



# **Balancing Authority/Transmission Operator Reliability Readiness Evaluation Report**

**Indianapolis Power and Light  
Indianapolis, Indiana**

**February 12–15, 2007**

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## **Introduction and Readiness Evaluation Process**

The North American Electric Reliability Council (NERC) Reliability Readiness Evaluation and Improvement Program is one of the commitments of NERC and the industry following the blackout of August 14, 2003, 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. 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 energy infrastructure will be contained in Appendix 1, a confidential appendix to the report that is sent privately to the organization evaluated and is not included in the public version of the report.

The evaluation team for Indianapolis Power & Light (IPL) met on-site with IPL representatives on February 12–15, 2007. This report reflects the views and recommendations of the evaluation team regarding the readiness of IPL to meet its responsibilities as a balancing authority/transmission operator.

## **Evaluation Team**

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## **Organization Profile**

Indianapolis Power and Light (IPL) has been providing service to the City of Indianapolis since October of 1926. Originally formed through a merger of Indianapolis Light and Heat Company and Merchant's Heat and Light Company, IPL was acquired in 2001 by the AES Corporation.

IPL's mission is to serve customer's needs for electric power in ways that provide exceptional value to its customers, shareholders, and communities. IPL's vision is to be the best electric utility in the world by balancing excellence in customer service, reliability, rates, shareholder value, environmental performance, safety, employee commitment, and community. IPL's values include putting safety first, acting with integrity and honoring commitments. The company and its people continue the tradition of supporting not-for-profits, community organizations, and civic initiatives. As one of the area's leading employers, IPL has sponsored major local events, led the way on economic development initiatives and supported city beautification and environmental efforts.

IPL employs over 1,400 people and is responsible for a service territory covering 526 square miles in central Indiana.

As a transmission owner, IPL operates transmission and distribution facilities serving 465,000 customers in and around Indianapolis. IPL manages 457 miles of 345 kV lines, 359 miles of 138 kV lines, 75 transmission substations and 69 distribution substations.

IPL is a member of Reliability *First* Corporation, Midwest ISO (MISO), the Midwest Contingency Reserve Sharing Group, and the EEI Equipment Sharing Group.

## **Executive Summary**

The readiness evaluation team found IPL to have a competent and experienced real-time operations and support staff, with a strong operational focus. Neighboring companies supported that finding by expressing a high degree of confidence in the IPL real-time operations staff's ability to operate in a safe, reliable manner. Overall, the IPL balancing authority/transmission operator has adequate facilities, processes, plans, procedures, tools, and trained personnel to perform the balancing authority/transmission operator functions necessary to maintain the reliable operation of the bulk power system.

The evaluation team identified one potential example of excellence and seven positive observations. The team also offers 17 recommendations that, if implemented, will enhance IPL's reliability readiness.

## **Potential Example of Excellence**

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

1. IPL purchased an EMS/SCADA quality assurance system that allows support functions to be performed from vendor facilities (Section 10).

## **Positive Observations**

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

1. IPL continually plans an n-2 level (Section 7).
2. IPL has taken a proactive approach in transmission line maintenance activities including the purchase of the transmission asset management information system (Section 15).
3. The IPL planning group supports operations by performing load flow studies on short notice (Section 7).
4. *See discussion in Appendix 1.*
5. IPL has begun to resolve its training tracking issues by purchasing the Learning Management System (LMS) (Section 5).
6. *See discussion in Appendix 1.*
7. IPL participates in joint training activities with neighboring utilities (Section 5).

## **Recommendations**

The evaluation team recommends that IPL take the following actions to address issues discovered during the evaluation process. The three key recommendations were selected by the company while the evaluation co-leads were on—site.

1. Hire a support engineer/trainer as planned in 2007 (Section 5)\*.
2. Revise the automatic voltage regulator (AVR) procedure to include transmission operations tracking of status and notification to the reliability coordinator (Section 12)\*.

3. Build in refresher training on importance of AVR, and notification procedures for plant operators, system energy coordinators, and transmission operators (Section 12)\*.
4. Implement a formal document control and management system for transmission operations and balancing authority operations policies and procedures (Section 6).
5. Review the IPL emergency supply plan for completeness, especially regarding roles and responsibilities (Section 14).
6. Continue current effort to implement the five-year transmission maintenance plan (Section 15).
7. Document the specific roles, responsibilities, and communication paths between the system operators/coordinators and the system energy coordinators (Section 3).
8. Evaluate the backup control center security procedures and the availability of operating procedures at the backup site for operators use during an emergency (Section 9).
9. Add implementation times to the demand—side management (DSM) reference chart in the IPL emergency supply plan (Section 14).
10. Train operators in contingency analysis and dispatcher load flow (Section 5).
11. Incorporate the IPL emergency supply plan into the system operators/coordinators and system energy coordinators annual training program (Section 5).
12. Develop training programs utilizing the components of a systematic approach to training (Section 5).
13. Continue current plan to implement and utilize the LMS in the training program (Section 5).
14. *See discussion in Appendix 1.*
15. *See discussion in Appendix 1.*
16. Develop a plan to staff the backup center without the assistance of on-shift personnel or supervision (Section 9).
17. Install a tool into the energy control system (ECS) that will monitor the health of the alarm system (Section 12b).

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

## **Discussion**

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 potential example of excellence that the team identified. The report uses the terms system operator, system coordinator and system energy coordinator to refer to the different on-shift operating personnel responsible for executing the functions necessary to operate reliably and maintain the reliable operation of the bulk power system.

### **1. Agreements**

*The balancing authority must have agreements that establish its authority as a balancing authority. The balancing authority/transmission operator must have agreements that establish the reliability coordinator for its footprint.*

MISO performs the reliability coordinator function for IPL. The evaluation team reviewed the MISO/IPL transmission energy market tariff and interconnection agreements dated March 31, 2000.

IPL has operating and maintenance agreements to operate the gas turbines at the Georgetown generating station for Indiana Municipal Power Agency and DTE Energy Services/DTE Georgetown LLC.

Reliability *First* Corporation (RFC) is IPL's reliability region.

## **2. Operator Authority**

*The balancing authority/transmission operator is responsible for establishing and authorizing the system operator position that will have the on-shift responsibility for the safe and reliable operation of its portion of the bulk power system in cooperation with neighboring operating entities and the reliability coordinator.*

The IPL *Statement Of Operating Authority* dated August 16, 2004 and the load shed directive dated August 20, 2004 are mounted in the control room. These statements provide the system operator and system coordinator the necessary authority to take actions as required to manage the reliability of the system. This authority includes any actions up to and including load shed without prior approval of management.

## **3. Delegation of Authority**

*Any functions that have been delegated must be clearly documented. The documentation must recognize that the balancing authority/transmission operator that is delegating the function continues to be responsible for that function.*

IPL has not delegated any balancing area functions to any other company or corporation. IPL has delegated certain balancing authority functions such as load and generation balance to the marketing group. The evaluation team did not find any documents that clearly define the delegation of balancing authority functions to the marketing group. Therefore, the team recommends that IPL document the specific roles, responsibilities, and communication paths between the system operators/coordinators and system energy coordinators.

MISO handles several transmission operator reliability-related functions for IPL, including reliability coordination, open access transmission tariff administration, open access same-time information system, energy scheduling, tagging service, facility outage scheduling, total reserve margin calculation, available transfer capacity calculation, system operating limit and interconnection reliability operating limits, transfer limit reduction, and initial load shed for controlled situations.

## **4. Staff Certification**

*Balancing system operators and transmission system operators must be NERC-certified operators. The balancing authority/transmission operator must have sufficient NERC-certified operator staff for continuous coverage of the system operator positions.*

The IPL system operator and system coordinators work a six-week rotating schedule. Two certified operators are on-shift at all times.

All IPL system operators and system coordinators, including the lead coordinator, are currently certified with the Reliability Operator credential, with the exception of one operator certified with the Balancing, Interchange, and Transmission Operator credential and one trainee who is not certified. All system operators and system coordinators completed the required 32 hours of emergency training for 2006.

Five system energy coordinators are certified with the Balancing and Interchange Operator credential, while the remaining three are certified with the Reliability Operator credential. None of the system energy coordinators completed 32 hours of emergency training in 2006.

## **5. Training**

*The system operators must be adequately and effectively trained to perform their roles and responsibilities. The balancing authority/transmission operator must have documents that outline the training plans for the system operators. The balancing authority/transmission operator must have training records and individual staff training records available for review.*

Applicants that wish to be hired into the IPL system operating group undergo a knowledge test and a stress test administered by human resources designed to help ensure the individual can handle the tasks and decision making required of a system operator. The applicant must also pass an Edison Electric Institute (EEI) basic test. A new hire is expected to focus on studying for and passing the NERC-certified operator's exam prior to concentrating on the operator desk duties.

The lead coordinator determines the roadmap for training new hires joining system operations. Once new hires pass the NERC exam, they will sit with a certified operator to learn operations of the system. New employees are required to attend classroom training. During the training process, the trainee does not perform any reliability-related functions without the direct supervision of a qualified operator. The lead coordinator makes the determination when the trainee is ready to assume the functional duties.

Each year, the system operators and system coordinators participate in the MISO restoration and blackstart drills. Annual code of conduct training is provided in CD format to current operators. All system operators and system coordinators completed their required 32 hours of emergency training in 2006. For continuing education hours, a mix of CD, vendor-supported online training, and a joint regional training program is utilized.

IPL participates with Vectren and other companies in a joint operator training program. The evaluation team has identified the joint training program with IPL's neighbors as a positive observation.

The operator six-week work schedule has designated training weeks. Specific training classes do not work for every operator because of shift coverage. IPL documented all training accomplished in 2006, and provided that documentation to the team.

Annual internal skill assessments are performed for the system operators. System coordinators are not subject to this same skills assessment.

The 2004 IPL readiness audit identified a need to provide a dedicated person to develop and coordinate a system operator training program. IPL budgeted for and received approval for an engineer/training coordinator position in 2007. IPL plans to fill this position in 2007. The evaluation team recommends that this position be filled in 2007.

The team recommends that IPL consider using the components of a systematic approach throughout the training program development. This approach helps to better define the job tasks being performed which then helps to define the training that would best fit that analysis.

IPL has taken the first step in resolving training tracking issues with its purchase of the LMS. The acquisition of this tool has been identified as a positive observation. The evaluation team recommends that IPL use the LMS tool as a support mechanism in the development of the training program.

Currently, the operators go to the planning group to have contingency analysis and dispatcher analysis run on a short-notice basis. The evaluation team recommends incorporating contingency analysis and dispatcher flow analysis into the operator training plan so the operators can perform these functions. This effort should focus on having the operators perform contingency analysis during the evening and weekends when planning support is not readily available.

The IPL emergency supply plan is made available in the control room to the system operators and system coordinators. The evaluator/operator interviews identified a need and the team recommends IPL provide annual training in the use of this plan. The DSM portion of the plan needs to include a reference chart with implementation times that provide clarity and the training should reflect the implementation times and megawatt support expected if exercised.

## **6. Operating Policies and Operating Procedures**

*The balancing authority/transmission operator must have an established procedure to ensure that system operators and operations staff are aware of any changes to NERC, regional, and/or local policies or procedures prior to taking over control of a shift position.*

*The balancing authority/transmission operator must have shift change procedures for updating incoming shift personnel on the current status of the system.*

IPL sends all changes to policies and procedures to the operators, generally via e-mail and in a written document that is placed in the control room. Once the policy or procedure has been reviewed and understood, the operator will initial the written document. All operators can access NERC and MISO policies and procedures online or by reading the paper copies available in the

dispatch office. Currently, IPL does not have a documented process that accounts for this. The evaluation team recommends IPL implement a formal document control and management system for transmission operations and balancing authority operations policies and procedures.

IPL has an informal shift turnover process. A short list of notes kept by the operators contains the names of individuals currently working at the substations. The formal log contains information other than routine operations. IPL system operators indicated they feel well informed by using the current method of shift turnover.

## **7. Planning**

*The balancing authority/transmission operator and its supporting planning organizations must have a process for day-ahead planning, and for longer-term planning, such as week-ahead, seasonal, and year-ahead, for the operation and outage scheduling of transmission facilities and generation and reactive resources.*

*The balancing authority/transmission operator and its supporting planning organizations must have agreements with its reliability coordinator to ensure that day-ahead and longer-term plans for the operation and outage scheduling of transmission facilities, and generation and reactive resources, will not jeopardize the reliability of the bulk power system.*

IPL's transmission system is designed and maintained at an n-2 basis. This provides the reliability benefit of the system withstanding two contingencies without a threat of loss of energy to current load. A benefit to this approach is that IPL can do additional immediate short-term outages without major system concerns. The evaluation team has identified this approach to system reliability as a positive observation.

MISO provides day-ahead and real-time operations support for the IPL transmission system office. IPL planning staff, which consists of three planners and one supervisor, provides daily support to the system operators. The IPL senior planning engineer visits the transmission office daily and consults with operations staff concerning loading and operation issues. The planning group's quick response to performing load flow studies on short notice for the system operators has been identified as a positive observation.

IPL developed a 5-year detailed plan and 10- and 15-year looks ahead, maintaining close involvement with community load growth. IPL is a part of the MTEP process (MISO transmission expansion process). MISO is responsible for conducting transfer analysis along with regional/interregional import capability studies for both the near and long term. IPL performs a seasonal analysis in-house but only for the summer peak loading period.

## **8. Outage Coordination and Communication**

*Planned outages of transmission facilities and generating units must be coordinated with the reliability coordinator to ensure that conflicting outages do not jeopardize the reliability of the bulk power system.*

*Information relative to forced outages of transmission facilities and generating units that may jeopardize the reliability of the bulk power system must be shared with affected balancing authorities, transmission operators, and the reliability coordinator as expeditiously as possible.*

MISO performs week-ahead and month-ahead outage studies that include the IPL transmission footprint. The IPL planner uses the General Electric power system load flow (PSLF) tool to verify and/or run contingency analysis on any upcoming outages. The planning engineer is then able to produce a graphical representation of contingencies or operating conditions for the specified system load.

Planning as a regional approach through MISO and RFC (ECAR prior to RFC) has been beneficial. IPL's biggest concern is outages to the 345 kV systems to the south.

## **9. Plans for the Loss of Control Facilities**

*The balancing authority/transmission operator must have a workable plan to continue to perform the balancing authority/transmission operator functions that are required to maintain a reliable bulk power system following the sudden catastrophic loss of its primary control facility, or the partial or full failure of its computer facilities or monitoring tools at the primary control facility.*

IPL is in the process of transitioning to a new backup control site. This control facility is expected to have all of the stand-alone capabilities necessary to provide IPL with an alternate resource for operating during evacuation or catastrophic loss of the primary control center. The backup site is expected to be completely functional in late 2007. During this transition period, the plans for loss of control facilities make use of an interim site. The evaluation team recommends that during this transition period, IPL review both the normal and transition plans for completeness to ensure the plan is workable and provides reliability.

IPL's plan for loss of control center is contained in its emergency operating plans for the transmission and distribution dispatching offices—emergency operating center. This plan gives specific details on when to leave the primary control center, what to take when departing, what to do while in transit, after-hours entry into the emergency operating center, reestablishing system operation and control, and current control and operating capabilities. The plan also includes a problem call list and a notification list. The problem call list identifies emergency notification numbers for managers, technical support, generation facilities, marketing, reliability contacts, and neighboring entities.

IPL has created a grab bag of information designed for operator use when leaving the primary facility and relocating to the backup control center. This grab bag contains necessary information to equip the operator to operate from the back up facility. The grab bag includes information on system restoration/blackstart or rotating outage plans that are currently used. This information is not currently stored at the backup site. Each IPL operator is expected to start up and operate the backup facility on an annual basis. The evaluation team noted that there is only one grab bag and no plans have been made to address the total loss of the primary facility. The team recommends that IPL develop a plan to staff the backup control center without the assistance of on-shift personnel.

The team reviewed the information available to the operator at the backup site and recommends that IPL evaluate its procedure for critical documents at the backup center to ensure that critical documents are available. On-site availability of the NERC Reliability Standards, RFC guides, etc. should also be considered.

The backup control facility has adequate space and an adequate working environment with two EMS/SCADA workstations and two corporate workstations. The phones and radios are also adequate to support emergency operations. The team noted that the current communication system relies on the equipment at the primary control center being operational. Redundancy of this communications is being addressed in the plan for the new site.

## **10. Tools**

*The balancing authority/transmission operator must have adequate analysis tools to perform the balancing authority/transmission operator functions. Such tools include state estimation, precontingency and postcontingency analyses capabilities (thermal, stability, and voltage), mapboard (static, dynamic, hardwired, or projected), e-tagging program, weather service, interchange scheduling system, outage scheduling system, trending tools, and a voice recording system.*

IPL's energy control system (ECS), the ABB Network Ranger management system which was upgraded in 2006, uses a dedicated (LAN) local area network system separate from the corporate LAN. This system scans 139 remote terminal units (RTUs), 8,888 status points, 4,982 analog points, and 167 pulse accumulator points. This ECS is equipped with a state estimator that currently models 419 substations, 977 circuits, 3,161 bus sections, and 464 transformers. Transmission planners are the main users of this tool, as they are with the General Electric power system load flow and contingency analysis tool. Some operators had an understanding of the tool but lacked experience actually using it.

In addition to the ECS, IPL provides the tools for use by system operators/coordinators to track the following information in real time: generator output, system frequency, system voltages, area control error, megawatts, megavars, interchange (both actual and scheduled), interconnection flow, system load, MISO messaging, and reserve sharing. Weather applications provide weather radar, lightning data, and weather data. Cable Television is provided for both weather and news.

IPL purchased an EMS/SCADA quality assurance system utilizing a fully functional EMS server that mimics the real-time server. This server is housed at the vendor's facility. By having this redundant server, the vendor can perform support functions as well as test upgrades without any threat to the real-time environment. Having this redundant "production-ready" server allows IPL to return EMS capabilities rapidly should there be a catastrophic failure of the existing equipment. Because of this foresight in both real-time operations and system restoration, the evaluation team has identified this as a potential example of excellence and commends IPL for this process. The evaluation team would like to recognize IPL's efforts in the area of EMS "server" upgrade and system configuration planning philosophy.

## **11. Load Shedding Plans**

*The balancing authority/transmission operator must establish plans for automatic load shedding for under frequency or under voltage conditions, coordinate load shedding plans with other interconnected entities, implement load shedding in steps to minimize further uncontrolled events, and have plans for operator-controlled manual load shedding to mitigate violations of system operating limits (SOL) or interconnection reliability operating limits (IROL).*

IPL has a documented load shed plan in place. Coordination with neighboring utilities is handled by MISO. Underfrequency load shedding set points are 59.5, 59.3, 59.1, 58.9 and 58.7, with 5 percent load reduction at each point. IPL underfrequency load shedding continues at 58.5 and 58.3, with load reduction of 2.5 percent per set point.

## **12. Real-Time Monitoring**

### **a. System Visibility**

*The balancing authority/transmission operator must monitor operating data and status in real time for its area and adjacent areas as necessary to maintain situational awareness of its system.*

IPL supplies its system operators/coordinators and system energy coordinators with all the necessary tools to perform their reliability functions. The IPL energy control system (ECS) includes supervisory control and data acquisition (SCADA), automatic generation control, state estimator, dispatcher load flow, resource scheduling, real-time contingency analysis, alarming, logging, and historical data retention and reporting capabilities. IPL installed the ECS in 2003 and upgraded it in 2006. IPL has modeled its system to include the “first breaker” into the neighboring systems.

IPL is currently working with RFC to determine locations for disturbance monitoring equipment. Installation of all time-stamping infrastructure is scheduled for completion in 2009.

### **b. Alarms**

*The balancing authority/transmission operator must have effective and reliable alarming capability. This should be supported in the energy management system (EMS) and/or supervisory control and data acquisition (SCADA) system by alarm priority*

IPL’s ECS has adequate alarming capability. Alarms are prioritized one to eight and have color designations associated with the priority. The audible tone differs with priority as well. The alarm page has filtering capability to help prioritize alarms in situations where multiple alarms are coming in at once.

There is no process in place to evaluate the health of the alarm processor. Currently the operator would investigate the health of the alarm processor only if alarms did not come in for a long period of time. The team recommends that IPL look into purchasing a tool that will monitor the health of the alarm system

**c. Frequency**

*The balancing authority/transmission operator must monitor frequency, direct actions to resolve significant frequency errors, and correct real-time trends that indicate potentially developing problems. Frequency monitoring points should be of sufficient number and from several locations with sufficient area coverage to allow the balancing authority/transmission operator to effectively monitor the balancing authority/transmission operator footprint to determine possible islands.*

IPL has two separate locations within the control room to monitor frequency. One monitor receives its information through the ECS, and the other has a separate source. IPL has three frequency-monitored points available to them that are independent of the ECS. Frequency metering is available at all IPL substations, which provides operators good visibility for determining if an islanding condition exists. The operators interviewed were knowledgeable of the frequency sources and their locations.

**d. Voltage/Reactive Reserve**

*The balancing authority/transmission operator must monitor voltage levels and take appropriate actions to support the bulk power system voltage if real-time trends indicate potentially developing problems. Voltage measuring points must be of sufficient number and from several locations and voltage levels to allow the balancing authority/transmission operator to effectively monitor the voltage profile of its footprint.*

*The balancing authority/transmission operator must ensure that reactive reserves are available and properly located to satisfy the most severe single contingency.*

IPL reactive requirements were established by reactive reserve criteria work performed by ECAR, IPL's previous regional council. IPL also hired an outside consultant to do a system reactive analysis. The consultant determined how high the load can go before the reactive reserves are depleted. Currently, 300 MV is being used as a minimum guideline.

IPL has established thermal ratings of 95 through 105 percent under single contingency conditions and 90 percent in the event of a double contingency.

IPL does not have an operating process to monitor the status of AVR at the generating stations. If the status of any AVR were to change, the plant operator notifies the generation marketing group. Currently, there is no procedure to ensure that the generation group will notify the transmission side, who must then communicate changes in this status to its reliability coordinator. The evaluation team recommends that IPL revise its AVR procedure to include transmission operations tracking of AVR status and notification of its reliability coordinator. The team also recommends that IPL provide refresher training on the importance of AVRs, and notification procedures for plant operators, system energy coordinators, and transmission operators.

**e. Critical Facilities**

*Monitoring of facilities that are critical to the reliability of the bulk power system is a joint responsibility of the balancing authority, transmission operator, and the reliability coordinator.*

*An established process must determine which facilities are critical to the reliability of the bulk power system. Real-time operating information (data and status) and operating limits for these critical facilities must be provided to the balancing authority, transmission operator, and the reliability coordinator.*

IPL developed and maintains a critical facilities list. A three-phase project is under way to install frame relay circuitry in substations identified as critical. This effort will provide redundant communication paths for these facilities.

**f. Transmission System Congestion**

*The transmission operator must monitor transmission flow gates and be prepared to take actions to alleviate congestion in conjunction with, and as directed by, its reliability coordinator.*

IPL operators respond to directions given by MISO as the reliability coordinator to alleviate transmission congestion. MISO issues transmission loading relief (TLR) procedures, and IPL system operators/coordinators implement reduction as prescribed in the TLRs or as they determine necessary for system reliability. In addition, IPL is a MISO market member and IPL generation is adjusted via market dispatch. IPL operators stated they do monitor the flow on transmission facilities within the IPL footprint and would take all appropriate actions to relieve overloading on facilities.

**g. Load Generation Balance**

*The balancing authority must monitor the balance of load, generation, and net scheduled interchange in its balancing area. The balancing authority must take actions to mitigate unacceptable load, generation, and net scheduled interchange imbalance.*

IPL is a MISO market balancing authority and has agreed to operate under MISO's *Transmission and Energy Market Tariff*. The tariff transfers to MISO responsibilities related to approving and confirming external schedules. In addition, the *NERC Waiver Request*, dated July 2003, grants to MISO the following:

- Act as the scheduling agent for its balancing authorities
- Provide inadvertent settlements
- Provide inadvertent accounting
- Calculate and provide net interchange to the balancing authorities
- Declare energy emergency alerts

MISO runs a five-minute economic dispatch for balancing authorities in the MISO market. MISO, using a load forecast engine, receives bids and offers for generation and

load from market participants and import/export schedules from entities external to MISO; a case is solved every five minutes. Individual generator base points and net scheduled interchange are communicated to every market balancing authority via intercontrol center communications protocol. The balancing authority is responsible for making sure generation output is adjusted and the net actual interchange matches the interchange schedule provided by MISO. In addition, the balancing authority is responsible for control performance and disturbance control standards. The balancing authority is responsible for whatever happens in between the five-minute MISO economic dispatch.

The MISO reliability coordinator is responsible for communicating the frequency schedule and time correction information to all entities in the MISO footprint, which expands beyond the market participants. Time error correction information and frequency schedule of 60.0, 59.98, and 60.02 Hz are provided to IPL by MISO.

IPL validates interchange with its neighbors each hour and the end of the day and with MISO at the end of each day.

#### **h. Contingency Reserves**

*The balancing authority must monitor the required reserves and the actual operating reserves in real time, and take action to restore acceptable reserve levels when reserve shortages are identified.*

IPL's marketing branch establishes the day-ahead plan for contingency reserves and makes adjustments in real time as necessary. The system operator/coordinator monitors the contingency reserves and is responsible to ensure that appropriate actions are taken when reserve shortages are identified.

#### **i. Special Protection Systems**

*The balancing authority/transmission operator and the reliability coordinator must be aware of the operational condition of special protection systems that may have an effect on the operation of the bulk power system.*

IPL does not have any special protection systems.

### **13. System Restoration**

*The transmission operator must have a documented system-restoration plan that is consistent with NERC Reliability Standard EOP-005-0 — System Restoration Plans. This restoration plan must be provided to its reliability coordinator.*

*The transmission operator must be prepared to restore its transmission area following a partial or total collapse of the system and coordinate system restoration with its neighboring transmission operators and with the reliability coordinators.*

IPL does have a system restoration plan and exercises/tests the plan annually during the fall MISO restoration drills. IPL has participated from a complete blackstart perspective as well as a “breaker away” scenario involving tying as an interconnect with an adjacent area where power is available. IPL coordinates its internal restoration process with MISO. MISO coordinates all interconnects with neighbors during restoration.

IPL has synch-check relays at all 345 kV interconnection points and nearly all 138 kV interconnection points. Manual synch-scopes are at most substations along with synch-check relays.

#### **14. Capacity and Energy Emergency Plan**

*Each balancing authority must have a capacity and energy emergency plan that address the applicable requirements of NERC Reliability Standards EOP-001-0 — Emergency Operations Planning and EOP-002-0 — Capacity and Energy Emergencies.*

IPL has a capacity and energy procedure available to the operators. IPL system operators/coordinators have the authority to shed load for immediate system emergencies however they deem appropriate. When time permits, the plan describes the order in which load shed should be considered. The evaluation team was not able to identify a clearly defined process listing whose responsibility it is to take the various actions to reduce load such as utilization of DSM, curtailment of designated loads, etc. It is apparent through interview that the marketing group (system energy coordinator) would make the decision to utilize DSM; however, this is not documented. The evaluation team recommends that IPL review the emergency supply plan for completeness and include clearly defined roles and responsibilities.

Related to clearly identifying roles and responsibilities, the evaluation team recommends that IPL add implementation times to the DSM reference chart. Currently, there is a list of the DSM available for use in a capacity and energy emergency. The plan does not provide the system operator/coordinator with any time frames for expected load relief nor the MW amount of load relief to expect. Both of these have a direct impact on decisions made during such an event.

#### **15. Equipment Maintenance and Testing**

*Transmission and generator owners must ensure that maintenance of transmission lines, substation equipment, transmission protective systems, and generator relays is carried out according to company, regional, and/or NERC requirements.*

IPL manages all relay testing and maintenance in-house. Functional testing of generator relays is scheduled every two years on machines over 100 MW, four years on machines less than 100 MW, and four years on plant auxiliaries. Relay testing includes inspections for proper tripping, correct trip time, and target operation. IPL visually inspects generator relays daily. IPL reports its maintenance and testing plan was performed on schedule last year with the exception of Petersburg Unit No. 4, whose 2006 outage was rescheduled for spring 2007.

Inspection of electromechanical relays (visual-mechanical) are done on a nominal three-year cycle with a maximum cycle of four years. This includes cleaning, maintenance, repair, and

voltage and current applied testing. Microprocessor-based relays have this same cycle and include a mechanical check/inspection and calibration. Solid-state and interconnection-circuit relays are checked for calibration. Interconnection circuit relays are handled in the same manner. The underfrequency load shedding procedure is tested every two years with 50 percent of the relays being tested each occurrence.

IPL employs four full-time substation maintenance personnel assigned to substation inspections. Each substation is inspected biweekly. Each substation undergoes a complete external inspection every five years and an internal inspection every seven years. Tracking of all substation transformer and breaker maintenance and inspections is handled through IMPACT, a third-party software package, which IPL feels handles the generation of work orders and tracking of the system maintenance very well. Two IPL schedulers are dedicated to this maintenance program. Transformers undergo dissolved gas analysis sampling annually; samples are collected by IPL personnel and outsourced for testing.

IPL dedicates two full-time staff to battery maintenance.

In 2006, IPL purchased a transmission asset management information system (TAMIS) as a tool to administer its transmission structure maintenance program. IPL had an 18-year cycle plan for painting every structure. Currently, structures are in need of a thorough inspection and plan for refurbishment. The evaluation team considers IPL's implementation of TAMIS as a positive observation for its proactive decision to ensure transmission structure reliability. The team recommends that IPL continue to implement the TAMIS program.

## **16. Vegetation Management**

*The transmission operator must have a documented vegetation-management program.*

IPL has a well-documented vegetation-management plan. An aerial inspection of the 138 kV and 345 kV systems is completed annually. IPL transmission line clearance requirements are 30 feet for 345 kV lines and 20 feet on the 138 kV system. If aerial inspection identifies a need for vegetation spraying, a follow-up aerial inspection will be performed after the spraying has been completed to verify results. Normal urban vegetation management is done by contractors who are awarded the contract based on a three-year cycle. Ground spraying accounts for 95 percent of IPL's vegetation-management efforts. IPL utilizes local tariff laws to trim vegetation as necessary, even in areas where IPL does not have an easement.

IPL transmission line clearance requirements are 30 feet for the 345 kV lines and 20 feet on the 138 kV system. IPL completes an urban area inspection twice a year. Vegetation growth is tracked in three categories which include planted trees, side trimming, and trees missed, but IPL does not have any formal vegetation-management tracking tool. The team found it interesting that IPL customers can purchase and plant a variety of predetermined trees (based on genus) in the transmission line right-of-ways. These trees enhance the aesthetic properties of the areas and have limited growth potential to ensure they do not become a potential reliability concern. All IPL-scheduled vegetation management was completed in 2006 with the exception of a portion

associated with a city park. The park delay was requested by the park manager, and that work is now scheduled in the spring of 2007.

### **17. Nuclear Power Plant Requirements**

*Transmission operators must support nuclear power plants in meeting regulatory requirements that allow the plant operators to maintain voltages within design limits and adequate off-site power sources in both normal and abnormal operating conditions (n-1 and system restoration).*

IPL does not have any nuclear facilities in its footprint.

## **APPENDIX 1: Critical Energy Infrastructure**

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

## **APPENDIX 2: Assessment Participants**

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

### **APPENDIX 3: Documents Reviewed**

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