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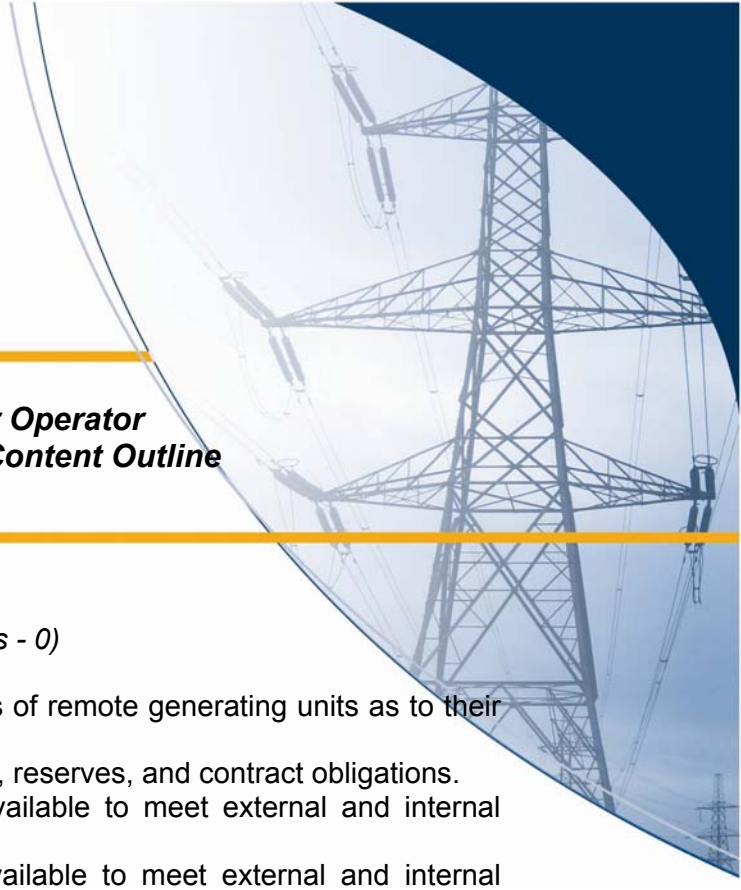

Reliability Coordinator Operator
Certification Examination Content Outline

I. Resource and Demand Balancing

14 items *(Recall - 6, Application - 8, Analysis - 0)*

1. Determine proper use of dynamic schedules of remote generating units as to their contribution to operating reserves.
2. Determine energy excess after meeting load, reserves, and contract obligations.
3. Ensure adequate generation capacity is available to meet external and internal requirements (real-time, or hourly).
4. Ensure adequate energy resources are available to meet external and internal requirements (real-time or hourly).
5. Apply operating reserves when needed.
6. Allocate generation resources to meet system requirements.
7. Allocate load resources to meet system requirements.
8. Operate generation to minimize inadvertent power flow.
9. Operate the SCADA and analog systems to control generation and monitor telemetered information.
10. Monitor AGC to ensure compliance with NERC CPS1 and CPS2 standards.
11. Minimize inadvertent flows, losses, and CPS1 and CPS2 criteria violations.
12. Monitor AGC performance to diagnose and identify telemetry problems.
13. Select proper mode of automatic generation control for system conditions.
14. Operate control equipment to continuously and accurately meet its system and Interconnection control obligation and measure its performance.
15. Procure alternate sources of energy when reliability coordinator curtails transactions or calls for generation re-dispatch.
16. Perform instantaneous reserve checks.
17. Compare actual generator output with anticipated schedules, and take action to account for the difference.
18. Monitor output of units ensuring that MW output is operating according to schedules.
19. Monitor an area's estimated and actual loads.
20. Manually calculate ACE as necessary.
21. Monitor ramping capability for requested interchange schedules.
22. Reestablish required operating reserve levels as soon as possible following a contingency that results in operating reserve usage.
23. Ensure that the balancing authority is satisfying its Interconnection frequency regulation obligation.
24. Check and validate hourly tie-line data.
25. Initiate manual control of generation, and maintain scheduled interchange following an AGC system component failure.

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26. Monitor ACE to determine if the calculation is correct.
27. Verify that the regulating capacity is distributed equitably over as many units as possible.
28. Monitor response of units to the AGC signals.
29. Operate the AGC system in tie-line bias control mode unless such operation is adverse to system or Interconnection reliability.
30. Ensure that the AGC and other vital control performance equipment are functioning properly when using the backup power supply following the loss of the primary power supply.
31. Determine reserves needed for the next hour.
32. Administer generator start-up and shutdown schedules.
33. Obtain replacement energy upon a loss of any major generating or interchange resource.
34. Respond to generation losses, recognizing reliability restrictions to effectively maintain tie-line flows.
35. Ensure adequate spinning and operating reserves are on line.
36. Review generation commitments, dispatch, and load forecasts.
37. Ensure adequate spinning and/or operating reserves are dispersed throughout the system
38. Perform after-the-hour checkout of actual and scheduled interchange with adjacent balancing authorities.
39. Validate adequacy of resource plans (in near real time).
40. Monitor available operating reserves and take corrective actions to correct deficiencies.

II. Emergency Preparedness and Operations

35 items *(Recall - 7, Application - 21, Analysis - 7)*

1. Respond to system emergencies and frequency deviations to meet local, regional, and NERC DCS requirements.
2. Implement system restoration procedures.
3. Notify appropriate personnel or departments in event of an emergency.
4. Perform or direct actions such as starting generation, canceling pre-scheduled maintenance, schedule interchange, or shed load to return the system to a secure state.
5. Respond to disturbance conditions.
6. Respond to requests for emergency assistance from neighboring systems.
7. Declare system emergencies.
8. Develop and/or implement contingency plans when facilities/equipment are forced out of service.
9. Coordinate response to system emergencies.
10. Request emergency assistance from neighboring systems.
11. Call for interruptible loads to be shed when required.
12. Manually shed load to alleviate system emergency conditions.
13. Prepare for a capacity emergency by:
    a. bringing on all available generation.
    b. postponing equipment maintenance.

   c. scheduling emergency energy purchases.
   d. reducing load.
   e. initiating voltage reductions.
   f. requesting emergency assistance from other systems.
14. Ensure that every effort is made to remain connected to the Interconnection.
15. Take action as necessary to protect the system if it becomes endangered by remaining interconnected.
16. Apply relief measures as necessary to permit re-synchronizing and reconnecting to the Interconnection when separated from the Interconnection.
17. Use manual load shedding to prevent imminent separation from the Interconnection due to transmission overloads, or to prevent voltage collapse.
18. Test or simulate system restoration procedures to validate restoration plans.
19. Report any disturbances or unusual occurrences, suspected or determined to be caused by sabotage to the appropriate systems, governmental agencies, and regulatory bodies.
20. Following a partial or total system shutdown:
    a. implement the appropriate provisions and procedures of the system's restoration plan in a coordinated manner with adjacent systems.
    b. arrange for start-up and/or emergency power for generation units as required.
    c. arrange for and utilize emergency (backup) telecommunications facilities as required.
    d. restore the integrity of the Interconnection as soon as possible.
21. Comply with reliability coordinators' instructions during emergency conditions.
22. Monitor and periodically test normal and emergency telecommunication systems that link with interconnected systems to ensure communications are adequate and continuous.
23. Direct implementation of emergency procedures.
24. Identify and take appropriate actions when partial or full system islanding occurs.
25. Identify and take appropriate actions when a partial or full system voltage collapse occurs.
26. Test, evaluate, and operate backup control center facilities/systems as needed.
27. Coordinate load shedding, and load restoration with, or as directed by the reliability authority.
28. Implement procedures for the recognition of sabotage events on your facilities and multi-site sabotage affecting larger portions of the Interconnection.
29. Following the activation of automatic load shedding schemes:
    a. restore system load as appropriate for current system conditions and in coordination with adjacent systems.
    b. shed additional load manually if there is insufficient generation to support the connected load.
    c. monitor system voltage levels to ensure high voltage conditions do not develop.
    d. monitor system frequency to ensure high frequency conditions do not develop.
    e. monitor the performance of any automatic load restoration relays.
    f. resynchronize transmission at preplanned locations if possible.

30. Request emergency energy upon loss of a resource.
31. Maintain knowledge of existing and proposed emergency assistance agreements and contracts.
32. Respond to Reserve Sharing Group requests for emergencies.
33. Respond to capacity deficiency.
34. Respond to generation losses, recognizing economic and reliability restrictions to effectively maintain tie-line flows.
35. Respond to loss of energy resources within allowable regional or pool timeframe.
36. Suspend automatic generation control as required.
37. Direct corrective actions to correct abnormal frequency.
38. Dispatch operating reserves to alleviate system emergency conditions.
39. Use sub-regional, regional, and NERC hotline to coordinate actions during emergency conditions.
40. Schedule emergency energy when needed and create interchange transaction tags within one hour.
41. Schedule available emergency assistance with as much advance notice as possible given a capacity emergency.
42. Utilize the assistance provided by the Interconnection's frequency bias (in a capacity emergency) only for the time period necessary to:
    a. utilize operating reserves.
    b. analyze ability to recover using own resources.
    c. schedule emergency assistance from others.
43. Separate or shut down generators that are unsafe to operate during or after an area disturbance.
44. Implement emergency procedures related to generating resources within a balancing area as directed by the reliability authority.
45. Provide emergency services coordination for field personnel.
46. Implement voltage reductions to alleviate system emergency conditions.
47. Monitor the condition of the transmission system and respond as required (including shedding firm load) to avoid voltage collapse and/or Interconnection separation.
48. Direct the restoration of the transmission system following a major system outage, load shedding, islanding, or blackout.
49. Implement load shedding as directed by a transmission operator.
50. Request the reliability authority to mitigate equipment overloads.
51. Utilize interconnected operation services as needed to maintain system reliability.
52. Direct Transmission Operators to reduce voltage or shed load if needed to ensure balance in real-time.
53. Direct distribution providers to shed load when required for system reliability.

III. System Operations

22 items *(Recall - 9, Application - 13, Analysis - 0)*

1. Check data and verify accuracy of each metering point used by Supervisory Control and Data Acquisition (SCADA).
2. Analyze operations log, and oral information from system operator leaving shift.
3. Evaluate impact of current weather conditions on system operations.

4. Evaluate system conditions and apply operating guides when applicable.
5. Maintain a working knowledge of regional, NERC, FERC, and company specific guides, policies, and standards.
6. Identify operating problems and deficiencies, and recommend corrective measures.
7. Respond to light load conditions.
8. Prepare daily reports and logs generated to meet company and regulatory requirements.
9. Monitor system load and generation.
10. Verify data used in operation.
11. Analyze and authorize requests for equipment outages.
12. Communicate the status of system conditions with appropriate reliability coordination offices.
13. Communicate the status of system conditions with appropriate balancing authorities and/or transmission operators.
14. Enforce operational reliability requirements.
15. Operate primary and backup telecommunications systems as required.
16. Communicate with interconnected systems during normal and emergency conditions using established procedures.
17. Maintain current knowledge of power system modifications and additions.
18. Monitor all reliability-related system parameters, such as MW, MVAR, voltage, and amps to determine system conditions.
19. Monitor and control access to the control center to prevent sabotage.
20. Apply guidelines, including lists of utility contact personnel, for reporting disturbances due to sabotage events.
21. Utilize the voice and data telecommunication systems as required while adhering to Interconnection and regional operating procedures.
22. Monitor and respond to telecommunication alarms or failures and notify the appropriate personnel.
23. Monitor and validate telemetry data for accuracy.
24. Monitor control center systems and support equipment and call out appropriate assistance as needed.
25. Adjust both short-term and future forecasts using actual load data and correction factors.
26. Develop both short-term and future forecasts using actual load data and correction factors.
27. Monitor output of units ensuring that MW output is within operating limits.
28. Adjust control systems to compensate for any equipment errors or failures.
29. Implement or delay generation outages to ensure system reliability.
30. Communicate with generating station regarding work for anticipated increases or decreases that may cause limit changes.
31. Dispatch generation resources economically while maintaining system reliability.
32. Coordinate ramp down of unit going on planned outage.
33. Adjust generation levels to implement proposed transmission system outage plan.
34. Operate power facilities in compliance with environmental standards (e.g., air quality, wildlife).
35. Apply the principles of economic dispatch to generating units.
36. Respond to generation losses, recognizing economic and reliability restrictions.

37. Control, direct, or manage generation dispatch to avoid transmission reliability limit violations.
38. Respond to solar magnetic disturbance (SMD) warnings as required by system operating procedures.
39. Determine the cause and extent of transmission system disturbances and interruptions and the impact on other facilities.
40. Analyze/research any bulk system disturbances affecting your system.
41. Provide input to system planners to help maintain accuracy in system models used for reliability assessments.
42. Provide input to ensure that the operations computer database is up to date.
43. Develop special operating procedures to allow continued operation of the transmission system based on the results of a reliability analysis.
44. Monitor radio system for calls requiring response.

IV. Interchange Scheduling and Coordination

12 items *(Recall - 5, Application - 7, Analysis - 0)*

1. Communicate with real-time scheduler regarding the purchase of resources.
2. Manually calculate net interchange when needed.
3. Implement terms of interruption for generation and transmission services according to contractual provisions.
4. Monitor status of NERC interchange transaction tags to ensure timely approval and implementation.
5. Maintain the confidentiality of interchange transactions.
6. Protect the confidentiality of all interchange transaction information.
7. Curtail, terminate, or modify interchange transaction requests that aggravate operating reliability limits.
8. Agree upon daily schedule totals and energy imbalance totals with balancing authorities or transmission operators and other schedulers as needed.
9. Curtail transactions as directed across interfaces.
10. Implement or terminate interchange transactions when needed.
11. Adjust interchange transactions.
12. Monitor the electronic (interchange) tagging system for accuracy of information (e-tagging).
13. Ensure all import and export schedule totals are checked for accuracy and correctness with each utility at the end of the day.
14. Ensure interchange transactions are conducted in accordance with regional and NERC standards.
15. Ensure that all curtailments are properly applied per reliability coordinators instructions.
16. Enter interchange transactions into the balancing authority's scheduled interchange.
17. Verify the accuracy of the AGC tie-line metering by comparing hourly MWh meter totals to the totals derived from tie-line meter registers.
18. Ensure that the ramp rate, start and end times, energy profile, and losses are communicated to all parties in the transaction.
19. Reestablish curtailed interchange transactions with affected balancing authorities or transmission operators.

20. Approve interchange transactions based upon a reliability perspective.
21. Implement interchange schedules.
22. Issue generation dispatch adjustments to mitigate transmission congestion.
23. Confirm and approve interchange transactions from ramping ability perspective.

V. Transmission Operations

16 items *(Recall - 3, Application - 3, Analysis - 10)*

1. Maintain constant awareness of neighboring transmission system conditions.
2. Ensure adequate transmission facilities are available to meet external and internal requirements (real-time or hourly).
3. Interpret SCADA-generated alarms and information, and then take appropriate actions to maintain system reliability.
4. Monitor performance of power system equipment and call out system personnel when appropriate.
5. Evaluate the extent of an outage or disturbance and develop a plan of restoration.
6. Direct and/or regulate the operation of the transmission system.
7. Ensure all tie-line limits are not exceeded.
8. Formulate a plan to implement corrective actions when an operating reliability limit violation is anticipated.
9. Formulate a plan to implement corrective actions when equipment ratings are exceeded or anticipated to be exceeded.
10. Initiate transmission loading relief procedures to relieve potential or actual loading on a constrained facility.
11. Monitor major transmission lines, flow gates, and scheduling paths.
12. Perform same-day reliability analysis of the electric system.
13. Report transmission outages to the reliability coordinators and other affected utilities.
14. Supervise and coordinate all activity at switching stations, generating stations, and transmission switchyards.
15. Utilize load flow modeling tools to determine power flow changes and optimum system configurations during normal and emergency conditions.
16. Implement transmission outages to ensure system reliability.
17. Direct and/or control transmission switching.
18. Adjust transmission configuration to implement proposed transmission system outage plan.
19. Initiate the cancellation of scheduled transmission work when system conditions require.
20. Maintain safe operating conditions for all persons and property within the transmission system.
21. Perform reliability analysis to determine impact of both scheduled and forced transmission outages.
22. Monitor and respond to transmission system equipment rating violations.
23. Coordinate planned and unplanned transmission outages with all impacted systems to ensure transmission system reliability.
24. Coordinate with impacted systems, and monitor actual and/or expected operating reliability limit violations and respond as required.

25. Monitor bulk transmission elements to determine constraints and operating limit violations.
26. Direct and/or control all energization and/or modification of new or existing facilities.
27. Direct and/or control phase shifting transformer taps.
28. Monitor and operate transmission system within its designed capabilities.
29. Initiate control actions resulting from thermal limit violations, considering the responsiveness of the system.
30. Interpret relay targets, oscillograph readings, breaker operations, and field observations to determine proper restoration methods during forced outages.
31. Identify special operating procedures that may be necessary to maintain acceptable transmission loading.
32. Ensure the accuracy of current system status by updating necessary operating procedures, diagrams, and map board.
33. Notify others of any planned transmission changes that may impact the operation of their facilities.
34. Manage transmission loading by directing the redispatch of generators or reconfiguring the transmission system to mitigate impact, including the load curtailment process.
35. Implement corrective actions from transmission problems resulting from an underlying sub-transmission or distribution event (local reliability issues).

VI. Protection and Control

3 items *(Recall - 1, Application - 1, Analysis - 1)*

1. Ensure all special protection systems and special design features are in service as needed.
2. Monitor and respond to alarms from status of special protective schemes.
3. Schedule system telecommunications, telemetering, protection, and control equipment outages to ensure system reliability.
4. Maintain records of special protection system, special design feature, and transmission protection system misoperations.
5. Ensure adequate protective relaying exists during all phases of the system restoration sequence.
6. Following the activation of automatic load shedding schemes, disable automatic underfrequency relays if system conditions warrant.
7. Arm or verify that special protection systems are armed to meet system conditions (contingencies) as needed.

VII. Voltage and Reactive

8 items *(Recall - 2, Application - 5, Analysis - 1)*

1. Monitor output of units ensuring that MVAR output is within operating limits.
2. Monitor and analyze regional reactive reserve availability.
3. Monitor output of units ensuring that MVAR output is operating according to schedules.
4. Minimize system voltage decay and prevent cascading outages.

5. Schedule system voltage regulating equipment outages to ensure adequate system voltage and system reliability is maintained.
6. Monitor reactive reserve levels to ensure adequate reactive reserves exist and are properly located to provide for adequate voltage levels under normal and emergency conditions.
7. Restore reactive reserves to acceptable levels as soon as possible after use.
8. Monitor the status and availability of generator voltage regulators and/or power system stabilizers, and respond as required to deficiencies that may impact system reliability.
9. Utilize transmission line removal as a voltage control tool only if system studies indicate that system reliability will not be degraded below acceptable levels.
10. Coordinate operation of voltage control equipment with interconnected utilities.
11. Monitor the voltages, and coordinate the reactive dispatch of transmission facilities, and the interconnections with neighboring systems.
12. Identify and respond to conditions likely to lead to voltage collapse.
13. Monitor and maintain defined voltage profiles to ensure system reliability.
14. Utilize reactive resources from transmission and generator owners to maintain acceptable voltage profiles.
15. Approve system voltage regulating equipment outages to ensure adequate system voltage and system reliability is maintained.
16. Notify generator operators of voltage limitations, or equipment overloads that may impact, or are impacting generator operations.
17. Implement voltage reductions as directed by a transmission operator.

VIII. Interconnection Reliability Operations and Coordination

15 items *(Recall - 3, Application - 6, Analysis - 6)*

1. Monitor system frequency and initiate a hotline conference call when frequency error exceeds specified limits.
2. Build contingency case for scheduled outages for next day.
3. Ensure all balancing authorities or transmission operators are aware of solar magnetic disturbances (SMD) forecast information.
4. Initiate line loading relief procedures upon request of members of the Interconnection using appropriate priority levels.
5. Perform next-day reliability analysis of the electric system.
6. Adjust transfers across interfaces to maintain system reliability.
7. Monitor the RCIS and respond to any information provided.
8. Perform reliability analysis to determine impact of both scheduled and forced generation outages.
9. Notify all affected areas that line loading relief has been requested, and that corrective actions are required.
10. Monitor all reliability-related data within a reliability authority area.
11. Coordinate reliability processes and actions with and among other reliability coordinators.
12. Direct to the appropriate entities those options necessary to relieve reliability threats and violations in a reliability authority area.
13. Perform reliability analysis (actual and contingency) for the reliability authority area.

14. Identify, communicate, and direct actions to relieve reliability threats and limit violations in the reliability authority area.
15. Direct transmission and generator operators to revise maintenance plans as required, and as permitted by agreements.
16. Recalculate interconnection reliability operating limits based on current or future conditions, and according to transmission and generator owners' specified equipment ratings.
17. Receive and review:
    a. generation operations plans and commitments from balancing authorities for reliability assessment.
    b. transmission maintenance plans from transmission operators for reliability assessment.
18. Direct transmission operators and balancing authorities to take actions to mitigate interconnection reliability operating limits.

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