

# NERC

NORTH AMERICAN ELECTRIC  
RELIABILITY CORPORATION

## Reliability Readiness Evaluation Report Reliability Coordinator

California—Mexico Reliability Coordinator  
Folsom, California

to ensure  
the reliability of the  
bulk power system

**October 8–11, 2007**

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## Introduction and Evaluation Process

The North American Electric Reliability Corporation (NERC) Reliability Readiness Evaluation and Improvement Program is one of the commitments of NERC and the industry to strengthen the reliability of the North American bulk power system. The program conducts independent evaluations of balancing authorities, transmission operators, reliability coordinators, and other key entities that support the reliable operation of the bulk power system to assess their preparedness to meet their assigned reliability responsibilities. The evaluations identify strengths and areas for improvement in an effort to promote excellence in operations among these organizations.

Since its inception in 2004, NERC and the industry have been working collaboratively to enhance the program. The evaluation process is based on fundamental aspects of reliability: culture, operations, maintenance, planning, and training. The document [NERC Readiness Evaluation Procedure](#) describes and defines the process used for reliability readiness evaluations. This document and other documents related to the program are available at <http://www.nerc.com/~rap/>.

The reliability readiness evaluation teams, each led by a NERC staff member and a regional co-leader, include industry volunteers with considerable expertise selected to provide representation from other interconnections, other regions, and neighboring operating entities. The teams also typically include representatives from the Federal Energy Regulatory Commission (FERC) staff.

The public version of the reliability readiness evaluation report contains the majority of the evaluation team's findings. Any discussion of findings pertaining to critical infrastructure will be contained in Appendix 1, a confidential appendix to the report that is sent privately to the evaluated entity and is not included in the public version of the report.

An evaluation team met on-site with California-Mexico Reliability Coordinator (CMRC) representatives on October 8–11, 2007. This report reflects the views and recommendations of the evaluation team regarding the readiness of CMRC to meet its responsibilities as a reliability coordinator.

## Evaluation Team

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## Organization Profile

The California-Mexico Reliability Coordinator (CMRC) performs the reliability coordinator function for California and a limited area in Mexico. The CMRC staff members are employees of the California Independent System Operator (CAISO) but perform their duties on an independent basis via a contractual agreement with WECC. The CMRC is designated and empowered by WECC to be the WECC reliability coordinator for the CMRC footprint. WECC has contracted with CAISO to host the CMRC organization within its facility. Essentially, funding for the CMRC is provided by WECC as part of an interconnection-wide reliability coordinator initiative.

The CMRC region encompasses the majority of the state of California and the northern portion of Baja California Norte, Mexico. Within this region are five associated balancing areas: CAISO, the Los Angeles Department of Water and Power, Sacramento Municipal Utility District, Turlock Irrigation District, and Comision Federal de Electricidad of Mexico.

The total, non-coincident peak for the CMRC region occurred in July of 2006, totaling 64,331 MW, roughly 40 percent of the total load in WECC. The CMRC area's total installed capacity of approximately 62,000 MW includes a mix of nuclear, fossil-fuel, hydroelectric, and wind-powered energy sources. Over 27,900 miles of transmission lines span the area.

Because of the infrastructure relationship with CAISO, the CMRC has two available backup control centers. One is a local, or interim, backup facility located near the primary control center, and the other is remotely located in a different California city.

## Executive Summary

The evaluation team found no significant operational problems and concluded that CMRC has adequate facilities, processes, plans, procedures, tools, and trained personnel to perform the reliability coordinator functions necessary to maintain the reliable operation of the bulk power system.

The team identified a number of positive observations for CMRC and noted a wide-area display covering the Western Interconnection as a potential example of excellence. CMRC reliability coordinator operators have access to a range of user-friendly and informative displays. Regarding infrastructure, CMRC has many frequency sources independent of the energy management system (EMS) at the primary and long-term backup control facilities, EMS and communications availability that exceeds expectations, and state estimation observability of over 90 percent. To decrease burden on the reliability coordinator operators, an IT support group receives alarms for critical facilities and applications.

The team offers recommendations in the areas of documentation, resources, and outage reporting. Though CMRC has support staff that handles some duties for operators, training and day-ahead studies are other opportunities to reduce burden. In cooperation with CMRC, the team identifies the need for a common outage reporting tool for balancing authorities in the footprint as a key recommendation.

Overall, the evaluation team identified 11 positive observations and one potential example of excellence. In addition, the team offers six recommendations that, if implemented, will enhance CMRC's readiness to operate reliably and maintain the reliability of the bulk power system. The findings are listed in order of importance.

## Potential Examples of Excellence

The evaluation team identified the following potential example of excellence in its reliability readiness evaluation:

1. CMRC has developed interconnection-wide displays using the PI Historian tool, providing operators a detailed wide-area view of the system using data available to the reliability coordinators in the Western Interconnection (Section 2.1).

## Positive Observations

The evaluation team noted the following positive observations during the reliability readiness evaluation process:

1. CMRC monitors additional frequency sources outside the reliability coordinator footprint (Section 2.3).
2. Many frequency sources are independent of the EMS at the primary control facility (Section 2.3).
3. An IT support group receives alarms for critical facilities and applications, relieving the reliability coordinator operators of this responsibility (Section 3.1).
4. CMRC has developed user-friendly data displays, and reliability coordinator operators can construct new displays as needed (Section 2.2.2).
5. The shift reliability coordinator who has been designated as the interim trainer is dedicated and enthusiastic (Section 5.1).
6. The EMS and communications infrastructure redundancy enables the systems to exceed availability expectations (Section 3.2.1).
7. The comprehensive reactive reserve monitoring displays contain geographically identifiable information which is layered to allow the system operator several levels of review (Section 2.3).
8. State estimation observability is over 90 percent (Section 2.2.2).
9. Access time to the interim backup facility is under 10 minutes (Section 2.4).
10. The interim backup facility is tested quarterly, and test results are documented (Section 2.4).
11. Reliability coordinator operators are eligible for spot compensation for exceptional performance (Section 1.2.2).

## Recommendations

The evaluation team offers the following recommendations:

1. Confidential information on the interim backup control facility redacted from public report. See discussion in Appendix 1.
2. Increase staffing to relieve on shift operators of additional duties not related to real-time monitoring, such as training and day-ahead studies (Section 2.3).
3. Develop or adopt a common outage reporting/processing tool, such as the Coordinated Outage System, for all entities in the reliability coordinator footprint (Section 2.3).\*

4. Confidential information on the interim backup control facility redacted from public report. See discussion in Appendix 1.
5. Expedite the development and implementation of quizzes or other acknowledgement mechanism in the document control application to verify operators understand new and revised policies and procedures (Section 5.1).
6. Update the manager's job description to reflect the current organizational structure, organization names, and job requirements (Section 1.2.4).

\*Jointly identified by the company and lead evaluator as a key recommendation

## Discussion

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The reliability readiness evaluation team examined the following key areas during the evaluation. The detailed discussion that follows provides the foundation for the recommendations, positive observations, and the potential example of excellence the team identified. The report uses the generic term “system operator” to refer to all on-shift operating personnel responsible for executing the functions necessary to operate reliably and maintain the reliable operation of the bulk power system. This term will be used for the discussions unless additional specificity is required, such as the *balancing* system operator or *transmission* system operator.

### 1. Culture

#### 1.1 General

*The corporate organization provides the necessary leadership and management for system operations to sustain high levels of safe, reliable operation.*

The CMRC management model is under development by WECC. Generally speaking, CAISO is contracted by WECC to provide reliability coordination functions to the CMRC footprint. The CMRC facilities are collocated within the California ISO (CAISO) operations center.

CMRC system operators and management staff indicated they feel supported by the WECC staff and that a number of ongoing improvements are being made to the reliability coordinator function throughout the WECC region.

Due to the potential for changes in the organizational structure as part of the WECC reliability coordinator strategic initiative, CMRC is in a state of flux with regard to its continued status as reliability coordinator. The WECC director in charge of the reliability coordinator functions indicated that new goals and objectives would be determined pending the outcome of upcoming WECC board decisions.

#### 1.2 Organizational Effectiveness

##### 1.2.1 Foundation for System Reliability

*The organization’s values and behaviors—modeled by its leaders and practiced by its members—serve to make system reliability a top priority.*

The CMRC employees, having close proximity to the CAISO system operators, have access to information related to the CAISO system through interaction with the CAISO employees. By providing reliability coordinator functions for CAISO and four other balancing authorities closely interconnected to the CAISO system, CMRC is in an excellent position to understand events that occur on any of the balancing authority systems.

CMRC focuses solely on the reliability coordinator function for its balancing authority areas and does not perform any marketing activities. CMRC management and employees are highly experienced and have detailed knowledge of the systems monitored by the company.

Interactions between the team and CAISO employees and management indicated a high level of support from that group for the reliability coordinators. CAISO representatives acknowledged that the reliability coordinators work independent of CAISO in many respects while still sharing a great deal of the needed infrastructure.

The team observed a high degree of professionalism and collaboration within the control facility itself, whether or not management personnel were present. The system operators in the facility understand their roles and were open to discuss those if needed.

### **1.2.2 Leadership and Management**

*Managers, by leadership, commitment, and example, establish and reinforce high standards of performance and align the organization to achieve safe, reliable system operation.*

The evaluation team examined a number of documents provided by CMRC and found them all to reflect a good overall focus on the job of the reliability coordinator. As will be discussed later in this report, the system operators for CMRC are well aware of the corporate expectations and expressed satisfaction with the support and communications provided to them.

CMRC management indicated that CMRC reliability coordinator system operators are eligible for spot bonus compensation for exceptional performance. The evaluation team notes this as a positive observation since it provides an incentive to continually pursue excellence in the system control center.

### **1.2.3 Corporate Oversight and Monitoring**

*Line management is used to strengthen reliability and improve performance. System reliability is kept under constant scrutiny through techniques such as self-assessments, performance indicators, and periodic management meetings.*

CMRC system operators are highly skilled and have reliability coordinator experience. Discussions with employees indicated a high degree of understanding regarding their expectations and priorities. CMRC system operators work in a collaborative atmosphere, and any performance issues can be determined and improved quickly.

### **1.2.4 Human Resources**

*Personnel resource needs are anticipated and individuals are systematically recruited, developed, and assigned positions in the system operations organization.*

CMRC does not have a traditional human resources department due to its small size. Decisions regarding hiring of new employees are made by the CMRC manager and supported by the senior system operator and the designated WECC manager. Due to the proximity of other electric utility operations in the nearby areas, finding qualified candidates for any openings is not difficult and does not pose a problem for the foreseeable future.

The evaluation team examined several job descriptions and noted that the manager's job description was not up-to-date in several aspects. The team recommends that CMRC update the manager's job description to reflect the current organizational structure, organization names, and job requirements. The team believes this is needed to properly document the operational alignment of the reliability coordinator organization within WECC.

### **1.2.5 Corporate Communications**

*System operations communications inform and engage both corporate and system operations employees so they can contribute to the strategic priorities of the organization.*

Since CMRC is small, corporate communications within the company are easily accomplished. The CMRC manager indicated that he is available continuously if there are any issues that require his attention, and discussions with the system operators indicated that there are no identified communications problems within the company. Because of the coordinated relationship, CMRC routinely communicates with both WECC (the contracting agency) and CAISO (provider of the majority of infrastructure). The CMRC staff receives appropriate e-mail correspondence as well as other mailings from both entities.

The CMRC manager indicated that he is in frequent contact with the designated WECC manager and that any new or changing initiatives are quickly communicated and understood. The evaluation team noted a spirit of openness within CMRC regarding the relationship with WECC.

At present, there is no formal feedback mechanism for receiving and acting on employee suggestions. However, there is an acknowledged open-door policy, and all employees agreed that any suggestions for improvements are taken seriously and acted upon quickly if appropriate.

## **2. Fundamentals of Operations**

### **2.1 General**

*Operations personnel monitor and control the system in a manner that ensures safe, reliable operation.*

The evaluation team observed a thorough demonstration of the monitoring capabilities of the CMRC reliability coordinator system operators. The system operators are knowledgeable about the capabilities of the monitoring system and associated displays and have been involved in the development of new displays when needed.

CMRC has an excellent wide-area view that includes the entire Western Interconnection. The reliability coordinators in the WECC organization have access to extensive operational data through a shared database. CMRC has developed interconnection-wide displays using the plant information (PI) historian tool, giving them a detailed wide-area view of the system using data available to the Western Interconnection reliability coordinators. The evaluation team notes this capability as a potential example of excellence in that it positions the system operator to not only analyze developing situations inside the CMRC footprint, but interconnection wide.

Because of the contractual relationship that exists between CMRC, WECC, and CAISO, the facilities used by the CMRC system operators are provided within the CAISO facility. All support services are provided by personnel employed by CAISO. CMRC system operators indicated that this arrangement works well and that the support activities take into account the criticality of the reliability coordinator function in determining work priorities.

The CMRC system operators have developed extensive alarm processing that is identifiable within the CAISO operations center. The team discussed whether there should be any physical and aural barrier in place and believes the existing physical arrangements allow for proper attention by the CMRC employees because of the relatively quiet atmosphere.

Operating procedures and other documents are available through an online system provided by WECC. The CMRC management personnel indicated that the necessary documents are available throughout WECC on an as-needed basis. The process includes the ability to control distribution, enforce review requirements, and document the understanding of system operators for new or revised procedures. The team observed the online access method and found it to be straightforward and intuitive.

The CMRC system operators use displays depicting voltages throughout the footprint in a bar chart format shown on a geographic map. The operators indicated this gives them a good perspective of any developing trends and whether the problem identified might be local in nature or something that could impact other entities.

Reactive reserves throughout the footprint are monitored by the CMRC system operators. The operators demonstrated the display used for this function, which geographically separates the footprint into three areas and provides for annunciation should any of the required reserve margins be lower than anticipated.

## 2.2 Operational Focus

### 2.2.1 Operational Safety

*System operation activities are conducted in a manner that maintains high levels of safety and reliability for all system conditions.*

CMRC system operators indicated that a number of remedial action schemes (special protection systems) are located in balancing authority areas within the footprint. Details as to the operational status of most schemes are automatically updated on displays used by the reliability coordinator. Details of the operation of each remedial action scheme are available to the system operator through the online documentation system. For locations where status information is not telemetered, the local balancing authority and/or transmission operator notify the reliability coordinator. Procedures are in place to ensure status information is interpreted and conveyed as required. CMRC indicated that information is also available and updated for power system stabilizers installed throughout the footprint.

CMRC uses e-mail as well as a WECC document management system for sharing new or revised operating procedures with its reliability coordinator system operators including the other

reliability coordinators in the Western Interconnection. The WECC document system, as well as the e-mail system, can track whether a document has been accessed by any particular individual.

### **2.2.2 Operational Decision-Making**

*Operational decisions are reached using a systematic and thorough approach that supports safe, reliable, and efficient system operations.*

CMRC uses a collaborative approach for operational decision-making. Discussions with the system operators indicated a willingness to seek assistance or input from any available personnel, particularly the EMS support personnel and other CMRC operators. The operators indicated that they understand their authority to completely operate the power system without input from others, but noted that collaboration with others is acceptable.

The evaluation team noted that CMRC's state estimation observability is over 90 percent. The team determined that this is a positive observation because of the area covered by the reliability coordinator footprint. CMRC system operators indicated that this level of observability gives them a good view of any developments in their area and allows for early detection of negative trends.

In conjunction with the overall observability of the system, the CMRC system operators have developed user-friendly data displays that are easy to interpret. The reliability coordinator operators can construct new displays as needed, making this functionality scalable as new needs are identified. The evaluation team identified this capability as a positive observation, improving the overall flexibility of the system used by the CMRC system operators.

### **2.2.3 Operational Alignment**

*Organizational structure supports safe and reliable system operation.*

CMRC management indicated company policies and procedures are kept in two distinct mechanisms, one owned by the CAISO and one owned by WECC. The CAISO system is used for the maintenance of CMRC operating procedures as well as other industry-related documents, such as NERC reliability standards and WECC requirements. The WECC system makes operating policies and procedures available to other appropriate WECC entities, including the other reliability coordinators in the western Interconnection.

The WECC document system allows for acknowledgement of receipt and understanding of any new or revised documents issued through the system. CMRC operators indicated a familiarity with the process used to access these documents.

The evaluation team noted that some aspects of the emergency response process are either incomplete or need improvement. Review of the appropriate documents indicated the following: the WECC operating agreement does not specifically state that another reliability coordinator would assume certain roles during emergency evacuation, no specific script is used for issuing directives under similar circumstances, and balancing authorities might not be fully aware of this possibility.

Since the bulk of this coordination responsibility belongs to the Regional Entity – WECC – the evaluation team suggests that CMRC encourage WECC to improve entity response in the interconnection under emergency conditions as follows:

- Improve the wording in the *WECC Reliability Coordination Operating Agreement* to reflect that a neighboring reliability coordinator would take over and coordinate SOL and IROL mitigation actions when necessary.
- Develop an appropriate script for the reliability coordinators in the interconnection related to the issuance of directives to balancing authorities not in their footprint.
- Instruct balancing authorities in the interconnection about receiving a directive from a neighboring reliability coordinator.

### **2.3 Managing System Configuration**

*Power system configuration is carefully designed, analyzed, maintained, and controlled throughout the life of the infrastructure, ensuring that system and equipment margins are understood, considered in decision-making, and managed consistent with design and system requirements.*

The team observed several system operator tools used by the CMRC, including displays for the monitoring of real and reactive reserves, system voltage levels, and line and path loading. Based on a discussion with system operators, the team believes there is a need for improved voltage monitoring at nuclear facilities and/or the provision of additional alarms for system operators. The team opted to not record this as a recommendation due to the broad scope but believes CRMC is aware of the need and that it will be addressed.

As required, the status of remedial action schemes on the transmission operator systems is reported to and recorded by the reliability coordinator system operators. CMRC operations planning personnel indicated that status and actions of the simple remedial action schemes are modeled for simulation purposes. For the more complex schemes, studies must be run with specific input by the study engineer.

The evaluation team observed the CMRC supervisory control and data acquisition displays and found them to be easy to understand and intuitive. CMRC receives a great deal of support from CAISO in the development of displays for its system operators. The system operators stated they have a good relationship with and derive a large amount of system information from the CAISO operations staff due to their close proximity.

For potential islanding situations, the CMRC system operators have available several frequency sources, many of which are outside the reliability coordination footprint. The evaluation team notes this external visibility as a positive observation, giving CMRC a good indication of potential islanding situations with respect to other reliability coordination areas.

While several frequency sources are available via telemetry through the EMS at the primary control facility, CMRC indicated that many frequency sources are independent of the EMS, a situation that the evaluation team noted as another positive observation. The team believes that this would allow the CMRC system operators to understand any potential islanding situation even if the EMS is unavailable.

The evaluation team noted that CMRC has comprehensive reactive reserve monitoring displays with geographically identifiable, layered information. The displays appear to be easily interpreted, and the evaluation team identified this robust, layered approach as a positive observation.

Discussions with the CMRC system operators, training coordinator, and operational planning personnel indicated that the system operators perform several duties in addition to their real-time monitoring duties. The evaluation team discussed this workload and believes that CMRC, due to its gradual changes through the years, may find itself in the undesirable situation of having too many collateral duties fall to the responsibility of the system operators. The evaluation team recommends that CMRC increase its staffing level to relieve the on shift operators of additional duties not related to their real-time monitoring requirements. These duties include, but may not be limited to, the provision of training and training coordination services as well as the completion of day-ahead planning studies.

CMRC participates in routine daily calls with the neighboring reliability coordinators in the WECC region. The outage coordination process is thorough and is used by other WECC reliability coordinators and many of the associated balancing authority areas. With regard to outage coordination activities with its balancing authorities, the evaluation team noted that the CMRC system operators rely on a system or process that is somewhat different from other entities within the WECC region. While the system is working as needed, the team is concerned that the inconsistency with the balancing authorities in the footprint could lead to opportunities for errors in the future. The evaluation team recommends that the CMRC adopt or develop a common outage reporting/processing tool, such as the Coordinated Outage System (in use at some WECC locations), for all entities in the reliability coordination footprint.

### **2.4 Emergency Preparedness**

*The organization is prepared to manage and mitigate the impact of system emergencies in order to preserve the reliability of the system and to protect the interests of the public.*

The evaluation team examined several CMRC procedures related to emergency preparedness and found them to be complete and concise, although some updates are on the horizon. Plans examined included those related to capacity issues, line overloads, emergency coordination activities, and blackstart and restoration training. The training coordinator indicated that blackstart and restoration simulator training activities are normally conducted at the training facilities of a neighboring WECC reliability coordinator.

The team examined the procedure relating to any needed movement of the CMRC system operators to the backup control facility and found it to be easily understood and accomplished. A subset of the evaluation team visited the interim backup facility and noted as a positive observation that the facility can be accessed in less than 10 minutes, making such a move less risky since the monitoring duties undertaken by a neighboring reliability coordinator would be of a relatively short duration.

CMRC would rely heavily on the CAISO communications infrastructure in any emergency situation. Since CAISO performs the balancing authority and transmission operator functions

and would respond to any directives issued by CMRC, however, the evaluation team was comfortable with this arrangement.

Discussions with the system operators indicated that the interim backup facility is tested quarterly and test results are documented as required by company protocols. The evaluation team noted this as a positive observation, as it provides a routine assessment of the readiness of the interim backup facility.

CMRC's emergency plans have been shared with neighboring reliability coordinators as well as all entities within the reliability coordinator footprint as appropriate. The system operators indicated that they are confident of the ability of other system operators to respond to system requirements in a timely and accurate fashion.

### 3. Fundamentals of Maintenance

#### 3.1 General

*Maintenance is conducted by skilled personnel to achieve safe, reliable control center equipment and system performance.*

CMRC management and CAISO support personnel indicated that many CMRC reliability coordination applications run on server systems with a high level of redundancy. System operators stated that down time is minimal and not significant from their viewpoint. CAISO employs extensive alarm processing for the applications and server systems and made particular note of the overall monitoring of the system for its general health. CAISO uses what is known as a "heartbeat" alarm to monitor the health of each system, primary and backup, including the applications and its redundant mirror.

As mentioned previously, CMRC makes use of the CAISO support personnel. Within the CAISO organization, an IT support group receives alarms for critical facilities and applications, both for CAISO and CMRC needs, relieving the reliability coordinator system operators of this responsibility. The evaluation team noted this as a positive observation in that it keeps the reliability coordinator system operators focused on the monitoring job at hand rather than having to deal with a myriad of alarms related to the IT infrastructure or applications.

Should the need arise to monitor the reliability coordinator footprint from the alternate control facility, CMRC estimated that it takes approximately 10 minutes to make the orderly transfer to or failover from the primary servers to the servers at the alternate facility.

#### 3.2 Equipment Reliability

##### 3.2.1 Equipment Performance

*The organization achieves high levels of equipment reliability. Equipment problems that impact reliability are resolved in a thorough and timely manner.*

CMRC system operators expressed no dissatisfaction with their monitoring systems and mentioned that the reliability of operators' platforms is excellent. Overall, the infrastructure

redundancy of the EMS and communications systems is comprehensive and exceeds availability expectations. The evaluation team noted this high level of availability as a positive observation.

### 3.2.2 Work Management

*Work activities, including corrective, elective, and preventive maintenance, surveillance testing, and modifications, are managed effectively to support safe, reliable operation during both outage and routine periods.*

CMRC management indicated that work to be performed within the control room is always carefully coordinated. CMRC management mentioned an agreement with CAISO allowing CMRC to have any planned activities stopped if necessary due to system conditions or work load.

For necessary software updates or equipment maintenance on systems used by the reliability coordinator system operators, work plans are approved by system operations prior to implementation. Such activities are essentially planned according to CMRC system operations needs with an aim for transparent updates and activities. CMRC and CAISO indicated that there is extensive software acceptance testing prior to reliability coordinator operator rollout activities.

## 4. Fundamentals of Operational Planning

*Operational planning provides the technical information and support necessary for safe, reliable system operation.*

CMRC system operators use an industry-standard platform for real-time monitoring activities. The hardware and software are supported by CAISO without regard to line of demarcation between reliability coordinator and balancing authority function. Discussions with CMRC system operators and management indicated that this method is working well, and that they believe the CAISO personnel understand the critical nature of the CMRC monitoring, giving them preference any time CMRC indicates it is needed.

In the operational planning time frame, CMRC uses a standard industry load-flow package to study outages and contingencies. For the day-ahead study process, the CMRC system operators perform the studies on a timetable needed to meet NERC and WECC requirements. The CMRC model database is updated routinely as part of the work done by several regional and interconnection study groups, and CMRC helps determine the adequacy of study information.

For the various study timeframes, load forecasts are obtained from the balancing authorities in the reliability coordination area as part of the regional study exercises. These data are updated continuously for regional studies and reposted on a daily basis for use in next-day studies. CAISO has developed a process for cataloging outage information to ensure the outage information used in the operational studies is kept viable and up-to-date. CMRC reports that many of the balancing areas use the same mechanism for submitting outage requests to the reliability coordinator.

At present, the CMRC operator uses a manual process to consolidate the outage information and must manually open the breakers in the study model in order to generate the base-case model for

the next-day studies. Once this has been completed, the model is run for a predefined set of contingencies. Given the size of the system being studied, this process seems cumbersome and could consume a large percentage of the operator's time in the midday period. The evaluation team believed the on-shift operator would need help to complete the next-day studies on days when the system also requires significant real-time work from the operator; this was confirmed by the CMRC staff.

The critical facilities list for the CMRC footprint is fixed, and specific studies must be run for any changes. CMRC indicated that its system operators run appropriate studies for several operational timeframes; however, depending on the workload and system conditions, meeting the required posting time is sometimes difficult. As noted earlier, the evaluation team is not comfortable with this studies workload for the system operator and has made a recommendation to change staffing levels to alleviate this burden.

## 5. Fundamentals of Training

### 5.1 General

*Training in both specific job-related skills and broader technical fundamentals is used to provide highly skilled, knowledgeable personnel for safe, reliable operations, and to achieve performance improvement.*

CMRC has placed a training coordinator position, but at present it is essentially collateral duty for a reliability coordinator system operator. As discussed earlier, the evaluation team is recommending a change in staffing levels to decrease the extra functions per position. It should be noted that the interim trainer, as he is referred to by CMRC management, is dedicated and enthusiastic, and the evaluation team notes this engagement level as a positive observation.

Discussions with the interim trainer indicated that at present CMRC has not decided to become a NERC continuing education hour's provider but that the CAISO training organization is. The evaluation team discussed possible ways of leveraging this relationship to take full advantage of any training that would be appropriate for the CMRC system operators. The interim trainer told the evaluation team that CMRC uses a dispatcher training simulator located at an adjacent reliability coordinator, even though there is a local simulator. The trainer and IT support personnel for CAISO indicated that the local simulator is not supported or used by CAISO.

The interim trainer reported to the team that a great deal of emphasis has been placed on developing and implementing evacuation and backup center activation drills. These activities are coordinated throughout the region, with many reliability coordinators, transmission operators, and balancing authorities involved.

The evaluation team noted adequate documentation for the status of the training activities within CMRC. For items that are rolled out to the system operators on a "read and understand" basis (typically via e-mail), the company is in the process of developing quizzes to verify that each individual system operator understands the material. The evaluation team recommends that CMRC expedite the development and implementation of these quizzes in the document control application. The team believes this will provide a valid basis for the expectation that all system

operators are knowledgeable regarding company and regional policies as well as NERC reliability standards.

### 5.2 Organizational Effectiveness

#### 5.2.1 Human Performance

*Personnel select and apply appropriate human error prevention techniques commensurate with the importance of assigned tasks to minimize the frequency and consequences of events.*

CMRC system operators indicated there is a general expectation of the balancing authorities within the footprint to report any and all abnormal results for activities on those systems. The operators indicated that this is the normal course of business and no changes to the reporting process are needed.

For switching orders developed by the transmission operators, CMRC operators are informed of any errors or last-minute changes due to technical problems. They reported that the transmission operators typically use second-party verification, but CMRC is not routinely involved with such switching-order development.

CMRC management and system operators acknowledged a general approach to human performance improvement and the reduction of errors through a system of collaboration both within the CMRC organization as well as with other control room operators. For events on the system that are unusual in nature, CMRC may initiate an investigation that would result in “lessons learned” activities and training, both for CMRC employees and others in the WECC regions as desired.

## APPENDIX 1: Critical Infrastructure

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*The following discussion will be presented under private letter to the evaluated entity only and will not be included within the public version of the report.*

## APPENDIX 2: Entity Participants

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*The following discussion will be presented under private letter to the evaluated entity only and will not be included within the public version of the report.*

## APPENDIX 3: Documents Reviewed

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*The following discussion will be presented under private letter to the evaluated entity only and will not be included within the public version of the report.*