



White Paper

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Team Training for Gas Control Centers

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Definitions

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

Control Room: Any facility that is staffed by trained and operator qualified personnel who monitor and/or remotely control transmission and/or distribution facilities through a gas SCADA system.

Controller: An operator qualified individual who remotely monitors and controls the gas transmission and distribution facilities via a gas SCADA system. This person holds operational authority and accountability for the remote functions of the pipeline facility.

Emergency Operating Conditions: A significant event condition on a gas system that occurs when the operating design limits have been exceeded due to a change in pressure, flow rate, or temperature change that is outside of normal conditions limits that may result in a hazard(s) to persons, property, or the environment.

Expert: A person who has comprehensive and authoritative knowledge and/or skill in a particular area.

Normal Operating Condition: An expected range of conditions in a gas system that are within operating design limits, allowing for the normal delivery of natural gas to customers.

Operator Qualification: An individual who maintains current Operator Qualifications mandated by their Company Operator Qualification Program (i.e., OQ Tasks 59, 60, & 70) to operate a gas transmission and/or distribution systems. They are considered qualified after successfully obtaining these qualifications.

PHMSA (Pipeline Hazards and Material Safety Administration): An agency that establishes national policy, sets and enforces standards, educates, and conducts research to prevent incidents.

SCADA (Supervisory Control & Data Acquisition): A computer-based system(s) used by a Controller in the Control Room that collects and displays information about a pipeline facility and may have the ability to send commands to the pipeline facility.

1 Background

This AGA white paper was developed to provide guidance and help natural gas utilities develop or enhance a successful Team Training Program for Gas Control Centers. Team Training for Gas Control Centers, regulated by PHMSA's Control Room Management regulation (49 CFR §192.631), impacts many groups inside a natural gas utility company. This paper offers natural gas utility companies leading practices for the application, development, and delivery of a program that meets the requirements mandated by PHMSA. Additionally, this paper offers a framework for identifying potential resources, including but not limited to, key personnel, processes, best practices, and tools which may be employed to help develop training content, identify impacted groups, and deliver training material in a more effective and impactful manner. This paper also identifies several methods for monitoring compliance and collecting required documentation that may be helpful during a Control Room Management audit. Operators are encouraged to utilize the information provided in this paper to actively engage with their leadership, associated lines of business, and any cross-functional teams to ensure that the appropriate personnel, processes, and technology are leveraged in the development and implementation of a Gas Control Center training program. The recommendations in this paper should be considered in the context of each operator's specific operating system. Consequently, not all practices described in this document will be applicable to every operator. The term 'should' is used here to suggest actions that are advisable but not obligatory.

This paper was prepared by several AGA Gas Control Committee members. Together, they identified a variety of leading practices that other industries have employed in the successful development of human factors based "Team Training". This paper discusses the evolution of Team Training with insights from the air, maritime, and rail industries. Additionally, this paper offers some suggestions regarding how Control Centers can learn from the successful application of tools, training, and other human factor performance improvement methods covered by Team Training.

2 Purpose and Scope

The mission of a Gas Control Center is to manage, operate and monitor all assets within its defined authority, along with ensuring the safe, reliable, and efficient delivery of natural gas to the natural gas utility's customers. The purpose and scope of this paper is to identify recommendations that may help natural gas utilities to meet the Team Resource Management Training requirements found in 49 CFR 192.631.

This paper seeks to share what members have learned when developing a training program, including the development of material to be covered during team training, course development and delivery, and proper record retention to adequately document compliance with PHMSA's training requirements. The overall goal of this document is to provide guidance to operators seeking to develop and implement a successful Team Training Program focused on improving human factors from the Control Center to the Field, and all the groups that interact with a modern Control Center in today's fast paced operating environment.

Note: The American Gas Association does not recommend specific vendors, consultants, or experts who may have developed or who can assist in developing a training program. Nothing in

this paper is intended to endorse, positively or negatively, any specific vendor, consultant, program or product.

3 History and Key Concepts

3.1 What is Team Training and Where Did It Develop?

Gas Control Centers consist of groups of individuals working together to safely monitor and operate the gas systems under their control.

Team Training evolves from a history of enabling individuals to work together in a highly specialized field to achieve a task or function safely and reliably. For example, in the aviation industry, Team Training is known as Crew Resource Management (CRM)¹; in shipping, Bridge Resource Management (BRM)²; and in oil fields it is called Well Operation Crew Resource Management (WOCRMR)³. Each of these forms of training seek to address human factors and other non-technical skills that, when ignored, can lead to significant accidents or near misses.

Some programs have defined these concepts as a family of instructional strategies to improve teamwork. For example, if we look at what the Federal Aviation Authority defines as Crew Resource Management, we can see that it has principles that can apply to Team Training for Gas Control Centers.

Crew Resource Management is defined as the effective utilization of all available resources--equipment and people--to achieve safe, efficient flight operations. Resources include autopilots and other avionics systems; operating manuals; and people, including crew members, air traffic Controllers, and others in the flight system. Therefore, the concept of effective Crew Resource Management combines individual technical proficiency with the broader goal of crew coordination, thus integrating all available resources to achieve safe flight⁴.

3.2 How Can Team Training Help My Control Center?

Team Training seeks to improve human performance by studying, sharing, and practicing (through drills) human factor principles and other non-technical skills (sometimes referred to as soft skills) to minimize error and mitigate risk. One critical factor in developing a Team Training program for Gas Control Centers involves incorporating those who operationally collaborate with the Control Center and perform critical roles within Normal, Abnormal, and Emergency operating conditions of a natural gas system.

¹ Crew Resource Management: An Introductory Handbook, August 1992
<https://www.tc.faa.gov/its/worldpac/techrpt/rd92-26.pdf>

² Bridge Resource Management (BRM) guidance,
<https://www.ukchamberofshipping.com/training/publications/bridge-resource-management-guidance>

³ Guidelines for implementing Well Operations Crew Resource Management (WOCRMR) training, December 2014
<https://www.hpog.org/assets/documents/IOGP-502.pdf>

⁴ Crew Resource Management: An Introductory Handbook, August 1992
<https://www.tc.faa.gov/its/worldpac/techrpt/rd92-26.pdf>

4 Mission

4.1 Developing a Team Training Program

49 CFR 192.631(h) tasks Gas Control Leaders with developing an effective Team Training Program. However, it is important to note that Gas Control Leadership will need the broader support of their company's Executive Leadership and key internal leaders to establish an effective Team Training Program." As discussed in detail below, the regulatory requirements and guidance issued by PHMSA apply to the Control Center, but also extend outward to multiple groups that operationally collaborate with Controllers on a routine basis. It is important that these other groups attend training, drills, and refresher training as well to align with the requirements of 49 CFR 192.631(h).

4.2 What Does PHMSA Say About Team Training?

49 CFR 192.631 (h)(6) requires that operators implement control room team training and exercises that include both Controllers and other individuals, defined by the operator, who would reasonably be expected to operationally collaborate with Controllers (control room personnel) during normal, abnormal or emergency situations.

PHMSA further provides guidance on Team Training in the CRM FAQs⁵, which can be found on their website. FAQ's sections H.05 through H.09 give more context to the rule and provide insight into what inspectors will be examining during an audit or inspection. Some key considerations gleaned from the regulation and PHMSA's FAQs that may be useful to natural gas utilities when developing a training program include:

- (1) Effective training must include both Controllers and Non-Controllers who as "defined by the operator" would "reasonably" be expected to operationally collaborate with Controllers.
- (2) Training should include individuals with the authority to "direct or supersede" specific technical actions of a Controller.
- (3) Training should include individuals who interact both remotely (via phone, etc.) and face to face.
- (4) Training should include normal, abnormal, and emergency situations.
- (5) Refer to FAQ H.06 for recommendations regarding what topics and skills should be covered in training.
- (6) Refer to FAQ H.07 for recommendations regarding how PHMSA recommends control room training be conducted. It is important to note that PHMSA wants the operator to evaluate and document the effectiveness of the training.
- (7) Refer to FAQ H.08 for a discussion of the use of exercises and the frequency of training exercises.
- (8) Refer to FAQ H.09 for a discussion of the role of a Controller in training exercises.

⁵ The Pipeline and Hazardous Materials Safety Administration (PHMSA). (2018). Control Room Management Frequently Asked Questions (FAQs). <https://www.phmsa.dot.gov/pipeline/control-room-management/control-room-management-faqs>

4.3 Developing a Team Training Program and Policy

One recommended best practice is to develop a Team Training Policy that spells out:

- (1) What is Team Training?
- (2) What are the topics to be covered in your program?
- (3) Who will develop and deliver your Team Training?
- (4) Who will be required to attend Team Training?
- (5) How will Team Training be delivered? In-person? Computer-Based (CBT)?
- (6) Will there be both initial and refresher training? How long is each? What is the cycle for refresher training?
- (7) Who will manage the Training and Documentation?
- (8) Who will participate in Control Room Management inspections?

4.4 Who Should Lead and Administer Your Team Training Program?

A key consideration for question 7 and 8, above, is who will “own” the Team Training Program. Some operators will have the Control Center fully own and manage the Team Training because of Control Room Management regulations and respective regulatory audits. A company’s traditional Learning and Development (L&D) Department may also be assigned ownership and responsibility of the Team Training function and delivery. This approach can leverage the L&D department’s expertise and experience on course development and delivery of training within the larger context of the company. These departments typically employ experts in training and can include the Team Training Program in broader training programs, such as an annual refresher cycle that many companies deliver to maintain safety and Operator Qualification Programs. Determining who “owns” Team Training is an important starting point for a successful program.

4.5 Who Should Be Included in a Team Training Program?

A key part of developing a Team Training Program is determining who should be included. It is also important for operators to determine which employees may be expected to operationally collaborate with Controllers to effectively meet the requirements. Some examples of who should attend are provided below. Note, these are only suggestions and not a complete or exhaustive list for who to include or exclude. A key to a successful inspection is providing clear reasoning and documentation for the inclusion and exclusion of individuals. Documenting this in the Team Training Policy is likely to enhance success during inspections.

Groups to consider including:

- (1) Gas Control (Controllers, Leadership, Support Personnel)
- (2) SCADA Support Teams
- (3) Gas Purchasing/Scheduling
- (4) Dispatch (whether internal or external to it)
- (5) Company First Responders (individuals who will report to the scene and communicate with Gas Control)
- (6) Instrumentation & Regulation (Pressure Regulation)

- (7) Engineering. Please note that this is a broad group for many operators. The key here is within the Team Training Policy to carve out what segments of large groups (like engineering) are reasonably expected to interact with the Controllers during the modes of operation (Normal, Abnormal, Emergency). Often, this may include the hydraulic modeling team in engineering and the project leadership section of engineering (i.e., those involved in pipeline projects of gas systems managed by the Control Center), among others.
- (8) LNG/CNG/Compressor Station Operations/Storage Operations
- (9) Damage Prevention and Contractor Oversight
- (10) Field Operations and Construction Organizations (if they respond to emergencies)
- (11) Internal Emergency Planning Teams
- (12) Leadership Teams

Operators should identify who would be included in an Incident Command Structure (ICS) for a major event to help identify individuals to include in the Team Training Program.

5 Operational Objectives

5.1 Potential Topics to Include in an Effective Team Training Program

PHMSA outlines the following guidance in its FAQs H.06⁶:

Training and exercises must provide individuals, and the team as a whole, with the skills necessary to address conditions that could occur in any operational mode (normal, abnormal, or emergency conditions). Important skills include, but are not limited to, teamwork, communication, situational awareness, decision-making, leadership, professionalism, understanding roles and responsibilities (including how company leadership and executive management are involved in operational decisions), recognition and appropriate responses to emergencies, resolution of data discrepancies, error diagnostics, error management, relevant procedures, and problem solving.

The training should specifically address scenarios when roles change, such as when an individual with authority to direct or supersede the specific technical actions of a Controller assumes operational control of the pipeline, if the operator has designated such individuals [§§ 192.631(h)(6) and 195.446(h)(6)].

Potential topics, as outlined by Salas et al. (2006)⁷, operators may want to highlight in team training include:

- Communication
- Briefing
- Mutual Performance Monitoring
- Team Leadership

⁶ The Pipeline and Hazardous Materials Safety Administration (PHMSA). (2018). Control Room Management Frequently Asked Questions (FAQs). <https://www.phmsa.dot.gov/pipeline/control-room-management/control-room-management-faqs>

⁷ Salas, Eduardo, et al. (2000). The Design and Deliver of Crew Resource Management Training: Exploiting Available Resources. Human Factors. Vol. 42. Pg 490 – 511.

- Decision Making
- Task Related Assertiveness
- Team Adaptability
- Shared Situation Awareness

There are many topics and resources for Gas Control Leaders to utilize when developing a Team Training Program. There are resources on the internet, in journals, and academic literature available to help design and outline an effective program. There are also consultants who can help an organization develop the content and materials for an effective Team Training Program. These consultants can also deliver the training should a company choose to pursue this route.

Adults learn through a variety of methods and approaches. Team Training and the concepts covered lend themselves to using real world examples. These concepts can be pulled from within one's company operating experience, or by seeking out publicly available industry events. Either way, real world events can help drive home the concepts focused on in Team Training. For example, real world events may be helpful to drive home topics like communication failures, lack of situational awareness, loss of focus, and poor leadership during safety critical operations.

5.2 What are the Expectations for Team Training Frequency and Duration?

Effective Team Training policies must identify who is required to attend, and provide details on initial sessions, frequency, and the targeted length of training sessions. For example, initial Team Training typically requires a longer class duration to allow background and examples of covered topics. Refresher training generally is shorter with the frequency guided within the Policy. Some operators may choose to perform an annual refresher training or align with your OQ refresher cycle. A detailed justification for the frequency may also be included within the Policy.

A good practice is to set forth a policy of "shall make best efforts to train new employees required to participate in the Team Training Policy within X time period of starting their role". This allows a cadence of classes throughout the year and does not require a company to provide training each time a new individual assumes a role covered by the Team Training Policy.

5.3 What Role Do Exercises and Drills Play in Team Training?

PHMSA, in FAQ H.07, includes the following guidance on exercises:

Exercises should present realistic scenarios and situations sufficiently complex to challenge the team's collective decision-making skills. Exercises should include lessons learned from the operator's actual events and should consider applicable events that have occurred at other oil and gas industry facilities.

Unless amended to include team training requirements, emergency procedure training or Oil Pollution Act drills alone are likely not sufficient to account for adequate team training and exercises.

Additionally, FAQ H.08 PHMSA states:

At least one fully qualified Controller must participate in all exercises and scenario practice. However, traditional classroom training on team concepts and soft skills could be accomplished without specific Controller participation.

Regular exercises and drills are a key component of developing an effective Team Training Program. The size, scope, frequency, and duration of these drills should be defined in the Team Training or Control Room Management Policy. The question of who owns or leads these drills is again a question for each operator. A key point made in the PHMSA FAQ is that at least one fully qualified Controller must participate in Team Training Exercises and scenarios.

Most operators will have an Emergency Planning Group that works to perform annual drills with First Responders and outside Emergency Groups (FD, PD etc.). Thus, this is an opportunity to expand these drills to include a Team Training Component along with Controller participation. Another approach is to include a drill portion at the conclusion of the initial and refresher training classes. Although computer-based training (CBT) alone would likely not be considered sufficient, a CBT could be used to supplement a team training program. Some challenges that an operator can be faced with would be Hours of Service (HOS). Those on 12 hours rotating schedule maybe faced with scheduling challenges to avoid HOS deviations and not allowing ample rest time.

6 Additional Resources

6.1 Documentation and Records

It is important to maintain accurate and complete documentation for inspection by PHMSA or State Regulators related to Team Training. A clearly written policy or procedure that outlines all aspects of Team Training will play a key role in successfully navigating inspection or audit.

Examples of records for Team Training that should be retained include:

- (1) Lists of Groups included in the Team Training Framework.
- (2) List of Employee Titles or Types impacted. This may help limit the training pool. For example, calling out a certain title specific to First Responders within Customer Metering Group. Thus, the amount of training required may be reduced by excluding those reasonably not expected to interact with your Control Center during an event.
- (3) Lists of employees who have received initial training with dates included.
- (4) Lists of employees who have received refresher training with dates included.
- (5) Training Dates with instructor names and class attendance records.
- (6) Exercise dates, the scenario exercised, all attendees with a specific notation of the Controllers present for the exercise. Examples of documentation could be the sign-in sheet, the power point used to drive the exercise.

6.2 Measuring the Effectiveness of Your Team Training Program and Exercises

A common question raised during inspections and frequently discussed among Gas Control Committees across the US is how to measure the effectiveness of various aspects of the Control Room Management Program. Team Training is no exception.

In PHMSA's FAQ H.07, it is clearly stated that "the effectiveness of training should be evaluated, documented and considered when preparing future training and exercises". Operators and Gas Control members have used a variety of means to determine the effectiveness of aspects within their Control Room Management Programs. Examples to consider for gauging the effectiveness of a Team Training Program may include:

- Post-class surveys on the effectiveness of the class and topics covered.
- A simple assessment given at the end of initial and refresher training to gauge the effectiveness of the class on the topics covered.
- Post-exercise surveys for participants and planners asking about the effectiveness of the exercise and its relationship to real-world events.

Conclusion

Team training is an integral part of ensuring and further developing Gas Control Center regulations and safety standards. Using available industry lessons learned, various drills, and other methods mentioned in this paper, a robust Team Training policy can be built within a company. However, when making Team Training policies/materials, it is important to consider who would be required to attend sessions, details on initial sessions, frequency, and the targeted length of training sessions. Similar consideration applies to coordinating drills as well; think about the frequency, scope, who would be attending, and who would be leading the drills. The frequency of training must be defined in the operators' Control Room Management Plan.