires the process variable to cross the alarm limit back into the normal operating range by some percentage of the range or present value (Figure 1) before the alarm returns to the normal state. Dead band is typically set based on the normal operating range of the process variable, taking into account the type of process variable and the level of measurement noise. Application of dead band can be very effective in eliminating a nuisance alarm.

Figure 1 - Alarm Dead band



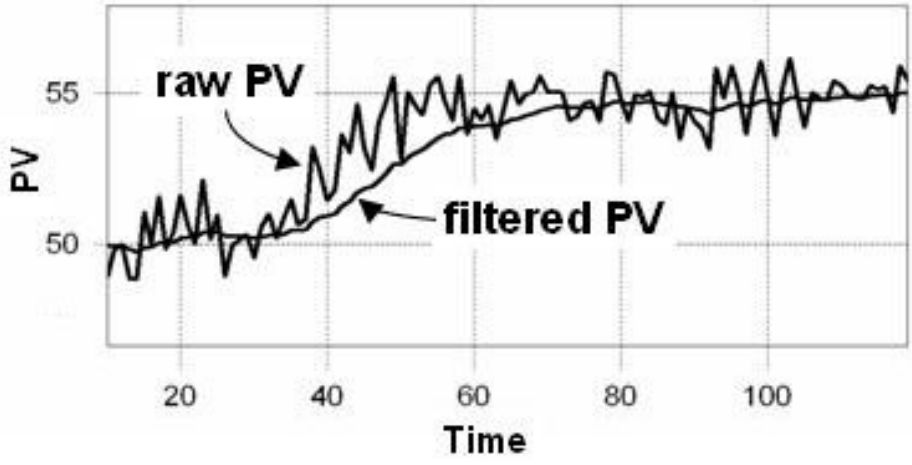
The attributes ***on-delay*** (Figure 2) and ***off-delay*** (i.e., filter timer and debounce timer) can also be used to eliminate nuisance alarms. The on-delay is used to avoid unnecessary alarms when a signal temporarily overshoots its limit, thus preventing the alarm from being triggered until the signal remains in the alarm state continuously for a specified length of time. The off-delay is used to reduce chattering alarms by locking in the alarm indication for a certain holding period after it has cleared.

Figure 2 - Alarm On-Delay



PV filtering (Figure 3) is a technique for removing noise from a process signal, which can also be useful in reducing nuisance alarms. There are a number of PV filter types: averaging, first-order lag, first or second order Butterworth.

Figure 3 - Example of PV Filtering



Proper engineering judgment should be employed when setting dead bands, on/off-delays, or PV filters in order to minimize nuisance alarms while maintaining process awareness and pipeline, station, and personnel safety. The following cautions should be observed:

- Excessive dead band, such as what might be calculated for an instrument with a large scale (e.g., flow of 0 – 100,000), can prevent an alarm from returning-to-normal, creating a stale alarm.
- Delay times should consider the residence time during all modes of operation and whether PV filtering is being applied to reduce signal noise. On-delay times should be applied only after careful evaluation and potential control system operational effects.
- Unlike alarm dead bands or on/off-delays, PV filtering affects the process signal and all functions (including alarming) that use the signal.

Alarm attribute settings should be documented in the MAdB and then reviewed during commissioning and after significant operating experience.

Table 9 provides recommendations that represent a good starting point for the alarm attributes of dead band, on/off delay, and PV filtering for common processes.

Table 9 - Alarm Dead Bands, Delay Times, and Filter Times

Process Variable Type	Dead Band (% of operating range)	Delay – On or Off (seconds)	PV Filter 1st Order Filter (seconds)
Flow*	5	15	2
Level*	5	60	2
Pressure*	2	15	1
Temperature*	1	60	0
Analyzer (in-situ)	2	60	2
Analyzer (sampling system)	2	0	0

*Sources: ML Bransby, "The Management of Alarm Systems", HSE Books, 1998, pp. 193-195
EEMUA 191, “Alarm Systems – A Guide to Design, Management and Procurement", 1999, pp. 84

4.2 Special alarm design considerations

Detection of events that trigger an alarm to the Operator may also be used to drive other logic in the PLC or control system.

Alarms may be generated in field devices (e.g. transmitters, PLCs, RTUs), auxiliary systems (e.g. leak detection), or in the HMI system based on the required functionality. All alarms will be presented to the Operator via the HMI.

The following situations will be considered for inclusion into this alarm management plan or an alarm design guide to foster consistency in alarm design:

- Redundant transmitters
  - Absolute high alarms, if configured, will use the highest of the good transmitters
  - Absolute low alarms, if configured, will use the lowest of the good transmitters.
  - Deviation and rate-of-change alarms, if configured, will use the average of the good transmitters.
  - A questionable PV alarm or alert, if configured, will be generated if the difference between the highest and lowest values of the good transmitters is greater than 2% of span.
- Open/Close valve logic
  - Fail-to-open & fail-to-close, should include valve travel time
- Instrument malfunctions
- Voting systems
- Watchdog timer & health status
- ESD systems
- ESD bypasses
- Hazardous (flammable/toxic) gas detectors
- Building/non-process alarms
- Programmatic alarms
- Manually initiated tasks
- Control system status alarms

4.3 Approved advanced alarm management techniques

The following are approved advanced alarming techniques:

Information linking using the rationalization data in the MAdB, alarm response procedures, operating procedures, or P&ID's.

Logic based alarms may be used to enable or disable alarms by design. For example, the run status of a pump may be used to disable a low flow alarm if the pump is shutdown or has been running less than fifteen seconds.

Simple model/predictive based alarming may be used for systems that have varying process dynamics. For example, alarm ten minutes before reaching a process limit, based on the current rate of change.

Dynamic alarm limit changes based on operating mode or state. Dynamic thresholds for alarms based on start-up, shut-down, or other transient conditions are explicitly approved for use.

Alarm suppression based on operating mode or state. Automatic suppression of alarms based on start-up, shut-down, or other transient conditions are explicitly approved for use.

Mode or ***state based*** alarming is an acceptable technique for adapting alarm limit or enabling/disabling the alarm for different modes of operation (e.g. start-up, shutdown, standby, and maintenance).

Out-of-Service is a technique that allows the Operator to suppress an alarm or groups of alarms associated with a piece of equipment or system that is out of service. This technique requires logic in PLC that prevents operation of the out of service equipment or system.

4.4 HMI design guidance

The following audible and visual attributes will be used to distinguish between the various alarm states for the Operator.

Table 10 - Alarm State Audible and Visual Attributes

Alarm State	Audible Indication	Visual Indications		
		Color	Symbol	Blinking
Unacknowledged Alarm	Yes	Urgent – Red High – Yellow Low – Blue		Yes
Acknowledged Alarm	No	Urgent – Red High – Yellow Low – Blue		No
Return to Normal State Unacknowledged Alarm	No	Urgent – Red High – Yellow Low – Blue		Yes
Shelved Alarm (suppressed with time limit)	No	Gray Shaded	Gray Shaded	No

(H – High, M – Medium, L – Low)

Point/tag descriptions will be reviewed and updated, if necessary, as part of the rationalization process. The Rationalization Team will determine a systematic method for constructing these descriptions. There should be limited set of abbreviations.

Alarms may be displayed on graphics in addition to the Alarm Summary.

5 Implementation, Operation & Maintenance

While Implementation, Operation, and Maintenance are distinct alarm management lifecycle phases, the training and testing requirements of each of these phases are essentially the same. For specific guidance, refer to Midstream Storage Control Room Management procedures.

5.1 Implementation guidance

Implementation is the installation of those things required to bring an alarm or alarm modification into service. Implementation planning should include the following considerations to assure the effective deployment of the alarm system:

- Disruption to operation
- Availability of resources
- Functional testing or validation (e.g. point-to-point testing)
- Verification of documentation
- Operator training

Implementation and commissioning are governed by the CRM Point-to-Point Checkout Procedure. These procedures will enforce the implementation, testing, and management-of-change requirements of this alarm management plan.

5.2 Operation

Operation is the state in which an alarm is on-line and able to indicate an undesirable condition to the Controller.

The expected Controller response to alarms can be broken into the following steps:

1. Acknowledge
2. Diagnosis
3. Corrective action
4. Monitor
5. Return-to-Normal or Escalation

Acknowledge are distinct functions of the alarm system that must be used correctly by the Controller. Their immediate response should be to check the alarm summary, identify the highest priority alarm, and begin working on it, if not already working on one of equal or higher priority.

Acknowledge, stops the blinking of the alarm. Use of the acknowledge function by the Controller indicates that he has taken ownership of the alarm and is actively working to resolve it. His immediate response should be to diagnose and respond to the situation and then to monitor the results of his actions.

Diagnosis is the process that the Controller goes through to understand the alarm. In general, the Controller needs to understand the current system condition, the future consequences of the disturbance that caused the alarm, and the root cause of the disturbance.

Once the Controller has diagnosed and understands the current alarm, he is required to take *corrective action*. The corrective action should be documented in the MAdB or an approved Alarm Response Procedure. In general, the Controller should take action to correct the current process condition, to prevent the effects of the disturbance from spreading, and to fix the root cause of the disturbance if possible. The corrective action can take many forms (e.g. action through the SCADA system in Control Center, dispatch of field personnel to a pipeline or station location).

The Controller is expected to *monitor* the effects of his corrective action to ensure that the system *returns-to-normal* within a reasonable period of time. If the Controller does not understand the alarm situation, if he does not know the proper corrective action, or if the system does not return-to-normal in a reasonable period of time, the Controller is expected to formally *escalate* the alarm to the Supervisor. The Controller is responsible and accountable for the resolution of the alarm until it returns-to-normal or it is formally escalated to the Supervisor. Once the alarm has been escalated, responsibility and accountability for the resolution of the alarm passes to the Gas Control Supervisor.

The function of Clear shall not be available to the Controller. This function shall only be accessible through the Engineering interface. The function of Page Acknowledge will be restricted as follows:

- From the Alarm Summary or Pipeline Overview – Access restricted to the Supervisor of Gas Control or system administrator
- From the Station or individual Pipeline graphic displays – No restriction
- From the Engineering interface – No restriction

Since the Controller is expected to use alarm priority as significant guide, in addition to his experience, in determining which alarm to respond to first, the suggested sort order of the alarm summary screen is:

1. Priority (highest to lowest)
2. Time (newest to oldest)

In addition to alarms, there are various tools at the Controllers' disposal to help them maintain situational awareness including:

- Controller alerts and notifications
- The pipeline leak detection system (where available)
- Overview screens
- Operational summaries
- Trend displays
- Gas Controller Day Check
- Operator Log
- Pipeline nominations, orders, or schedules

Shift turnover between Controllers shall be in accordance with the Shift Change Hand-over procedure. It is important that the Controllers use all of these tools to manage their system and avoid an over-reliance on alarms.

In addition to alarms, there are various tools at the Operators' disposal to help them maintain situational awareness including:

- Operator alerts and messages
- HMI screens
- Overview screens
- Operational summaries
- Trend displays
- Turn over checklist
- Console Checkout display
- Electronic logbook (E log)
- Operation orders, schedules and procedures

It is important that the Operators use all of these tools to manage their system and avoid an over-reliance on alarms.

Since the Operator is expected to use alarm priority as significant guide, in addition to his experience, in determining which alarm to respond to first, the suggested sort order of the alarm summary screen is:

3. Priority (highest to lowest)
4. Time (newest to oldest)

5.3 Remote Monitoring

Storage Operations has a site that is unmanned for night time operations. For this plant, other plants/operators are designed to monitor the remote sites. When an operator acknowledges alarms originating from the unmanned site that means the operator has taken ownership of those alarms. For most of those alarms, the operator response is to call/contact local management for the remote plant. The response will not match the response as defined in the master alarm database for the remote plant.

Additionally, Storage Operations has times when the operator of an occupied facility needs to be outside the control room. During these times, the alarms from that plant may be monitored from remote locations. For most of these alarms, the operator response is to call/contact the onsite operator to notify them of the alarm and get further instruction.

5.4 Alarm system maintenance

Maintenance is the upkeep of the alarm system and includes alarm system testing, replacement-in-kind, and repair.

Alarms that will be compromised for extended durations shall be examined to determine whether an alternative alarm is necessary. If an interim alarm is necessary, it shall adhere to the alarm MOC requirements. Placing an alarm out-of-service and returning it to service will be coordinated by the Operator using the MOC form.

An authorization and documentation process (e.g. permit process) shall be used to take an alarm out of service. A list of out-of-service alarms, with their corresponding replacements where applicable, shall be available for review on demand. Before an out-of-service alarm is returned to service, the alarm and associated equipment will be fit for service.

The following information shall be recorded for each out-of-service alarm:

- The name of the point in alarm
- The alarm type
- Approval details
- Details concerning interim alarms or procedures, if required
- The reason for taking the alarm out of service

Information related to an alarm malfunction should be available to the Operator.

If replacement equipment (e.g., measurement devices, valves, process equipment) will change operating conditions or alarm attributes, then site management of change procedures should be followed. Replacements that do not result in such changes do not require management of change. If a replacement is made, alarm validation may be required.

Before returning out-of-service alarms to the operational state, Operators shall be notified to ensure they are aware of the returning alarm and the removal of the interim methods.

5.5 Training

For new or modified alarms, the following items should be included in the training package:

- The technical basis of the alarm (e.g., consequence of inaction, determination of alarm limit value, causes for alarm, corrective action, points used for confirmation, etc.)
- The audible and visual indications for the alarm
- The response or corrective action to the alarm

For modifications to the alarm system, the following items should be included in the training package:

- The audible and visual indications for alarms
- The distinction of alarm priorities
- The use of the alarm HMI features (e.g., alarm summary sorting and filtering)
- The proper methods for suppression
- The proper methods for removing an alarm from service

Documentation of training must include:

- The persons trained
- The method of training
- The date of the training

The MOC procedure will determine the training method used for a given change.

An example of training methods and when they are used is as follows:

- For minor changes (no MOC required, no money spent), an email to the affected Operators describing the change is adequate
- For intermediate scale changes (MOC required, no money spent), a sign-off sheet is required
- For significant changes (e.g. capital project), a formal training activity with signature will be required. A demonstration of understanding and competence should also be considered.

5.6 Testing of alarms and alarm systems

Alarms and alarm systems should be tested during implementation and periodically thereafter to ensure that they perform as designed and meet the requirements specified in this alarm management plan.

Alarm testing should include:

- Verification of the alarm limit or logical condition
- High and High High or Low and Low Low Set points
- Verification of the alarm priority
- Verification of the audible and visual indications for the alarm
- Verification of any other functional requirement for the alarm as specified
- Requirements based on management of change policies
- Point-to-Point check (loop or function check) as required
- Remotely monitored alarms must be verified in the remote control room

Alarm system testing should include:

- The audible and visual indications for each alarm priority
- The HMI features, such as alarm messages displayed in the alarm summary or equivalent
- The methods for removing an alarm from service
- The methods for alarm suppression
- Any additional functions of enhanced or advanced alarming techniques
- Method of alarm filtering, sorting, linking of alarms to process displays
- Requirements based on management of change policies
- Requirements in the Alarm System Requirements Specification if applicable

The results of all testing must be documented and include:

- The persons conducting the testing
- The method of testing and acceptance criteria
- The results of the testing and resolution of any failures or non-compliance
- The date of the testing

Initial testing during implementation will be part of the MOC or project startup (point-to-point, loop function check or Pre-startup Safety Review (PSSR) if required). Periodic testing will be done to meet the alarm priority, PSM, DOT, or PHMSA requirements as appropriate. Non-Safety-Related alarms are not tested on a periodic basis. Safety-Related alarms will be verified at least once each calendar year,

but at intervals not to exceed 15 months to ensure that alarm limits and alarm descriptions are correct. Specific testing requirements will be developed as part of CRM and implemented in the OPM.

6 Monitoring & Reporting

The monitoring and assessment phase is the routine check-up of the alarm system to verify that design, implementation, rationalization, operation, and maintenance are satisfactory.

6.1 Alarm system metrics

Metrics for monitoring the alarm system are shown in the Storage Operations Alarm Management Plan Table 11.

Alarm suppressions or attribute changes should be evaluated on a periodic basis and the reports sent to the appropriate individuals or groups as described in Table 11.

Table 11 - Alarm Metric Reporting

Report Type	Period	Group
Shelved	Shift	Operator as part of shift turnover
Out-of-Service	Shift	Operator as part of shift turnover
	Month	Operator
Inhibited and Manual Override	Shift	Operator as part of shift turnover
	Month	Operator
Nuisance alarms (Chattering/Fleeting, Consequential/Duplicate, Standing, and Stale)	Week	Operator
Unauthorized Alarm Inhibiting Improper Alarm Attribute Change	Month	Local Management
Alarm rate trends	Month	Local Management
All Metrics	Month	Local Management
All Metrics and Overall Alarm Management Program Status	Quarter	Local Management

6.2 Alarm system review

The alarm system should be reviewed periodically to evaluate consequences of changes in areas such as regulatory requirements, alarm technology, or this management plan. The Director of Storage and Peaking Operations will determine the timing of such reviews. The local manager shall be responsible for investigating and resolving any deficiencies. Any deficiencies found will trigger a re-rationalization of the affected alarm classes and/or modification to the alarm management plan, as appropriate.

6.2.1 Immediate Response Alarm Review

In response to an immediate alarm concern, the Controller will coordinate a discussion with the local Supervisor to determine what actions should be taken to address the alarm settings. Once actions are identified, the local Supervisor will implement all changes and document all actions, the reason for the action, and any additional support details on their Operator Log. All deviations to this Plan will be documented as defined in the CRMP.

6.2.2 Monthly Alarm Review

Each calendar month, the local Supervisor will review console-specific Alarm Management Reports that include safety-related point statuses as follows:

- Taken off scan in the SCADA host
- Been inhibited
- Resulted in false alarms in compliance with Southern Company Gas' definition of false alarms
- Had manual values associated for period of time exceeding those required for maintenance/operations

In addition, local Supervisor will review reported alarms from Controllers (documented on the Operator Log) and (where necessary) interview affected Controllers to gather additional details in support of that alarm's status.

The local Supervisor will document all results of this analysis on the Monthly Alarm Review and submit to the Real Time System Support (RTSS) Technician for review and determined action items (this may require a meeting if a concern arises). The Supervisor will determine what actions are required.

The local Supervisor will track each item and document rationale for all changes on the form.

Only after all action items have been closed as defined by the Alarm Management Plan can the CRM local Supervisor consider the review process complete and file all paperwork in accordance with Southern Company Gas's policy. All deviations to this Plan will be documented as defined in the CRMP.

6.2.3 Annual Alarm Management Program Review

Once each calendar year, not to exceed 15 months, the Midstream Storage Director will coordinate a meeting with the Midstream Storage managers Team to conduct a thorough review of the entire Alarm Management Program to ensure effectiveness of the following:

- Initial implementation results (alarm metrics, Controller alarm response, reduction to nuisance alarms, etc.)
- Status of all safety-related alarms
- Controller feedback on existing alarm response times via interviews and review of operator log reports
- Continuous Improvement Activities

- Alarm Management discussions in Safety meetings
- New alarms and all D&R completed for that alarm
- Incident findings that affected the Control Room
- Documented Lessons Learned from initial implementation and also from affected programs
- Workload for each console in accordance with Southern Company Gas' Workload Analysis Process
- Deviations to Alarm Management Plan requirements
- Status of all safety-related alarms
- The Alarm Management Plan
- The Alarm Management Section of the CRMP

The Midstream Storage Director will document all action items resulting from this review on the Annual Alarm Management Review form and track through completion prior to considering the annual review complete. All Alarm Management Team members will sign off that review was completed in accordance with the established procedure.

6.3 Alarm history preservation

The alarm and event history (e.g., annunciations, acknowledgements, return-to-normal, Operator actions, etc.) should be preserved as specified in SCG's Document Retention policy and Control Room Management plan. Unless specified elsewhere, the retention time for alarm and event data shall be five (5) years.

7 Management of Change

Management of change is the process that ensures that additions, modifications, and deletions to the alarm system are properly evaluated and authorized. Changes to the control system in general and the alarm system in particular will be made in accordance with SCG's MOC process.

8 Audit

An audit establishes periodic reviews of the managerial and work practices associated with the alarm system to verify that the entire alarm management program is in line with procedures, policies, and industry guidelines.

Personnel interviews or questionnaires should be conducted as part of the audit to identify performance and usability issues. Interview topics may include:

- Do alarms occur only on events that require Operator action?
- Is alarm priority consistently applied and meaningful?
- Do alarms occur in time for effective action to be taken?
- Are roles and responsibilities for the alarm system users and support personnel clear?
- Is training regarding the proper use and functioning of the alarm system effective?
- What changes are foreseen in technology, regulatory requirements, etc. and how will they affect the alarm management program?

The audit should review work practice documentation, which may include:

- Verification that alarms require Operator action to avoid a defined consequences
- Documentation of alarm attributes and rationalization
- Management of change documentation of modifications to alarm attributes in the MAdB
- Alarm performance monitoring reports
- Documentation of repairs to malfunctioning alarms
- Documentation for shelved alarms

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Action plans that include timelines and accountability for corrective action should be developed for problems identified during the audit processes. A review of the results of the corrective actions should be documented for each item.

The alarm management program will be audited annually not to exceed fifteen (15) months. The alarm management program shall be audited against PHMSA/DOT/PSM regulations, this alarm management plan, Storage and Peaking Operations Control Room Management plan, ANSI/ISA-18.2-2009, and API 1167. In case of conflict between the various regulations and standards, the order in which they are listed in the preceding sentence shall be the order of precedence used in resolving any conflict.

9 Appendix A – Prioritization rules and guidelines

The purpose of this appendix is to define rules and guidelines for scoring the impact severities of alarms and for prioritizing certain types of alarms.

9.1 Fire and Gas alarms

The impact severities of fire and gas alarms will be evaluated as follows:

Table 12 – Fire / Smoke Alarm Impact Severity Scoring

Impact	Default Severity
Safety	Urgent
Operability	Urgent
Environmental	Urgent
Cost	Urgent

9.2 System Alarms

The priority of all system alarms will be evaluated as low priority and sub-priority as 10. The operator response to all system alarms will be to contact Midstream Storage or Peaking Operations IT support (Real-time Systems Specialist) either by phone or email.

10 Appendix B- Definitions

The following is a list of common alarm management terms and acronyms that has been compiled from both ANSI/ISA-18.2 and API 1167. If there was a conflict or disagreement between these two sources, the definition from API 1167 was used.

Table 2 – Terms, Acronyms, and Definitions

Term / Acronym	Description
Abnormal Operating Condition (AOC)	An abnormal operating condition (AOC) refers to any condition identified by the operator that may indicate failure of a component or deviation from normal operations and that may indicate a condition exceeding design limits or result in a hazard to persons, property, or the environment. Abnormal Operating Conditions are defined in 49 CFR 192.605 (c) (1).
Acknowledge	The Operator action that indicates that he has taken ownership of and responsibility for responding to an alarm.
Advanced alarming	Alarms that have dynamic parameters. A collection of techniques (e.g., state-based alarming, and dynamic prioritization) that can help manage alarm rates in specific situations. (See ANSI/ISA-18.2-2009 Clause 12 and ISA-TR18.2.4-2011 for more information on advanced alarming.)
Alarm	A visible and/or audible means of indicating to the Operator an equipment malfunction, an analog or accumulation process deviation, or other condition requiring an Operator's response. (API 1167 Section 3.1.1) Per EEMUA 191 a good alarm has the following characteristics: • Relevant — Has significant operational value • Unique — Does not duplicate other alarms • Timely — Does not activate too long before any response is needed nor too late to respond effectively • Prioritized — Indicates the importance that the Operator attaches to the alarm and the order in which multiple alarms should be managed • Understandable — Is clear • Diagnostic — Identifies the problem that has occurred • Advisory — Indicates the action to be taken • Focusing — Draws attention to the most important issues
Alarm class	A group of alarms with common alarm management requirements (e.g., testing, training, monitoring, and audit requirements).
Alarm Configuration (attributes, settings)	The setup of individual alarms (such as their alarm limits, priorities, dead bands, delay times, etc.).
Alarm Flood	A condition during which the alarm rate is greater than the Operator can effectively manage. An alarm flood is normally defined to begin when the alarm rate exceeds ten alarms in a ten-minute period and ends when the rate falls below five alarms in a ten-minute period.

Table 2 – Terms, Acronyms, and Definitions

Term / Acronym	Description
Alarm Limit (Activation Point, Set Point, Trip Point)	The point or logical condition at which an alarm is triggered; it should allow the Operator sufficient time to manage the alarm.
Alarm Management	The processes and practices for determining, documenting, designing, operating, monitoring, and maintaining alarm systems.
Alarm Philosophy Document (APD)	A document that establishes the basic definitions, principles, and processes to determine, design, document, implement, operate, monitor, and maintain an alarm system.
Alarm Occurrence (Alarm Activation)	When the conditions in the alarm configuration are met (such as a process value exceeding a high alarm limit), an alarm occurrence is generated. This is the audible and/or visible indication of the alarm, along with a time-stamped electronic record containing information about the particular alarm.
Alarm Priority	A relative importance assigned to each alarm indicating the urgency of response, typically using an allowable response time and consequence severity.
Alarm System	The collection of hardware and software that detects an alarm state, communicates the indication of that state to the Operator, and records changes of the alarm state. It controls the presentation of alarms to the Operator(s). It determines when, how, and to which Operator(s) a specific alarm is displayed. It helps the Operator navigate to the appropriate display to begin to resolve the situation.
Alert	A visible means of indicating to the Operator an equipment or process condition that requires awareness. An alert does not require an Operator response, does not meet the criteria for an alarm, and is indicated separately from alarms.
Chattering Alarm	An alarm that transition into and out of the activated state in a short time period (three times or more per minute).
Consequential Alarm	An alarm that consistently (at least 75 % of the time) occurs within a short time (fifteen minutes or less) of another alarm.
Control Room	An operations center staffed by personnel charged with the responsibility for monitoring and/or controlling single, multiple, or entire sections of a process or pipeline facility.
Control System	A computer-based system that gathers process data, generates alarms, and provides a structured view of a plant or pipeline system with the capability to control the operation. This is a generic definition of Control System. The use of the term “Control System” in this document is intended to be inclusive of industry-specific use of the term SCADA as well as including Distributed Control Systems (DCSs), or systems that utilize Programmable Logic Operators (PLCs), Remote Terminal Units (RTUs), or similar technologies. Commonly used terms such as Basic Process Control System (BPCS), and Process Control System (PCS) are also synonyms for the purposes of this document.

Table 2 – Terms, Acronyms, and Definitions

Term / Acronym	Description
Operator	A qualified individual whose function within a shift is to monitor and/or control the operation of single and/or multiple facilities via a control system from a control room, and who has operational authority, responsibility, and accountability for the daily operational functions of the process as defined by Southern Company Gas.
Operator Position	The span of control and alarm responsibility of a single Operator, generally involving consoles, displays, and communications equipment enabling an Operator to interact with the control system.
Dead band	The change in signal from the alarm limit necessary to clear the alarm.
Diagnostic Alarm	An alarm indicating sensor or hardware malfunction. The Operator's reactions to diagnostic alarms may be limited to notification of the maintenance function.
Duplicate Alarm	An alarm that persistently (100 % of the time) occurs within a short time period (one second) of another alarm.
EEMUA	Engineering Equipment and Materials Users Association
First Out	First alarm in a series of alarms. This alarm usually indicates the cause of alarm sequence.
HAZOP	Hazard and Operability Studies As used in this document, it is a generic term for any hazard analysis including, but not limited to: Process Hazards Analysis, Process Hazards Review, Fault Tree Analysis, Layer-of-Protection Analysis, or Probability-to-Fail-Dangerous Analysis.
HMI	Human-Machine Interface
Interim alarm	An alarm used on a temporary basis (e.g., in place of an out-of-service alarm) and requires no or limited change management.
Management of Change (MOC)	Process that ensures that additions, modifications, and deletions to alarm systems, facilities and processes, organizations, and documents are adequately identified, evaluated, planned, controlled, communicated, and authorized.
Master Alarm Database (MAdB, Alarm Dictionary)	The approved list of all rationalized alarms for a control system/HMI, and their correct attributes and settings. The information can be gathered, stored, and maintained using a variety of formats or methods.
Maximum Time to Respond (MTTR)	Maximum allowable time for the Operator to respond to an alarm before his response becomes ineffective
Non-Annunciated Alarm (Journal Event)	An alarm occurrence that is not presented to the Operator. This is an informal but improper use of the word alarm. Some control systems have the ability to route certain event occurrences directly to electronic storage, without any indication to the Operator, or to other functions (such as maintenance). Such "non-annunciated alarms" do not meet the general definition of an alarm used in this document. They do not impose a load on the Operator and thus are not considered when determining Operator alarm rates.
Nuisance Alarm	An alarm that annunciates excessively, unnecessarily, or does not return to normal after the correct response is taken (e.g., chattering, fleeting, false, or stale alarms). Also informally called bad-actor alarms.

Table 2 – Terms, Acronyms, and Definitions

Term / Acronym	Description
Off-delay (Debounce)	The time a process measurement remains in the normal state before the alarm is cleared.
On-delay	The time a process measurement remains in the alarm state before the alarm is annunciated.
Peaking Operations	A division of Southern Company Gas that includes the plant facilities comprising LNG plants, Propane plants, Compressor stations and other supporting operations.
Pipeline Operator	An entity that owns, manages, or operates a plant or pipeline facility.
P&ID	Process and Instrumentation Diagram or Piping and Instrumentation Diagram
PHMSA	Pipeline and Hazardous Materials Safety Administration
Rationalization (D&R)	The process to determine and ensure that alarms are selected, designed, prioritized, and documented in accordance with the principles of the pipeline operator's alarm management plan. A multi-step process that begins with accepting or rejecting candidate or potential alarms or alarm changes by evaluating them against the criteria established in the alarm management plan. The next step, for accepted alarms, is a preliminary design stage, in which the priority and alarm limit of each alarm are determined. Finally, accepted alarms are documented as specified in the alarm management plan. Also referred to as Documentation and Rationalization (D&R).
Safety-Related Alarm	A safety related alarm is defined as an alarm that has a Human or Environmental impact severity of III, IV, or V (see Table for definitions of the impact severities). An alarm that specifically indicates that equipment or processes are outside the pipeline operator's defined safety-related parameters. Federal regulations 49 CFR 192 specify certain requirements around safety related alarms. It is therefore desirable for each pipeline operator to identify and document any safety related alarms along with the criteria for that identification. Regulations 49 CFR 192 require that safety related alarms are accurate, be reviewed, and support safe pipeline operations.
Shelving	A mechanism, typically initiated by the Operator, to suppress temporarily an alarm, following proper administrative and functional requirements.
Silence	The Operator action that terminates the audible alarm indication.
Stale Alarm	Alarms that continuously remain in the alarm state for an extended period (more than 24-hours).
Storage Operations	A division of Southern Company Gas that includes the gas storage facilities comprising Under Ground Storage Caverns, Compressor stations and other supporting operations.

Table 2 – Terms, Acronyms, and Definitions

Term / Acronym	Description
Sub-Priority	A numeric value 0,5, or 10 displayed to the operator on the alarm summery representing the operator time to respond. i.e.: “0” requires immediate response,” 5” requires less than five minutes, and “10” requires less than ten minutes.
Suppress (Disable)	Any mechanism to prevent the indication of a configured alarm to the Operator when the alarm condition is present.

Appendix . C. Related Site Procedures

The following is a list of documents and procedures that fall under the Storage umbrella. All items are not necessarily relevant to each facility.

Table 3 - Site Related Procedures

- Midstream Operating and Maintenance manual
- Alarm Shelving Procedures
- SPCC - Spill Prevention, Control and Countermeasures
- Control Room Management Plan
- ERP - Emergency Response Plan
- Integrity Management Plan
- Incident Review/Lessons Learned Form
- Management of Change
- Operations Manuals
- Operation Procedures (SharePoint)
- Shift Responsibilities Manual
- Training Manual

This alarm management plan will define the requirements for managing alarm or alarm system changes. Storage Management will be responsible for ensuring that all related documents are synchronized and kept up-to-date per the CRM plan.

The document retention time for alarm and event logs, alarm and alarm system testing results, training records, and all other alarm system related documents will be in accordance with federal regulation 49

CFR 192, the Document Retention Policy, or this alarm management plan based on alarm class. Unless otherwise specified, the document retention time is five (5) years.

Appendix . D. References

The following references are recognized and generally accepted good engineering practices or regulatory requirements and should be used as part of the audit of the alarm management program.

- 49 CFR Parts 192.631
- ANSI/ISA-18.2-2009, Management of Alarm Systems for the Process Industries and associated Technical Reports
- API RP 1130 – Computational Pipeline Monitoring for Liquid Pipelines
- API RP 1165 – Recommended Practice for Pipeline SCADA Displays
- API RP 1167 – Pipeline Alarm Management
- API RP 1168 – Pipeline Control Room Management
- ML Bransby, "The Management of Alarm Systems", HSE Books, 1998, pp. 193-195

Point To Point Verification Procedure

1. APPLICABILITY

1.1. When specific changes are made to the field-based equipment, a point-to-point verification of all of the impacted safety-related points must be completed prior to relying on those points for facilities operation. The specific field changes that are in scope include:

- Adding a new RTU, PLC
- Migrating existing equipment to a different make/model of RTU, PLC
- Adding or changing safety-critical pressure monitoring equipment
- Adding or changing safety-critical remote control equipment
- Adding or changing gas and fire detection equipment
- Adding or changing hazardous atmosphere detection equipment
- Adding or changing emergency shutdown (ESD) equipment
- Adding or changing a SCADA display

1.2. The definition of “Safety-Related Points” can be found in the Alarm Management Plan.

2. TESTING REQUIREMENTS

2.1. The following shall be verified during the point-to-point verification:

- Physical location of device
- Data value or status
- Alarm settings (Hi & Hi-Hi or Lo & Lo-Lo)
- Confirmation of test signals to the local and remote control rooms

2.2. The point-to-point verification process is accomplished by working with a Technician at the remote site.

2.2.1. Signals being verified are generated at the site and tracked to the correct graphic component on the appropriate SCADA screen(s).

2.2.2. In the case of verification of controls, the command is issued from the appropriate SCADA screen(s) and the command is confirmed to reach the appropriate equipment at the remote site.

2.2.3. The Technician may have to intercept the command in the case of an operating facility.

2.2.4. Alarms that are related to the testing may be temporarily disabled for the duration of the test provided the Operations manager give their approval.

3. DOCUMENTATION

3.1. Maintain records demonstrating the following minimum information:

- Date of testing
- Personnel performing testing
- Reason for testing
- Points verified
- Record all alarm set points related to the alarm (Hi & HiHi or Lo & LoLo)
- Record that the alarm is being received at local and remote control rooms
- Adjustments / follow-up, as necessary

3.2. Maintain records for a minimum of 5 years.

Attachment 2 – Emergency Responder Meeting Sign-in Sheet

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