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LETTER REPORT

Summary Results of the NRC Team Interaction Skills Study at Diablo Canyon Power Plant

Prepared for

Office of Nuclear Regulatory Research
U.S. Nuclear Regulatory Commission

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Battelle Human Affairs
Research Centers

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Human Factors Branch
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EXECUTIVE SUMMARY

This report presents information to participants in the Team Interaction Skills study conducted at Diablo Canyon Power Plant from September to November 1989. A study was conducted to develop and assess measures of team interaction skills of nuclear power plant control room crews in simulated emergency conditions. Data were collected at a boiling water reactor (BWR) and pressurized water reactor (PWR) using three sets of rating scales: Behaviorally Anchored Rating Scales (BARS), Behavioral Frequency rating scales, and Technical Performance rating scales. Diablo Canyon Power Plant agreed to serve as the PWR plant in the study. Observers consisting of contract license examiners, Diablo Canyon Power Plant training instructors, and project staff used the rating scales to provide assessments of team interaction skills and technical skills of control room crews during emergency scenarios as part of license requalification training. Crew members were also asked to provide self-ratings of their performance to gather information regarding crew responses to the Team Interactions Skills rating scales.

The principal findings and conclusions regarding the Team Interaction Skills study at Diablo Canyon Power Plant are presented below.

REVISE THE RATING SCALES AND PROVIDE RATER TRAINING

Interrater agreement between observers on the Team Interaction Skills rating scales was low. This may be due to: (a) the lack of a structured rater training program, (b) a limited amount of time to observe the crews, or (c) the need for scale revision. In future data collection efforts, project staff will focus on refining the Team Interactions Skills rating scales and expanding the rater training to ensure that raters agree on their evaluations of team interactions skills.

A HIGH DEGREE OF CREW PERFORMANCE WAS OBSERVED AT DIABLO CANYON POWER PLANT

Crews at Diablo Canyon Power Plant were rated favorably on the Team Interaction Skills and Technical Skills rating scales. On the BARS, crews generally received Average to High ratings. On the Behavioral Frequency Scales, positive behaviors were generally noted frequently; negative behaviors were generally not observed, or were observed infrequently. The Technical Skills rating scales also showed predominantly favorable ratings.

EXAMPLES OF HIGH, AVERAGE, AND LOW TEAM INTERACTION SKILLS WERE PROVIDED BY RATERS

Raters provided the greatest number of comments on the BARS for High ratings (for instance, 7, 6, or 5). Raters seldom provided behavioral examples in conjunction with Low ratings of team performance. In other words, high crew performance at Diablo Canyon Power Plant generated favorable comments; low crew performance generated few, if any, comments. Appendix B provides a plant-specific knowledge base of High, Average, and Low team interaction skill behaviors for training purposes.

CERTAIN TEAM INTERACTION SKILLS WERE SELDOM OBSERVED AT DIABLO CANYON POWER PLANT

Several team interaction skill dimensions received a high number of Not Observed ratings on both the BARS and Behavioral Frequency rating scales (namely, Advocacy, Conflict Resolution and Decision Making, and Stress Management). These dimensions were perceived as not necessary for high team performance (and were not observed often because most of the crews at Diablo Canyon performed well). An alternative theory is that raters were not trained to be sufficiently sensitive to these behaviors. In the case of Stress Management, the team interaction skill may be needed, but was not observable in the training simulator. Future research will consider

- (a) whether these behaviors are positively or negatively correlated indicators of team interaction skills and
- (b) address how Stress Management behaviors in particular can be observed in a plant simulator environment

MOST FREQUENTLY OBSERVED BEHAVIORS CONSISTED OF COMMUNICATION, GROUP PROCESS, AND TECHNICAL PERFORMANCE BEHAVIORS

Raters most frequently observed the following types of behavior at Diablo Canyon Power Plant; communications, group processes (team characteristics and problem solving/decision making), and technical performance. Communications and group process examples comprise about 50 percent of all crew behavior examples. Raters provided only small numbers of comments regarding technical performance. The distribution of comments across these categories was fairly constant between crew members and observers, suggesting common perceptions among rater groups regarding crew

performance behaviors. These comments suggest several broad types of behavior are observable during performance in simulated emergency conditions.

COMMENTS REGARDING THE USABILITY OF THE RATING SCALES WERE PROVIDED BY RATERS

Comments regarding the wording of the rating scales highlighted several themes regarding the usability of the rating scales. Raters regarded several of the team interaction skill dimensions as irrelevant because they did not report observing the behavior during the scenario. Some team interaction skill dimensions were regarded as contingent upon specific circumstances. Several raters expressed confusion or difficulty with the concept of team performance. Several raters reported interpreting the definition of "team performance" differently. Several raters expressed difficulty with the structure of the ratings scales. Similar to the statistical findings, these findings highlight the need for further rating scale revision and improvements in terms of rating scale usability and rater training.

GENERAL COMMENTS WERE PROVIDED BY RATERS

General comments regarding the data collection environment, the simulator environment versus the "real-time" environment, and the use of procedures and other reference materials were also provided. Several raters recommended more team interaction skills training at Diablo Canyon Power Plant. Several raters noted that in some instances the simulator did not accurately reflect the corresponding "real-time" situation. These issues should be considered by Diablo Canyon training staff within the context of plant simulator exercises.

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1.0 INTRODUCTION

This report presents information to study participants regarding team interaction skills ratings and observations collected at Diablo Canyon Power Plant from September to November 1989.

Crew performance is a critical aspect of safe nuclear power plant control room operations. Broadly defined, crew performance is a function of the crew's technical proficiency and team interaction skills. Technical skills consist of:

- the crew's ability to understand and interpret annunciators and alarms
- diagnose events and conditions based on instrument signals and readings
- understand plant system operations
- use procedures and Technical Specifications
- operate the control boards
- communicate relevant technical information clearly, accurately, and effectively

On the other hand, team interaction skills consist of:

- sending clear messages
- understanding what is said
- questioning what is not understood
- providing useful suggestions and ideas when needed
- participating in group decisions
- resolving conflicts between crew members, if they arise
- managing stressful situations, if necessary
- providing assistance to overworked fellow crew members
- fostering a strong team spirit

If team performance in any of these team interaction areas is weak, highly competent crew members may fail to contribute their knowledge and abilities to effectively address technical problems as they arise. In some cases, strong team interaction skills can compensate for limited technical proficiency, allowing the team to pull together to solve an unanticipated problem. In the complex and potentially hazardous environment of a nuclear power plant, it is essential that control room operators apply their knowledge and abilities to their fullest advantage at all times in a cooperative teamwork atmosphere. This requires effective use of technical skills and team interaction skills at all times during plant operation. Extensive research supports the notion that improved quality and effectiveness is possible when a group works together, rather than as individuals alone. Up to this point, however, little research has addressed the issue of how such team interaction skills should be measured in nuclear power plant control room operations.

This study was conducted to evaluate a set of rating scales designed to assess the team interaction skills and technical skills performance of nuclear power plant operators under simulated emergency conditions. Section 2 presents the findings of the study, and discusses the usefulness of the rating scales for measuring team performance, implications for future team interaction skills research, and training implications. Appendix A describes the study background, approach, and rating scales used in the study. Appendix B provides a list of crew performance observations at Diablo Canyon Power Plant and is intended for use as a knowledge base of team interaction skill behaviors observed at Diablo Canyon Power Plant.

2.0 FINDINGS

The findings¹ in this section address the following areas:

- description of study participants (crew composition and observers)
- discussion of quantitative data regarding the Team Interaction Skills rating scales
- discussion of comments regarding team skills performance observed at Diablo Canyon Power Plant; the use of the Team Interaction Skills and Technical Skills rating scales; and comments of a general nature

2.1 STUDY PARTICIPANTS

A total of 43 crew members participated in the study. The majority of crew members hold advanced degrees and have military experience (either Army, Air Force, Marine Corps, or Navy). All but two of the crew members hold an RO or SRO license. On average, at the time of the study, crew members had about eleven years of commercial electric generating industry experience (nuclear or fossil) and five years of operating experience. On average, time spent on the job with fellow crew members ranged from 6 months to nearly 3 years.

A total of 14 observers participated in the study at Diablo Canyon. Observers consisted of three principal groups: license examiners, training instructors; and project staff (primarily with a non-nuclear background).

2.2 OVERVIEW OF QUANTITATIVE FINDINGS REGARDING THE TEAM INTERACTION SKILLS RATING SCALES

This section discusses the following quantitative findings regarding the Team Interaction Skills rating scales:

- interrater agreement
- comparison of observers and crew member ratings
- Not Observed ratings

¹For an extended discussion of the findings presented in this section, see Montgomery et al. (1990).

2.2.1 Interrater Agreement

Interrater agreement, as it is called, is the degree to which raters agree or disagree when evaluating the same crew actions or behaviors. When using rating scales to rate certain areas of crew behaviors, it is important to ensure that raters make consistent and accurate ratings. Interrater agreement is the foundation for establishing the validity and accuracy of measures for team interaction skills. As such, the rating scales need to be constructed in such a manner that raters agree on ratings of the behaviors they observe. Without a relatively high level of interrater agreement, the ratings made by future raters will likely depend upon the idiosyncracies of the raters themselves, rather than on observable team interaction skills. This can lead to subjective and inconsistent ratings of crew performance of little validity or usefulness.

In this study, the level of interrater agreement of observers for each of the seven Team Interaction Skills dimensions was examined for each type of rating scale (BARS and Behavioral Frequency). Interrater agreement was calculated by examining the relationship between two raters' evaluations (ratings) of a single crew on a single dimension (for instance, Two-Way Communication of Objectives/Plant Status). Results of these calculations were averaged across raters and crews to provide a single value for each dimension. These calculations yield a correlation coefficient. Values for correlation coefficient range from -1.0 to +1.0. A negative value (-1.0) indicates that pairs of raters provide opposite ratings (that is, one rater provides a high rating and the other provides a low rating). A zero value (0.0) indicates that there is no agreement among raters. A positive value (+1.0) indicates that raters provide the same or very similar ratings for each crew.

At Diablo Canyon Power Plant, interrater agreement was moderate for some pairs of observers and quite low for others. As a result, the average correlation coefficient was near zero for all pairs of raters across all dimensions. These low values suggest that raters did not agree on the level of effectiveness for Team Interaction Skills dimensions. This may be due to:

- (a) the absence of a structured rater training program
- (b) a limited amount of time to observe the crews
- (c) the need for scale revision.

Future research will need to consider these factors to ensure that raters agree on ratings assigned to crews when using the Team Interaction Skills rating scales.

2.2.2 Comparison of Observer and Crew Member Ratings

This section discusses a comparison of observer and crew member ratings. The mean ratings and standard deviations by rater type and scale dimension are presented for the BARS and the Behavioral Frequency rating scales in Table 1 and Table 2. On average, crews at Diablo Canyon Power Plant were rated very favorably across the different facets of Team Interaction Skills on the BARS and the Behavioral Frequency rating scales. Several differences emerged, however. On the BARS, the crews tended to rate themselves higher than observers on some dimensions of team interaction skills (either contract license examiners, training instructors, or project staff). However, the crews tended to rate themselves lower than observers on the Stress Management dimension. Crew members and observers tended to rate performance on a continuum ranging from Average (4) to High (7). Mean ratings on the BARS usually varied between 4 and 5 on the rating scale for all crews. These findings suggest that crew performance at Diablo Canyon was regarded very positively by all raters. This is noteworthy since the Team Interaction Skills rating scales were developed to rate crews already assumed to be highly competent.

On the Behavioral Frequency rating scales, positive behaviors were generally noted frequently. Negative behaviors were generally not observed or observed infrequently, again suggesting a high level of crew performance was observed at Diablo Canyon Power Plant.

The Technical Skills rating scales also indicate predominantly favorable ratings. Similar to the Team Interaction Skills rating scales, differences emerged between crew and observer ratings. That is, crew ratings were higher than observer ratings on some dimensions, and lower on others. In most cases, crew ratings exceeded observer ratings. Regarding the satisfactory/unsatisfactory summary ratings, there was almost no variance (over 95 percent of the raters rated crew performance at Diablo Canyon Power Plant as satisfactory). Overall, these findings suggest that a high degree of crew performance was observed during the emergency scenarios at Diablo Canyon Power Plant.

2.2.3 Not Observed Ratings

Space was provided on the BARS and the Behavioral Frequency Rating Scales for noting that a particular behavior was not observed during the scenario. Raters used the Not Observed option most often on the Advocacy, Conflict Resolution and Decision Making, and Stress Management dimensions. According to a number of raters, behaviors included in the Advocacy dimension are inappropriate in the majority of plant operations (except in some emergency situations in which various courses of action

TABLE 1. Mean BARS Ratings for Each Scale Dimension Across Rater Type
(Standard Deviation in Parentheses)

	Rater Type		
	Crew Members (Self-Ratings)	Instructors	Project Staff
1. Two-Way Communication of Objectives/Plant Status	5.46 (.82)	5.00 (1.07)	5.45 (.85)
2. Resource Management	5.58 (.82)	5.27 (.88)	5.41 (.94)
3. Inquiry	5.48 (.97)	5.45 (1.01)	5.36 (.90)
4. Advocacy	5.45 (.96)	5.36 (1.05)	5.86 (.81)
5. Conflict Resolution and Decision Making	5.62 (.89)	5.64 (.90)	5.27 (.98)
6. Stress Management	5.74 (1.03)	5.81 (.80)	6.05 (.72)
7. Team Spirit	5.59 (1.01)	5.57 (.93)	5.36 (.55)

Note: A total 43 crew members, 10 instructors, and 4 project staff provided ratings.

TABLE 2. Mean Behavioral Frequency Ratings for Each Scale Dimension Across Rater Type
(Standard Deviation in Parentheses)

	Rater Type		
	Crew Members (Self-Ratings)	Instructors	Project Staff
1. Two-Way Communication of Objectives/Plant Status	5.59 (.65)	5.64 (.55)	5.60 (.42)
2. Resource Management	5.32 (.73)	5.47 (.47)	5.23 (.61)
3. Inquiry	5.63 (1.08)	5.58 (1.07)	5.61 (.37)
4. Advocacy	4.88 (1.11)	5.63 (1.02)	5.13 (.72)
5. Conflict Resolution and Decision Making	5.86 (.63)	5.89 (.55)	5.80 (.59)
6. Stress Management	5.93 (.72)	6.22 (.52)	5.97 (.71)
7. Team Spirit	5.89 (.80)	6.17 (.59)	5.90 (.72)

Note: A total 43 crew members, 10 instructors, and 4 project staff provided ratings.

may need to be considered). Raters also reported that Conflict Resolution and Decision Making behaviors seldom occur during control room operations. Since so many observers stated that Advocacy and Conflict Resolution and Decision Making were not appropriate types of behaviors in the plant scenarios used, these dimensions should be clarified and evaluated further in scenarios in which these types of behaviors are more noticeable.

There are two possible explanations why Stress Management behaviors were seldom observed at Diablo Canyon. First, it is possible that the scenarios performed in the Diablo Canyon Power Plant simulator failed to induce extremely high stress levels often associated with a "real-time" accident or emergency situation. It is also possible that Stress Management was seldom observed because the rater orientation program failed to alert observers to stress management behaviors that occurred during the scenarios. These issues will be explored further in the Team Interaction Skills research program.

2.3 CONTENT ANALYSIS OF COMMENTS

This section presents a content analysis of qualitative information collected as part of the study. Recall that raters were provided with space on the Team Interaction Skills rating scales and the Technical Skills rating scales to record behavioral examples, clarify or provide a rationale for a rating, or remark on the structure or wording of the scales. At Diablo Canyon Power Plant, raters provided 426 comments: 287 of these comments were initially categorized as behavioral examples and the remaining 139 comments were categorized as wording comments and general comments. Rater comments collected during the team performance study at Diablo Canyon Power Plant were sorted into three categories: These are:

- (1) Examples of Crew Behaviors: examples of positive or negative team interaction skills observed at Diablo Canyon Power Plant, for instance, "Very effective procedure reading and response," and "Use of two-way feedback."
- (2) Comments About the Rating Scales: comments regarding the use of the rating scales, for instance, "Referring to the 'average' rating, it is unclear."
- (3) General Comments: general comments regarding the scenarios, for instance, "Reference materials were at fault and temp too high on response to seal problem."

Figure 1 shows the distribution of all comments concerning observed behaviors provided for the Team Interaction Skills dimensions. The greatest number of comments provided by Diablo Canyon Power Plant raters pertained to Two-Way Communication of Objectives/Plant Status, followed by

FIGURE 1. Percent of Comments by Dimension: Team Skills Interaction Rating Scales

Resource Management and Inquiry. Team Spirit and Stress Management received the fewest comments. Also note that raters provided the fewest number of crew behavior examples for Stress Management and the greatest number of wording and general comments. This suggests that Stress Management behaviors were not easily observed by the raters during the scenarios.

The content of the crew behaviors examples, comments about the rating scales, and general comments are discussed below.

2.3.1 Crew Behavior Examples

Examples of crew behavior were analyzed across all team performance dimensions. The most frequently cited examples of behavior are:

- repeat-backs
- no talking
- excess talking or everybody talking at once
- supervisor's role behavior (intrusive or non-intrusive)
- crew member or supervisory control of the situation
- overloads or losing control of the situation
- emotions (frustration, panic, or nervousness).

As a result of further content analysis, behavioral examples were categorized into three new content categories:

- Communications
- Technical Performance: observations of technical performance, resources, and competence
- Group Processes: team characteristics, and problem solving/decision making

In terms of content, raters provided more examples of Group Processes than for Communications. Both categories comprised approximately half of the behavioral examples. Raters provided the fewest number of behavioral examples pertaining to technical performance. Observers and crew members provided nearly equal numbers of comments in each category, suggesting common perceptions among rater groups regarding their crew performance observations. Table 3 provides examples of both positive and negative examples associated with each type of behavior.

TABLE 3. Team Interaction Skills Performance Behaviors Observed at Diablo Canyon Power Plant

Behavior	Positive Incidents	Negative Incidents
Communication	<ul style="list-style-type: none"> - Use of repeat-backs - Questioning the actions of others (when action clear or ambiguous) - Clear, concise communication - Frequent communication, but not more than necessary* 	<ul style="list-style-type: none"> - No use of repeat backs - Lack of communication that results in errors - Unclear communication - Lack of response to questions
Technical Performance	<ul style="list-style-type: none"> - Group understanding of processes - Supervisor understanding of processes - Prompt response to controls - Proper use of resources - Ability to handle emergencies 	<ul style="list-style-type: none"> - Lack of understanding of processes - Supervisor doesn't know what is going on - Not watching controls - Not referencing materials - Slow response - Mistake is made - Incorrect procedure is applied
Group Processes	<ul style="list-style-type: none"> - Appropriate* amount of group participation - Helping behaviors - Appropriate* level of decision making - Team gets along 	<ul style="list-style-type: none"> - Not all team members are involved - Not all team members have a chance to participate - Supervisor does not make a decision when one is warranted

*As determined by rater.

2.3.1.1 Incidents of High, Average, and Low Crew Performance by Dimension

Since comments generally accompanied a rating, behavioral examples were reviewed by rating level. This provides incidents of High, Average, and Low team interaction skill behaviors. Appendix B provides a full listing of the comments by High, Average, and Low ratings. For the BARS, behavioral examples were grouped by High (ratings of 7 or 6), Average (ratings of 5, 4, or 3), and Low (ratings of 2 or 1). For example, on the dimension Two-Way Communication of Objectives and Plant Status, a rating of 7 was accompanied with this comment: "Unclear procedure - other crew members helped to clarify and suggested other information. Crew communicates actions clearly (i.e., 'Hey I've got control of the feed pump, stand by for trip')."

The greatest number of behavioral examples are associated with positive ratings of 7, 6, or 5. That is, raters most often provided examples of behavior when that behavior was rated high (7 or 6). The number of behavioral examples by rating, however, drops off significantly for Average ratings (5, 4, or 3), except for Team Spirit at Diablo Canyon Power Plant, where the number of comments for High and Average ratings is approximately equal.

Raters seldom provided behavioral examples in conjunction with Low ratings of team performance. For example, in four of the dimensions at Diablo Canyon Power Plant (Two-Way Communications of Objectives/Plant Status, Inquiry, Advocacy, and Team Spirit), one comment per dimension was associated with a low rating (in all cases the lowest rating was 3). In the other four dimensions, Resource Management, Decision Making, Stress Management, and Overall Team Skills/Performance, no comments were provided with a Low rating.

To summarize, raters tend to provide favorable comments for high performance ratings; raters provide few, if any, comments for low team interaction skills. A list of team performance incidents observed at Diablo Canyon Power Plant is provided in Appendix A.

2.3.2 Comments Regarding the Use of the Rating Scales

This section provides a summary review of rater comments about the rating scales. These comments were analyzed to determine predominant themes associated with the wording or structure of the rating scales. The following themes were identified:

- acceptability of the Team Interaction Skills dimensions

- usability of the Team Interaction Skills dimensions
- conceptual understanding of team interaction skills
- rating scale format

Raters regarded the usefulness of several Team Interaction Skills dimensions as limited because the behaviors occurred infrequently. As indicated above, most comments of this nature were directed at the Conflict Resolution and Decision Making, and Stress Management dimensions.

Some team performance dimensions were regarded as difficult to use since their value is contingent on specific circumstances. For example, Inquiry and Advocacy are regarded as counterproductive if the procedures are well-specified (this occurs in the majority of operations), but may be highly appropriate in situations where the procedures are not well defined, or if there is a question about the proper course of action.

A number of raters expressed confusion or difficulty with the concept of team performance and the relative importance associated with each crew member position. The overriding question raters asked was how to evaluate the shift foreman in relation to the other crew members. For example, "Are his actions more important than other crew member actions? If so, how can these relative weighting values be captured in the rating scales?"

Raters also perceived the term "team performance" (the term used during the study to describe team interaction skills) differently. Some raters thought that the notion of a team referred to the frequency and amount of certain individual crew member behaviors and actions and how quickly they responded to certain events. Other raters thought that team performance referred to how well crew members interacted overall during a scenario. As a result, there was a notable difference of opinion on whether team interaction skills should be measured by quantifying certain individual crew member behaviors, or whether team performance should be measured using a more holistic and primarily judgmental and qualitative assessment of overall crew performance. This difference in rater definition of team performance was not related to any particular group of raters. It was a common perception among crew members, contract license examiners, training instructors, and project staff.

Several raters commented on the structure of the rating scales. There were very few comments regarding the format of the 7-point rating scale. There were a number of comments regarding the wording of anchors and behavioral frequency statements. Raters recommended specific wording changes to improve the format of the rating scales.

2.3.3 Comments Regarding the Scenarios

The following discussion focuses on general comments provided by the raters. These comments pertain mainly to the simulator environment in which the data were collected.

In terms of requalification training, one rater recommended more training on the simulator. One rater noted that poor performance during one incident was due in large part to inadequate training on certain newly installed systems, interlocks, and setpoints.

In terms of using simulator scenarios versus "real-time" incidents, one rater noted that exam situations tend to bring out better team spirit than routine evaluations on shift. Other raters noted simulator modeling problems. That is, the simulator did not accurately replicate the plant scenario. This made diagnosis of team skills difficult or misleading. A rater also noted that team performance was difficult to evaluate in some instances since the trainer was constantly interrupting and freezing the scenario. When problems occurred with the procedures, the trainer froze the scenario to discuss the problems. Some raters noted that stress was not particularly evident during the scenarios, and that certain dimensions were difficult to rate because the simulator atmosphere versus the actual control room atmosphere is very different. Some raters noted that problems arose due to the unclear, conflicting, and confusing nature found in some reference materials.

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APPENDIX A
PROJECT APPROACH

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PROJECT APPROACH

BACKGROUND

In May 1988, the Nuclear Regulatory Commission (NRC) initiated a research project with Battelle's Pacific Northwest Laboratory (PNL) to develop and evaluate criteria for measuring team skills performance observed in nuclear power plant control room operations under emergency conditions. Initial research efforts resulted in the development of two different types of rating scales designed to measure seven aspects of team interaction skills. The first type of rating scale, Behaviorally Anchored Rating Scales (BARS), asks raters to evaluate the quality of performance in seven different team interaction skill areas and in overall team interaction skills performance. The second type of rating scale, Behavioral Frequency Rating Scales, asks raters to evaluate the frequency of behaviors in the seven team skills areas. The third type of rating scale, the Technical Skills rating scales, as they are called, asks raters to evaluate the technical skills of the crew as a whole, rather than individual operators.

The scales were experimentally evaluated by collecting ratings and technical parameter data on operator performance at one boiling water reactor (BWR) and one pressurized water reactor (PWR) simulator. Based on a review of the literature and through preliminary assessment of the rating scales during pilot application and expert review, three assumptions guided the design and conduct of the study:

- different observers will provide the same or similar ratings of a crew's performance in terms of team interaction skills
- team interaction skills and technical skills ratings will be related moderately to each other, i.e., some proficiency in team skills will be needed to communicate technical knowledge to other crew members, and team skills may compensate for a limitation in technical skills or knowledge.
- team interaction skills will be related to measures of safe performance for unusual operating situations

A study was designed to evaluate the rating scales in terms of reliability (agreement between raters) and validity of the rating scales. A draft report documenting these activities was prepared and submitted to the NRC for review and comment.¹ Ongoing statistical evaluation and expert review of the rating scales is aimed toward refining the rating scales and evaluating the relationship between team interaction skills and plant performance variables. Information obtained from the team performance study is also being used to determine subsequent data collection and analysis requirements for evaluating the revised set of team performance rating scales.

¹The draft report is titled, Team Interaction Skills Evaluation Criteria for Nuclear Power Plant Control Room Crews; see Montgomery et al., 1989.

APPROACH

The approach used in the study involved four principal activities:

- (1) identify the major facets of team performance
- (2) develop the draft rating scales
- (3) select plants and scenarios
- (4) collect data

Each activity is described in turn below.

The first activity in the study involved identifying the major areas or facets of observable team interaction skills. Findings from previous research efforts, a review of team performance appraisal literature, and a workshop involving NRC examiners was used to generate a list of 11 potential team interaction facets and definitions of behavior. These were later refined into a total of 7 dimensions for evaluation in the study. The Team Interaction Skills dimensions and their corresponding definitions are provided in Table 1.

The second principal activity involved developing draft rating forms. A set of behaviorally anchored rating scales (BARS) incorporating a 7-point rating scale were developed for use in the study. For each Team Skills Performance dimension, raters were provided with a definition of the dimension and behavioral examples of "High," "Average," and "Low" team performance. An example of the BARS is presented in Figure 1. Note that a "Not Observed" column is provided for each Team Interaction Skills dimension in the event that behaviors represented by the dimension were not observed in the scenario. In addition, space is provided for writing down comments related to crew performance, scenario events, or the rating scales themselves.

Using the same Team Interaction Skills dimensions, a set of Behavioral Frequency Rating Scales were developed to assess the relative frequency of certain behaviors observed during the scenario. Rating points also ranged from 1 to 7, but these values indicate relative frequency, such as Always (7), or Never (1). An example of a Relative Behavioral Frequency Rating Scale is presented in Figure 2. A "Not Observed" column is also provided on the rating scales in the event that the behavior was not observed in the scenario.

Finally, although not developed for this study, a third set of rating scales was administered during the data collection phase of the study. The Technical Skills rating scales were used to evaluate the hypothesis regarding the relationship between the Team Interaction Skills rating scales and technical performance. These scales were originally developed for the simulator examination component of license requalification examinations (Shiraki, 1989). Figure 3 provides an example of one dimension from the Technical Skills rating scales. Similar to the BARS, space is provided for writing down comments related to crew performance, scenario events, or the rating scales themselves.

Observer and crew member background information forms were developed for all study participants. These forms were designed to gather information about study participants such as length of experience in control room operations, experience in license examinations, and training levels.

The third activity involved plant and scenario selection. Diablo Canyon Power Plant agreed to serve as the PWR site in the study. At Diablo Canyon Power Plant, two training simulator scenarios were developed to evaluate the Team Interaction Skills rating scales. The following emergency scenarios provided opportunities to observe crew interaction:

TABLE 1. Team Interaction Skills Dimensions and Definitions

Dimension	Definition
I.	<u>Two-Way Communication of Objectives/Plant Status</u> : Team's ability to maintain plant awareness.
II.	<u>Resource Management</u> : Team members' ability to use resources (such as procedures, assistance from other crew members, and assistance from other plant organizations).
III.	<u>Inquiry</u> : Extent to which members can create an atmosphere in which all are encouraged to question one another for clarification.
IV.	<u>Advocacy</u> : Team members' ability to present and defend arguments for a particular action (advocacy is expected to occur most often when members identify conflicting or unclear procedures).
V.	<u>Conflict Resolution and Decision Making</u> : Team members' ability to recognize and resolve differences in opinions related to actions required to sustain or stabilize plant status.
VI.	<u>Stress Management</u> : Team's ability to get the job done, even when confronted with unpleasant and potentially dangerous situations by reducing stress in high-stress situations or effectively handling the stress.
VII.	<u>Team Spirit</u> : Degree to which members of the team support one another as they perform under routine and emergency conditions.

I. TWO-WAY COMMUNICATION OF OBJECTIVES/PLANT STATUS: The teams' ability to maintain plant status awareness among all appropriate plant staff.

High	Average					Low	Not Observed
7	6	5	4	3	2	1	0

Team members:

Maintain constant awareness of plant status and plans for stabilizing the plant. Communications are always acknowledged by recipients.

Provide plant status updates to one another; generally appear aware of plans for stabilizing the plant. Communications are usually acknowledged by recipients.

Provide insufficient information about plant status and plans for stabilizing the plant. Seldom acknowledge communications.

Comments/Examples:

FIGURE 1. Example Dimension: Behaviorally Anchored Team Performance Rating Scales (BARS)

- I. TWO-WAY COMMUNICATION OF OBJECTIVES/PLANT STATUS: The teams' ability to maintain plant status awareness among all appropriate plant staff.

<u>Frequency Rating</u>	
_____	1. Remain focused; do not engage in behaviors that may distract one another.
_____	2. Deviate from given role structure when necessary to complete a task or handle an unusual situation.
_____	3. Fail to keep everyone fully informed and updated on plant status and changing plant conditions.
_____	4. Appear confused and unclear about the direction the team is going to maintain or stabilize plant status.

<u>Frequency Rating Scale:</u>							<u>Not Observed</u>
7	6	5	4	3	2	1	0
Always	Very Frequently	Often	About Half the Time	Sometimes	Seldom	Never	

FIGURE 2. Example Dimension: Relative Behavioral Frequency Rating Scales

UNDERSTANDING/INTERPRETATION OF ANNUNCIATOR/ALARM SIGNALS

DID THE CREW:

(a) NOTICE and ACKNOWLEDGE alarms, and ATTEND TO alarms in order of their importance/severity?

3	2	1
All alarms that directly related to significant changes in plant conditions were noted.	Minor awareness or response difficulties or lapses.	Failed to notice and/or extremely slow at responding to significant alarms at critical times; easily distracted by nuisance alarms.

(b) Correctly INTERPRET the meaning and significance of alarms and annunciators (including the use of the Alarm Response Procedures, as applicable)?

3	2	1
Crew readily determined what failures/events alarms were indicating.	Minor inaccuracies in alarm interpretation but without safety related consequences.	Significant misinterpretations, resulting in plant degradation.

(c) VERIFY that annunciators/alarm signals were consistent with plant/system conditions?

3	2	1
All necessary verifications performed, including the identification of erroneous alarms.	Minor lapses in alarm verification, but no inappropriate actions taken as a result of inadequate verification.	Verification of failed systems was poor or altogether absent.

SCORE ON UNDERSTANDING/INTERPRETATION OF ANNUNCIATORS/ALARM SIGNALS:

Satisfactory _____

Unsatisfactory _____

Comments/Examples: _____

FIGURE 3. Example Dimension: NRC Technical Performance Rating Scales

- Auxiliary service water/component cooling water (ASW/CCW) and reactor coolant pump seal failure
- Secondary plant startup/shutdown with digital feedwater control (DFC) system

These scenarios proceeded gradually from normal operating conditions to emergency conditions. Each involved equipment and instrument failures which resulted in increased workloads, less familiar emergency operating procedures (EOPs), and secondary failures.

Prior to running the scenarios, raters attended a brief rater orientation session. The purpose of the rater orientation session was to ensure that the study participants understood the objective of the research and how to use the rating scales.

The fourth principal activity involved data collection. Data collection activities were scheduled at Diablo Canyon Power Plant to coincide with their license requalification training schedule. Data were collected at Diablo Canyon Power Plant from September 1989 to November 1989. A total of 9 crews participated in one or more training events. During each scenario, observers were asked to evaluate crew performance in terms of team skills and technical skills performance. Observers included trained contract license examiners, Diablo Canyon Power Plant training instructors, and project staff. A total of 14 observers participated in the study.

Immediately following the scenario, observers and crew members were asked to complete the three sets of rating scales. Note that the purpose for gathering crew self-ratings after the scenario was to obtain quantitative and qualitative information about crew members' reactions to the Team Interaction Skills Rating Scales.

APPENDIX B

TEAM PERFORMANCE INCIDENTS OBSERVED AT DIABLO CANYON POWER PLANT

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TEAM PERFORMANCE INCIDENTS OBSERVED AT DIABLO CANYON POWER PLANT

The comments presented below are examples of team performance observed during the scenarios performed at Diablo Canyon. For each team performance dimension, comments were grouped by the rating assigned to the crew. Aggregating these comments is intended to demonstrate the range of team performance observed during the study at Diablo Canyon, and provide a list of positive and negative examples of team performance observed during the scenarios.

TWO-WAY COMMUNICATION OF OBJECTIVES/PLANT STATUS

The team's ability to maintain plant status awareness among all appropriate plant staff.

Incidents of High Performance (Associated with Ratings of 7 or 6)

- Very effective procedure reading and response. Use of two-way feedback.
- Good communications between SF/SCO/ACO.
- Crew was very communicative verbally.
- Excellent work by both SF and SCO. Clear statements by SCO and returns by COs and ACOs. SF communicated with ACO and CO prior to RX trip to prepare them.
- Clear and consistent at all times. Open discussion between all members.
- Unclear procedure- other crew members helped to clarify and suggested other information. Crew communicates actions clearly, (i.e. "Hey, I've got control of the feed pump, stand by for trip.")
- The CO and ACO attended observed boards for changes, and diagnosed the few problems quickly. SFM consistently consults typewriters. The STA is always scanning boards, SPDs, and procedures.
- Good repeat backs to instructions. Good "mini tailboard" prior to important events (i.e. We will ramp down...then trip RX...then trip RCP, etc.) prior to actual performance.
- One crew member didn't always acknowledge the information he received.
- Communication generally OK, but some lack of comment by SCO. During seal leak problem SCO performance improved markedly.
- Individuals repeat back instructions to verify instructions and expected actions of operation of controls.
- Overall very good. SFM gave up the big picture frequently. The only glitch was in E 1.1. The CO wasn't fully aware that decreasing level should have caused them to enter E-1 again.

- SFM keeps crew apprised of situations and proposed courses of action: ACO makes recommendation and got adopted after some discussions with the other crew members.
- SCO and SFM were kept advised by STA, CO and ACO. Repeat backs were used.
- Reports made of plant status changes were acknowledged clearly and loud enough to be heard.
- During high-stress situations, not all communications were acknowledged due to the high volume of communications.
- During feed valve failure, the CO and ACO-7 communication of feed and steam mismatch remained constant during transient ACO-7. During the 10% steam valve failure, they needed to repeat failure twice to the SC.
- In responding to feedwater closing, the team responded well, especially in communication between ACO/CO and SCO/SFM.
- Communication good between crew members. Repeat backs were used during procedure steps in EO. CO kept SCO informed of pressurizer level during SI trip.
- Good communication between all members with the exception of the SCO. The SF directed all actions until the emergency procedures were entered.

Incidents of Average Performance (Associated with Ratings of 5 or 4)

- SCO update of scale problem and approach to correct feedback from CO/ACO/STA regarding board indications during seal problem and subsequent RX trip SI/ASW pump: OK trip.
- Repeat backs not always done.
- ACO appeared to communicate well but more to errors.
- Very quick crew. They did not appear to communicate as thoroughly as they should have. SFO and SFM discussed but did not communicate with CO/ACO.
- Good discussions concerning plant anomalies throughout the scenario.
- Some communications were not acknowledged although proper actions were carried out as instructed.
- Communication very active, but some confusion.
- Some instructions had to be re-communicated due to independent conversations.
- SCO orders relay through CO, but often bypassed. CO rarely interfaced with ACO, felt SCO in command. Didn't feel SCO waited for response to actions on boards.
- RO directed AO to trip RCP after trip. SCO was in procedure, didn't acknowledge status. However, at times the AO informed the SCO as to why the SCO level was higher than the rest, and most communications were acknowledged.

- Questions sometimes had to be repeated prior to receiving a response.
- SFM informed CO of changes in plans and reasons why. STA and ACO kept up good plant status updates. STA tended to talk only to AFM. ACO tended to talk only to CO.
- SCO mode did not include a lot of feedback. The ACO and CO did not respond. Other than that, communications were OK. Good use of "tailboarding" and "big picture" communications.
- Communications of SCO were very good. They summarized the state for the crew and communicated well. Most of the crew communications, however, were not good. The responses to EO procedures steps were not clear.
- Communication during SI trip between all members was good, including the necessary repeat-back information. Communication between the SCO and CO was poor. The SCO asked the CO a question about the turbine load and did not receive an answer. The SCO was not well informed of feed reg valve failure by CO. Communication between AO and CO was constant during feed valve transition. SCO instructed CO to manually trip RX and the CO tripped the SI instead.
- Communications was quite good, but there were problems with content in that the STA comments were not always recognized. This was a question of his accuracy.

Incidents of Low Performance (Associated with Ratings of 3, 2, or 1)

- Acknowledgement between team members was weak.

RESOURCE MANAGEMENT

Team members' ability to use resources.

Incidents of High Performance (Associated with Ratings of 7 or 6)

- References/people used effectively.
- STA was pulled in to help out during critical incident. Team broke into two groups to handle LOCA and other incident.
- SFM directs STA to contact maintenance as heads-up information of RCP 1-1 seal failure and work planning mobilization. Procedures are consulted extensively during the different scenarios.
- Anticipation of going to EO during ramp prior to RX trip.
- Shift foremen used all crew effectively, or split procedure readers into two groups.
- P&IDs, OVIDS, and E-procedures were all used.
- The SCO and SFM used IIC to determine feed reg valve failure. They used P&ID drawings to determine air line break on main feed valve. They used all outside resources necessary to stabilize the reactor after a reactor/SI trip.
- Use of handwritten notes and other procedures to figure out next step.

- Utilized RCP vib monitor (Admin. Bldg.) during RCP transient.
- Looking ahead to possible ATWS, use of procedures, etc. I thought was pretty good. (6)
- Heads-up announcements to crew of impending trip. Calls to CARP and MM trip and RCP prob.
- Procedures referenced.
- Called watch stations outside control room to inform of plant status obtain information.
- All crew members appeared to support each other. Foremen stepped in to correct ACO errors in communicating values for containment pressure.
- Good - SF directed ACO/SS to activate annunciators and not SCO who should use procedures. SF directed division of labor between two ACOs.
- Didn't apply very much for this scenario. Did contact outside as necessary. Could have consulted TSC on E1.1 problems, but chances are they wouldn't be warned yet.
- Resources used well. SCO asked ACO to concentrate on RX part of board CO responded to procedure.
- SCO used outside resources (IIC) to T/S P250 computer alarm. The STA, and SCO were the three individuals who decided to increase surveillance.
- Some comments are the same as in question one (13284-A1). Plenty of requests via to IIC ready room. Utility senior used control room asst. and site PA. CHSM/RAD consulted on Degas and load changes.

Incidents of Average Performance (Associated with Ratings of 5 or 4)

- Crew used PA system and verified with crew members (outside the control room) that certain actions had been performed.
- Staff and resources were used effectively most of the time.
- Could have informed personnel outside of control room (SD, OPS manager, AUX operators, etc) prior to start of ramp, but did inform them shortly thereafter.
- Resources not directed- tended to drift to points of interest, but did affect technical performance. Later, resource management improved. STA observed problem and was then directed by SF to pursue a course of investigation.
- SFM actively participated but did not direct crew to best use them.
- Resources used well mostly- SF arena did not prepare for anticipated RX trip.
- Appeared that crew was pretty busy, but not overwhelmed. Maybe they could have resources a bit more effectively.
- Some redundancy in actions. Review of plant not corrected by SFM.

- SCO used loss of feed water procedures for guidance. SCO called AOs to out feed reg valve. ACO used P&IDs in valve failure. The IIC was never informed on the failure.
- Notified IIC and AOs when necessary to resolve plant problems.
- Within group answers were provided to questions about plant status. Not all benefitted at all times and no questions were referred outside or really needed to be (except the E1.1-E 1.0 cycling problem). Here, TSC could have been brought in.
- Crew members had more to do because they did not have the STA present.
- STA was not involved in scenario nor called upon.
- SCO was not actively involved- needed more involvement but seemed reluctant.

Incidents of Low Performance (Associated with Ratings of 3, 2, or 1)

None.

INQUIRY

The extent to which team members create an atmosphere in which all are encouraged to question one another for clarification.

Incidents of High Performance (Associated with Ratings of 7 or 6)

- Foremen indicated one diagnosis wrong while other crew members suggested another correct possibility.
- Thorough discussion of all events. All members participated.
- Continual questioning to verify procedures and actions.
- All members gave input on HSW/CCW problems and on E1.1 problems. Decisions were made as a team with the SFM taking the final role.
- An adequate amount of this occurs.
- Roundtable to discuss valve positions. Frequent discussions course of action, questions encouraged by all, e.g. diagnosis of SI reset.
- During power reduction, the SCO questioned the CO on the rod movement to boration. The entire crew questioned the available ways to verify the auto control of the fed reg bypass valves and the SI reset possibilities. The crew also questioned if feeding bypass valve could be placed in auto.
- Foreman and CO as well as others kept each other informed.
- They questioned procedures, i.e., "They want us to turn off the pump to power (referring to the procedure)? Well what they mean is..."

- This was a strong area, with the exception of the STA. No members' input suppressed or discouraged. All contributed actively.
- STA questioned shift supervisor about wrong accident classification. SCO discussed unclear instructions with others.
- No active steps taken to promote inquiry, but it appeared that the crew generally asked for information. This seems to cover inquiry and response quality - there may be a problem with compounding communication and inquiry.
- Good questions.
- Some questioning of crew members by others both for clarity and understanding.
- Good example of open discussion of whether or not to shut down equipment and how this could be accomplished.
- A large amount of discussion between crew members to question one another. Particular examples associated with ASW standby pump.
- Very good discussion of emerging and sudden trends.
- Team determined turbine load/RX power necessary for SG bypass valves control SG level in auto control.
- Inquiry was high, but at times, such as when the bypass flow valve too much pressure, the foreman should have taken charge. In this instance, too much inquiry is counterproductive.
- ACO questioned different ways that the steam dump valve could be isolated. CO questioned whether steam dumps should be placed in steam pressure mode.

Incidents of Average Performance (Associated with Ratings of 5 or 4)

- SCO-SFM conflict over stopping CCP, and some procedure confusions. SFM took control as expected.
- ACO and CO often questioned the SFM and got clarification for their questions.
- There were many good discussions: some included everyone, while others were subgroups.
- Determined exact status of plant before definitive action was taken.
- Initially, RX trip wasn't called for although they were going in that direction. No one really questioned (the action) because they all thought it was appropriate. When someone had a question it was accepted and answered without discussion.
- In the case of a 10% dump valve opening, the STA asked about a lack of SG level response and lack of alarms. Some limited questioning occurred.
- SCO attempted to get answers to feed reg valve problem. The CO commented that he "only pushes the button". The SCO frequently created an atmosphere to question actions that were

to be done by procedure. He also questioned why a step was being done on a shutdown procedure (MSR step).

- The CO questioned and offered advice. ACO asked why they could not put bypass in automatic.
- ACO asked SCO re: cutting in CCW HX 1-2 (action stopped by instructor). Questioning is generally not expected if orders are clear, direct, and concise.

Incidents of Low Performance (Associated with Ratings of 3, 2, or 1)

- Crew did not actively create an atmosphere of questioning.

ADVOCACY

Team members' ability to present and provide reasons for a particular action. (Advocacy is expected to occur most often when members identify conflicting or unclear procedures).

Incidents of High Performance (Associated with Ratings of 7 or 6)

- All members provided input with ideas about problems. Some input was better than others and the best input was used (on ASW/CCW failure).
- Sometimes this has to be quick, but it is done well.
- Roundtable to discuss valve positions. Suggestions made openly between all members.
- SF questioned an indicator reading. The ACO provided a reason for the reading. The entire crew provided ideas for actions to try to stop running equipment on A train. During the SI trip the SF suggested placing SI in test.
- Understood problems. They have been the best group in this respect so far.
- Very clear diagnosis and recommendations.
- SCO advocated the correct use of Annun. RESP. procedure even though the entry conditions were ambiguous.
- SCO did an admirable job of "clearing a path" when the annunciator response posed a normal fuel injection flow rate and high temps. The SCO stated that the present condition could be combatted correctly under this heading. He did not let one word prevent his taking the proper course of corrective procedural action.
- During transient feed reg bypass valves, the team decided that placing the valve in "auto" created an infrared situation, so they placed the valve back in manual. During the power reduction, the CO suggested doing one SG bypass valve in auto at a time. The crew argued with this action. The CO established the letdown needed due to pressurizer level increase.
- SCO suggested that the CO lower turbine power to aid in SG level recovery during the feed reg valve failure. The team decided to trip reactor due to SI trip. SCO suggested resetting phase A isolation with full agreement from the rest of the team.

- ACO suggested placing all SG on bypass control (40% power). The SCO suggested waiting until 30%, which was agreed on by the rest of the crew. The CO provided a reason for the MSR step in the procedure. During the SI actuation, the entire crew was involved in finding out why the train A SI would not reset.
- On the FE problem there was active participation by all to pose possible solution and test them. The same thing occurred for the SPSS problem.

Incidents of Average Performance (Associated with Ratings of 5 or 4)

- ACO recommended cutting in the other CCW HC when he saw ASE PP 1-1 had a low amp (not reduced pumping) and was adopted after discussions. STA recommended a manual SI after Hi Rod indicator plus CONTMT pump level up w/c was indicative of a SBLOCA (RCP #1 seal had degraded). It took awhile for the SFM to acknowledge and do it.
- Various theories were tossed into the air with quick discussions and resolutions.
- Announcements made by AFM as to why certain procedures/actions were taken.
- Overall good except on E1.1-F.1 cycling problem. The reasons for the high SG 1-1 level and other occurrences were provided by the AO. Most members were sharp and didn't need explanation.
- The SCO took the lead in the diagnosis and recommended courses of action. The ACO and CO were not strong advocates. The shift foreman was non-existent.
- Everyone became involved with the way the feed pump should be taken off line and whether the decrease should be manual or automatic. No doubt existed as to who was in charge but the CO and ACO did suggest several times different ways of doing things. This tended to be a result of the new control chain and untried and unclear procedures surrounding the new chain.
- SFM often made decisions without explaining why, but most people already knew why.
- ACO advocated a course of action following the dump valve opening. Only one case was hard to decide.

Incidents of Low Performance (Associated with Ratings of 3, 2, or 1)

- STA advocated actions which were not considered or discussed. ACO put forth ideas which were accepted.

CONFLICT RESOLUTION AND DECISION MAKING

Ability of team members to recognize and resolve differences in opinions related to actions required to sustain or stabilize plant status.

Incidents of High Performance (Associated with Ratings of 7 or 6)

- All actions were agreed upon by all members.
- Again, a lot of discussion and effective resolution.

- ACO recognized that the steam dump valve was open. The CO questioned the SCO on why it was open. The CO agreed on the reason (establishing letdown) that the valve should remain open.
- Discussion on question of PORV opening. Resolved by discussion of observation by different staff members.
- Both points apply because we had good open discussion, but after a certain point the SFM properly made and implemented a decision whether or not everybody agreed with him.
- There were many discussions with all team members involved and good sound resolutions were created and executed.
- Once again, good positive direction avoided conflicts. SFM directed SCO to implement OP AP while within EP status. The same occurred for OP E-S II.
- STA originally classified the SI trip as an alert but changed it to a usual event after talking to the simulator instructor. Regarding power reduction rate, the STA and SCO decided to reduce load decrease from 25% to 5% during the transition to bypass feed control. Regarding the steam dump valve failure, the crew was very good about getting involved in a group discussion.
- During the SI trip the CO suggested isolating the BIT. The SCO informed him that the BIT could not be isolated with an SI input.
- No conflicts due in part to effective decision making.
- No problem. There was an appropriate amount of discussion on all decisions with proper deference to SFM for final resolution.
- Open discussion was promoted, but in the end it was the shift foreman's call, as it should be.

Incidents of Average Performance (Associated with Ratings of 5 or 4)

- Decision to change from EP to refer to AP for guidance required termination of recovery action in progress and to initiate recovery to EP E-O. This created confusion.
- I felt they were OK in resolving differences, but they could have done better.
- STA got overruled at first when he recommended a manual SI because the CO felt he was controlling PR level/press well. The SFM decided to go along with the CO for awhile until CONTMT condition degraded and he asked for a manual SI.
- Toss up when SI occurred. There was dissent among instructors on how well this was handled.
- SFM was in charge. Conflict was muted due to respect for his decision. Didn't observe too much conflict except SCO-SFM on decision in procedure progression.
- Difficulty here: did not see many conflicts.

- Same discussion on points of conflict (i.e., use of Atmospheric dump). Correction of STA reading of alarm printout by CO.

Incidents of Low Performance (Associated with Ratings of 3, 2, or 1)

None.

STRESS MANAGEMENT

Team's ability to get the job done, even when confronted with unpleasant and potentially dangerous situations by reducing stress in high-stress situations or effectively handling the stress.

Incidents of High Performance (Associated with Ratings of 7 or 6)

- A very relaxed, comfortable group.
- As a team the crew knows how to proceed/control the RCP-1 seal failure problem!
- All members maintained a cool controlled condition.
- Performed properly except displayed a little lack of faith in procedures.
- Shift foreman very laid back; he let the crew members do their job.
- No evidence of emotional breakdown. Control boards were prompt, but not rushed. Communications were clear and timely, but not rushed.
- Feed reg valve failure did not affect the team's ability to deal with stress.
- Emotions in check during all transients.
- No apparent stress evident. The absence of stress may be because of high stress management. Consequently, the "7" and the "0" on the rating scale need to be rectified.
- Some stress noted on failure of feed valve. This was probably due to the unfamiliarity with the digital controller.
- Referring to the middle description of performance, this is about what I observed. They were slightly better than average.

Incidents of Low Performance (Associated with Ratings of 3, 2, or 1)

None.

TEAM SPIRIT

The degree to which members of the team support one another as they perform under routine and emergency conditions.

Incidents of High Performance (Associated with Ratings of 7 or 6)

- Spirit is good only during emergencies. Routinely there may not be very good cooperation.

- There were many cases where members thought ahead and reminded or provided input to aid others in a positive manner stimulating thought and teamwork.
- Currently all personalities are compatible.
- This was facilitated by lots of communication and a comfortable chain of command relationship. There was a high degree of professionalism which helped in this area.
- Team divided up work responsibilities well among the different members.
- Good responses and volunteering of information.
- Discussion by SCO with ACO and SF on leakage (seal) causes and effect seemed to promote a cooperative spirit. Crew tended to be quiet and undemonstrative.
- All members tended to step in and help.
- All team members stepped in to support. For example, they shared duties between ACO and CO. SCO helped support CO and ACO.
- STA provided ACO with assistance during bypass feed reg valve control from manual to auto during power reduction.
- Overall team participation was good. The CO didn't want to get involved in any decision making.
- Good, with the exception of the SCO. The SCO remained out of the picture until the emergency procedures.
- This crew has always had teamwork as a strong suit (including non-licensed operators).

Incidents of Average Performance (Associated with Ratings of 5 or 4)

- More noticeable on CO and ACO level. Supervisor and STA do not have prerogative to perform manipulation. As far as problem solving, cooperation was good.
- Crew needed to slow down- SFM needed to step back and allow SCO to go through OPs.
- SFM/CO were concerned about manual safety inspecting the plant because of piping/RX vessel stress and thought of trying to control PZR level by two CCPs. STA recommended a manual SI right away, but STA supported the SFM's decision.
- No black eyes!
- Crew friendly and supported each other but not too demonstrative.
- Foreman was pretty active on the floor.
- Quite good team spirit.
- Between average and high. They were very supportive of one another, although not as strong as others.

- Crew members more aloof than other crews.
- Tended to work together but not overly so. During quiet periods crew members did not talk to one another.
- Team spirit was mixed. The loss of a foreman (replaced by the STA) made me question the validity of the scenario. Cooperation and team spirit were good overall.

Incidents of Low Performance (Associated with Ratings of 3, 2, or 1)

- Team spirit was not too noticeable. The CO acts as a damper. There is a limited view of his responsibilities.

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